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IIM
SAMBALPUR

INTERNATIONAL MANAGEMENT PERSPECTIVE CONFERENCE
(IMPeC-25)

Digitalization, Entrepreneurship, and Sustainability

Dates: January 30 - February 1, 2025

VOLUME - I

Editors
Prof. Mahadeo Jaiswal
Prof. Saumyaranjan Sahoo
Prof. Padmavathy Dhillon

Volume I

International Management Perspective Conference 2025

(IMPeC-25)

Digitalization, Entrepreneurship, and Sustainability

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Organized by

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Editor's
Prof. Mahadeo Jaiswal
Prof. Saumyaranjan Sahoo
Prof. Padmavathy Dhillon

DISCLAIMER

Message from the Director

Keeping in line with the vision of Viksit Bharat@2047: Transforming the Nation's Future, the Indian Institute of Management Sambalpur is proud to organize its Annual Flagship Conference, International Management Perspective Conference (IMPeC) 2025. This year, the conference emphasizes the transformative themes of Digitalization, Entrepreneurship, and Sustainability, which are pivotal for shaping the future of management and societal progress.

IMPeC 2025 is designed to unite a diverse array of participants—academicians, practitioners, policymakers, scholars, and students—from various management-related domains. The conference serves as a dynamic platform for knowledge sharing, fostering research collaborations, enhancing institutional pedagogy, and disseminating global business best practices. Through its vibrant sessions, thought-provoking discussions, and engaging activities, we aim to inspire participants and spark potential interdisciplinary and linear collaborations that drive impactful change.

In today's rapidly evolving landscape, three key drivers—Digitization, Decarbonization, and Democratization—are reshaping industries and societies, including the startup ecosystem. Digitization leverages cutting-edge technologies such as AI and blockchain to streamline operations and enable data-driven decision-making, although it brings challenges like cybersecurity. Decarbonization pushes for sustainable practices and green technology adoption to combat climate change, balancing economic opportunities with regulatory demands. Democratization, meanwhile, empowers individuals and smaller entities through access to technology and knowledge, fostering innovation and competition but raising concerns about data integrity. These drivers are interconnected; digitization fuels democratization, and decarbonization benefits from digital advancements. Addressing these complexities requires a holistic approach that blends technology, ethics, and innovation. IMPeC 2025 aims to delve deeply into these critical themes and explore innovative strategies and solutions to shape a sustainable and interconnected future.

Central to the conference agenda is the theme of entrepreneurship focusing on unleashing the potential of forward-thinking ventures to drive progress and prosperity. Additionally, the conference will highlight sustainability, showcasing how cutting-edge technologies and innovative practices can foster sustainable growth and development. By facilitating collaboration and knowledge exchange among diverse stakeholders, this conference seeks to inspire policies, strategies, and initiatives that tackle societal challenges while leveraging opportunities in a digitally connected world.

Ultimately, IMPeC 2025 aspires to shape a brighter future rooted in inclusivity, sustainability, and progress. Through shared expertise and innovative thinking, we aim to pave the way for a more equitable, resilient, and prosperous world. Your active participation in this transformative event will be instrumental in forging a better tomorrow for our interconnected global community.

Warm regards,

Prof Mahadeo Jaiswal
Director
Indian Institute of Management Sambalpur

PREFACE

We are pleased to present the proceedings of the International Management Perspective Conference (IMPeC) 2025, held on January 30 to February 1, 2025, at the Indian Institute of Management, Sambalpur.

The theme of the conference was dedicated to exploring the transformative themes of **Digitalization, Entrepreneurship, and Sustainability**. These interconnected domains represent the driving forces shaping the future of global business, governance, and society. As the world embraces digital innovation, seeks sustainable solutions, and champions entrepreneurial spirit, this conference has sought to provide a platform for fostering meaningful dialogue, sharing innovative practices, and advancing scholarly and practical knowledge.

Digitalization continues to redefine how organizations operate, creating opportunities for efficiency, innovation, and connectivity. Entrepreneurship fuels economic growth and resilience, serving as a cornerstone for creativity and problem-solving. Sustainability, now an imperative rather than an option, challenges us to reimagine development through responsible resource use, inclusive practices, and a long-term vision. Together, these themes form the foundation of IMPeC 2025, providing insights into navigating complex challenges and opportunities in a rapidly changing global landscape.

This two-volume compilation reflects the conference's focus on these transformative themes. **Volume I** highlights diverse research and ideas on **Sustainability**, addressing critical issues such as sustainable business models, green innovation, and the role of organizations in fostering environmental stewardship. **Volume II** presents cutting-edge contributions on **Digitalization and Entrepreneurship**, exploring topics like digital transformation strategies, entrepreneurial ecosystems, and the intersection of technology with business and society. All papers included in this collection underwent a rigorous peer-review process to ensure academic and practical relevance, showcasing innovative methodologies and emerging trends in these fields.

The event featured dynamic technical sessions, expert keynote addresses, panel discussions, and interactive workshops that encouraged deep exploration of these themes. Through collaborative discussions, participants exchanged perspectives and cultivated ideas aimed at addressing pressing global issues and advancing management practices.

We extend our heartfelt gratitude to the contributors for their exceptional research and insights, which have enriched these proceedings. We also express our appreciation to the reviewers and program committee for their diligence in upholding the quality of this publication. The success of IMPeC 2025 was made possible by the commitment of the organizing team, sponsors, and volunteers, as well as the active participation of attendees who engaged in thoughtful dialogue and meaningful collaboration.

We hope that the ideas and perspectives presented in these proceedings will inspire further research, innovation, and action in the domains of **Digitalization, Entrepreneurship, and Sustainability**, contributing to a more equitable, innovative, and sustainable future.

Sincerely,
The Editors

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TRACK 1: MARKETING PRACTICE AND RESEARCH

Driving Sustainable Consumption: Unveiling the Impact of Environmental Identity and Social Norms on Millennials' Organic Purchase Intentions

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ABSTRACT

This study investigates the link between "environmental awareness", "green self-identity", "subjective standards", and millennials' attitudes towards purchasing organic products. A quantitative, correlational technique using a cross-sectional design was used. A 25-question survey was distributed to 710 Bangalore-based millennials. The data was analysed using Confirmatory Factor Analysis (CFA) and Structural Equation Modelling. The adequacy of model fit was ascertained through scrutiny of goodness-of-fit indices, with particular attention given to the X2/df ratio, where a model was deemed acceptable. The study discovered that green self-identity and subjective standards had a considerable impact on environmental sentiments. Environmental views have a favourable influence on green purchasing intentions. Interestingly, environmental awareness was shown to have a beneficial influence on green self-identity but no direct impact on environmental sentiments. Additionally, subjective norms had no substantial effect on green self-identity. These findings emphasise the importance of self-identity and societal factors in influencing environmentally conscious behaviours among millennials. The findings indicate that cultivating a green self-identity and leveraging social norms can successfully impact millennial views and inclinations to buy organic items. Contrary to popular belief, environmental awareness alone may not immediately influence attitudes, highlighting the importance of specific efforts to encourage sustainable purchasing.

Keywords: Environmental Awareness, Green products, Organic purchase, Sustainability.

1. INTRODUCTION

The swift growth of the economy and advancements in technology have undoubtedly enhanced the quality of life (Lopes and Gomes, 2023). However, they have also given rise to numerous environmental risks, such as air, and water contamination, and depletion of biodiversity(Tian *et al.*, 2022). These challenges pose a direct threat to the sustained well-being of both the environment and society (Tian *et al.*, 2022). Various studies have established that consumer behaviour, particularly in terms of consumption patterns, exerts a harmful impact on the natural environment (Sun *et al.*, 2022). Customers are eager to acquire green items that are ecologically beneficial owing to environmental considerations (Khan and Mohsin, 2017; Majhi, 2022; Sun and Xing, 2022). Consumers are more engaged in environmental issues, which is reflected in their desire to buy green products (Barbu *et al.*, 2022). The growing preference for eco-friendly consumption is prompting businesses to embrace green marketing strategies. This is aimed at showcasing to customers a positive corporate image and a commitment to social responsibility (Barbu *et al.*, 2022; Zyadin *et al.*, 2021). Companies employ a variety of techniques to apply their green philosophy, including green production, eco-label packaging, and distribution (Lopes and Gomes, 2023). By leveraging these strategies, organizations are gaining a competitive edge and accessing new markets,

thereby enhancing their brand image, reputation, and product perception among customers (Yin *et al.*, 2010). However, consumers' lives and consumption models are the major focus of initiatives to improve green purchasing habits (Tarabieh, 2021; Tian *et al.*, 2022). Accordingly, businesses have shown an interest in producing and promoting green products. Business executives and experts have been seeking ways to influence customers to buy ecologically friendly things (Wang *et al.*, 2019).

In recent years, a noticeable trend towards sustainable consumption has infiltrated worldwide consumer behaviour, with an increased emphasis on items that represent environmental responsibility (Chen and Chang, 2012). At the forefront of this developing landscape is the rising interest in organic products, recognised for their perceived ecological benefits and possible contribution to environmental sustainability (Han, 2020; Shin and Ki, 2019). Concurrently, the concept of green self-identity introduces a psychological dimension to sustainable consumption, wherein individuals align their self-concept with environmental consciousness (Vu *et al.*, 2022). Moreover, subjective norms, reflecting societal and peer expectations concerning environmentally friendly behaviours, play a significant role in attitude formation and preferences in the marketplace (Hong *et al.*, 2021; Zhou *et al.*, 2021). Comprehending the drivers and barriers of environmentally conscious consumer behaviour is

essential for crafting and designing effective incentives (Majhi, 2022).

The rapid growth of the economy and advancements in technology have significantly enhanced the quality of life (Lopes and Gomes, 2023). However, these advancements have concurrently led to environmental risks, such as air pollution, water contamination, and biodiversity depletion, which threaten long-term societal and environmental well-being (Tian *et al.*, 2022). Research indicates that consumer behaviour, particularly in consumption patterns, exerts a detrimental impact on the environment (Mustafa *et al.*, 2022). As a result, there is a growing consumer interest in green products that are perceived as ecologically beneficial (Kamalanon *et al.*, 2022; Lin, 2023; Mustafa *et al.*, 2022; Tarabieh, 2021) is a significant predictor of pro-environmental attitudes (Chen *et al.*, 2020; Frank and Brock, 2019). Research shows that heightened environmental awareness increases concern for ecological well-being, influencing positive attitudes and behaviours towards environmentally beneficial actions (Chen *et al.*, 2018; Rahnama and Rajabpour, 2017; Shabbir *et al.*, 2020). For example, Yang (2017) found that increased environmental awareness correlates with a deeper sense of duty towards the earth, fostering positive attitudes. Green self-identity, defined as identifying with environmentally friendly behaviours and beliefs, plays a crucial role in shaping pro-environmental attitudes and behaviours (Biswas and Roy, 2015; Chen and Chang, 2012). Studies by Tseng (2013) highlight the importance of self-identity in determining environmentally friendly behaviours.

Subjective norms, or the perceived societal pressures to conform to specific behaviours, are consistently linked to the formation of pro-environmental views (Mutea, 2015). According to Ajzen's Theory of Planned Behavior, subjective norms influence individual attitudes by shaping perceived societal expectations (Icek Ajzen, 1991). Gan (2008) found that social norms significantly affect pro-environmental behaviour, indicating that societal support can encourage eco-friendly views. Environmental awareness also influences the development of a green self-identity. Yin et al. (2010) posit that knowledge about environmental concerns, combined with understanding one's impact, contributes to forming a pro-environmental identity.

Studies indicate that individuals with high environmental concerns are more likely to develop a robust environmental identity and engage in environmentally beneficial behaviours (D'Souza *et al.*, 2006; Gan *et al.*, 2008). Green purchase intention, reflecting a consumer's likelihood to buy products based on environmental beliefs, is influenced by environmental attitudes (Suban, 2022). Research shows a strong link between pro-environmental attitudes and the intention to purchase organic products (Adhitiya and Astuti, 2019; Woo and Kim, 2019).

Despite extensive research on individual elements such as "environmental awareness, green self-identity, and subjective norms", there remains a significant gap in the integrated examination of these factors within the context of green purchase intention for organic products. Existing studies often focus on behavioural determinants, validating the Theory of Planned Behavior (Choi and Kim, 2021; Tarabieh, 2021; Wei *et al.*, 2018). This study aims to fill this gap by analyzing the interconnections among "environmental awareness", "green self-identity", and "subjective norms", proposing a model to explore their impact on attitudes towards purchasing organic products. The findings intend to provide valuable insights for fostering sustainable consumption among businesses, policymakers, and marketers.

2. BACKGROUND OF THE STUDY

2 1 *Environmental awareness and attitude*

Environmental awareness, which includes people's knowledge and perception of environmental concerns, has been recognised as a strong predictor of pro-environmental views (Sun and Xing, 2022). Research reveals that heightened environmental awareness leads to higher concern for ecological well-being, affecting one's attitudes and behaviours towards ecologically beneficial actions (Dong *et al.*, 2023). Furthermore, the importance of green self-identity has become prominent in environmental psychology (Zhao *et al.*, 2014). An article by Dunlap et al. (2000) demonstrates that increased environmental awareness is related to a deeper feeling of duty and care for the earth, generating positive attitudes. Additionally, D'Souza et al. (2006) assert that "environmental awareness" plays an underlying role in shaping pro-environmental attitudes. However, it is essential to acknowledge contrasting perspectives within the literature. Some studies, such as those by Gan et al. (2008), propose that while awareness is crucial, it may not always be sufficient to trigger environmentally friendly behaviours without additional contextual factors. This dissident position shows that the relationship between environmental awareness and attitudes may be complicated and dependent on different circumstances, and we predict that the link between these elements will be greater. Therefore, we hypothesize the following;

H1: The awareness of environmental issues has a positive impact on millennials' attitudes towards the environment.

2.2 *Green self-identity and environmental attitude*

Research by Whitmarsh (2010) Implies that people possessing a robust environmental self-identity are more inclined to engage in pro-environmental behaviours. Similarly, studies by Gatersleben et al.(2014) emphasise the significance of self-identity in determining environmentally friendly attitudes and behaviours. The concept of environmental self-identity emphasises individuals find a

sense of belonging and purpose through their association with social organizations, particularly those dedicated to environmental causes (Turner, 1979). Moreover, Chen et al. (2020) established a definite correlation linking subjective norms and environmentally responsible behaviour. However, it is essential to recognize the complexity of identity formation. Some studies, such as those by Corner et al (2014), caution against an overly simplistic understanding of identity, emphasizing the need to consider multiple identities that may coexist and sometimes conflict. Despite this complexity, the findings suggest that a 'green' self-identification has a favourable impact on the formation of environmental attitudes, albeit further study is needed to understand the complex dynamics of identity and environmentalism. Hence, we propose the hypothesis as;

H2: Green' self-identity has a positive effect on shaping environmental attitudes

2.3 *Subjective norms and environmental attitude*

Subjective norms, defined as perceived societal pressures to comply with a given behaviour, have consistently been associated with the formation of pro-environmental views (Arli *et al.*, 2018). Ajzen's Theory of Planned Behavior (Icek Ajzen, 1991) reveals that subjective norms play a critical role in moulding individual attitudes by influencing perceived societal expectations about environmentally friendly behaviours. Research conducted by Schultz et al (2014) discovered that social norms strongly affected pro-environmental behaviour, showing that individuals are more inclined to adopt eco-friendly views when they feel society supports such acts. Moreover, a meta-analysis by Hunecke (2001) demonstrated a positive association between subjective norms and environmental attitudes, lending credence to the notion that societal expectations contribute to the creation of healthy environmental attitudes. However, some research shows that the link between subjective standards and environmental attitudes may not always be obvious. In a study by Harland et al (2007), the authors discovered that, whereas subjective norms affected pro-environmental intentions, their impact on actual behaviour was smaller. As a result, the influence of subjective standards on environmental attitudes may differ across cultural settings, calling into question the universality of a consistently beneficial impact. So, the following theory was proposed:

H3: The influence of subjective norms has a positive impact on environmental attitudes.

2.4 *Green self-identity and environmental awareness*

The green self-identity, referring to an individual's affiliation with ecologically friendly behaviours and beliefs, has grown in significance in environmental psychology (Amallia *et al.*, 2021). Individuals with heightened awareness of environmental issues are more prone to develop a robust environmental identity (Schultz, 2001). Whitmarsh (2010) says that knowledge about environmental concerns, together with an understanding of one's effect, helps to the building of a pro-environmental identity. Additionally, Schultz (2001) Individuals with higher degrees of environmental concern were more likely to participate in environmentally beneficial behaviours, indicating a possible relationship between awareness and identity development. This research lays the groundwork for this concept, indicating a favourable relationship between environmental awareness and the formation of a green self-identity. Therefore, we recommend the following.

H4: Green self-identity is positively shaped by environmental awareness.

2.5 *Green self-identity and subjective norms*

Self-identity refers to a person's consistent behaviour based on the roles they take on(Juan *et al.*, 2024). Research by Corner (2014) suggests that increased awareness of environmental issues fosters a sense of personal responsibility, leading individuals to adopt sustainable behaviours and identify with environmentally friendly values. Additionally, Barbarossa (2016) found that heightened environmental concern is associated with stronger pro-environmental attitudes and behaviours, reflecting a positive correlation between awareness and green self-identity. Conversely, critics argue that external factors play a more substantial role in shaping environmental attitudes, challenging the assumption that heightened environmental awareness directly correlates with the formation of a green self-identity Mahapatra (2008). Moreover, certain studies propose that the intricate interplay of individual values and societal structures may introduce inconsistencies in the connection between awareness and self-identity. This highlights the necessity for a nuanced understanding of the factors shaping the development of green identity (Lopes and Gomes, 2023; Sun and Xing, 2022).

Therefore, we propose;

H5: The formation of a green self-identity is positively influenced by subjective norms

2.6 *Green purchase intention and environmental attitude*

Green purchasing intentions reflect the probability that a consumer will buy a product based on their environmental beliefs (Suban, 2022, 2022, 2023; Suban *et al.*, 2021). It indicates how willing consumers are to buy from companies known for their environmentally friendly practices (Hosta and Zabkar, 2021; Siyal *et al.*, 2021) and a consumer desires to buy things when they realise they are green or green brand products (Zhang *et al.*, 2018). A study by Thøgersen (2012) not only validated the favourable link between environmental views and green purchasing but also underlined the mediatory function of personal norms in this relationship.

This aligns with the findings of Choi and Kim (2021), who proved that pro-environmental attitudes greatly contribute to developing consumer ethical intentions, including the intention towards organic buying. Moreover, the contemporary application of (Icek Ajzen, 1991) in the work of Chekima et al(2023) presents more evidence, indicating that environmental sentiments have a substantial impact on purchasers' intentions to engage in green purchasing behaviour. As a result, the researcher developed the theory presented below.

H6: The green purchase intention is positively impacted by one's environmental attitude.
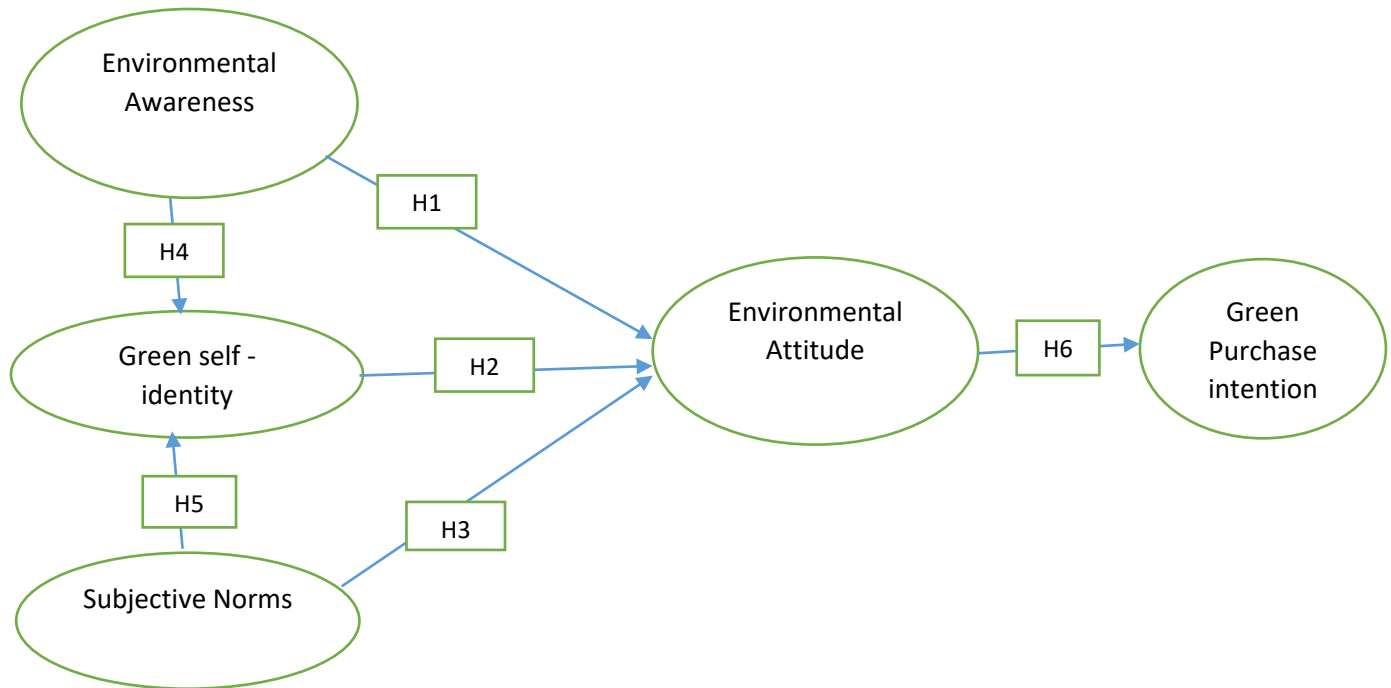
Figure 1 Research hypothesis model

Source: By author

3. METHODS

3.1 Sample design and data collection

The study used a quantitative, correlational technique with a Cross-sectional design to investigate correlations between variables. A 25-question survey was used to collect data, which included five demographic questions and 20 items related to model variables that were hypothesised. To confirm the questionnaire's validity, a team of professionals, including research and marketing specialists, verified it. Following that, a pilot test with 30 millennials was done. The survey addressed millennials living in Bangalore. Surveys were done outside retail malls using a random sampling method. Out of 731 willingly participated questionnaires, 20 were eliminated owing to discrepancies, leaving a dataset of 710 individuals for additional statistical analysis.

3. 2 Measurement of Construct

To assess the proposed dimensions, we employed an established five-point Likert scale. Environmental awareness was assessed using three dimensions derived from Ahmed (2020). Green self-identity was gauged according to the metrics established by Rahnama and Rahnama (2017). Subjective norms were evaluated using the methodology outlined by Chen et al.(2020). The measurement of environmental attitude, as well as four items assessing green purchase intention, was adapted from the study conducted by Chen and Cheng (2012).

3.3 Data analysis

The statistical analyses were guided by recent publications on green consumption, emphasizing methodological rigour. A Cronbach's Alpha test was used to assess the internal consistency of the questionnaire. For assessing goodness-of-fit indices during the analysis, we initially considered the relative value of X2 divided by the degrees of freedom (X2/df), adhering to the literature-established threshold of 0.7. KMO test produced a value of 0.900 with a significance level of 0.001 (p < 0.05), meeting the widely accepted criteria (Chand and Fei, 2021; Hosta and Zabkar, 2021). Additionally, the variance explained indicated a robust grouping of study items into five dimensions, accounting for 71.83%, surpassing the recommended threshold of 60% (Le-

Anh and Nguyen-To, 2020). CFA was employed to assess convergent and discriminant validity, and SEM. Goodness-of-fit indices were verified by evaluating the X2/df ratio, with a model considered acceptable when the value is below 3.0 (Choi and Johnson, 2019).

4. RESULTS AND DISCUSSION

4.1 Demographics

The profile of the study's participants in Bangalore, as presented in table 1, provides valuable insights into the sample composition. The majority of respondents are graduates, constituting 59.44% of the total, while 40.56% have an undergraduate education. In terms of gender distribution, 58.03% are male, and 41.97% are female. The age distribution is fairly evenly spread, with 30.28% falling within the 23-28 years range, 23.66% in the 29-34 years category, and 46.06% in the 35-44 years range. The social class distribution indicates a predominantly middle to upper-middle-class representation, with 71.55% falling into the middle-upper class category, 21.69% in the middle class, and 4.23% in the lower-middle class. Notably, a small proportion (2.54%) belongs to the upper class. These demographics lay the foundation for understanding the perspectives and behaviours of the study's participants, providing context for the subsequent analyses and findings.

TABLE 1. Demographics

Category	Description	Frequency	Percentage
City	Bangalore	710	100
Education Background	Graduate	422	59.44
	Undergraduate	288	40.56
Gender	Male	412	58.03
	Female	298	41.97
Age	23-28 Years	215	30.28
	29-34 Years	168	23.66
	35-44 years	327	46.06
Social Class	Upper Class	18	2.54

Category	Description	Frequency	Percentage
	Middle- upper Class	508	71.55
	Middle Class	154	21.69
	Lower- Middle Class	30	4.23

Source: By author

4.2 Measurement model

The findings presented in Table 2 provide a thorough examination of the Confirmatory Factor Analysis (CFA) results, offering insights into the psychometric properties of the study's key constructs. "Environmental Awareness" exhibits robust validity, supported by high load factors, a commendable Cronbach's Alpha (0.897), and a Composite Reliability (CR) of 0.931. The AVE value of 0.745 further affirms convergent validity. However, attention is drawn to "Green Self-identity," which, while showing satisfactory load factors, has a slightly lower AVE (0.572), indicating potential room for improvement in convergent validity. Similarly, "Subjective Norms" and "Environmental Attitudes" demonstrate strong psychometric properties but fall slightly short in AVE values, suggesting consideration for construct refinement. The evaluation of "Green Purchase Intention" raises concerns with its AVE (0.641). Nevertheless, the overall internal consistency, measured by Overall Alpha (0.8894), is high, confirming the reliability of the instrument. Moving to Table 3, the analysis of discriminant validity and inter-construct correlations reveals robust relationships among the constructs. Significant correlations at the 0.01 level highlight the interconnectedness among "Environmental Awareness," "Green Self-identity," "Subjective Norms," "Environmental Attitudes," and "Green Purchase Intention." The absence of a significant correlation between "Green Self-identity" and "Subjective Norms" underscores the unique variance within these constructs, reinforcing their distinct contributions to the overall model. This nuanced understanding significantly enriches the comprehensiveness of the measurement model and contributes to a refined interpretation of the study's theoretical framework.

TABLE 2: Convergent validity and measurement model's confirmatory factor analysis (CFA)

Variables/ Constructs	Items	Load Factor	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Environmental Awareness	"I am very concerned about the environment"	0.915	0.897	0.931	0.745
	"Major political change is needed to protect the natural environment".	0.867			
	"Major social changes are needed to	0.902			

Variables/Constructs	Items	Load Factor	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
	protect the natural environment."				
Green Self-identity	"I think of myself as someone who is concerned about environmental issues"	0.872	0.799	0.854	0.572
	"I think of myself as a 'green' consumer"	0.657			
	"Buying this chair would make me feel like a green consumer"	0.861			
	"would feel totally satisfied with myself if I bought this chair"	0.735			
Subjective Norms	"Most of my friends think purchasing"		0.899	0.864	0.628
	"Most of my colleagues think purchasing organic products is the right thing to do"	0.631			
	"Most of my family members think purchasing organic products is the right thing to do"	0.975			
	"My acquaintances would approve my decision to buy organic products"	0.763			
Environmental Attitudes	"I think organic products help save nature and its resources"	0.891	0.983	0.963	0.822
	"Environmental protection is important to me when shopping for products"	0.992			
	"I have a favorable attitude toward purchasing organic products"	0.985			
Green Purchase Intention	"I consider purchasing organic products because they are less polluting"	0.721	0.869	0.873	0.641
	"I consider switching to other brands for ecological reasons"	0.953			
	"I intend to buy organic products"	0.753			
	"I intend to switch to an organic version of a product"	9.725			
Overall Alpha			0.8894		

Source: Author

TABLE 3. Discriminant validity &Inter-construct correlations and square root of the AVE along the diagonal

	Environmental Awareness	Green Self-identity	Subjective Norms	Environmental Attitudes	Green Purchase Intention	SR AVE
"Environmental Awareness"	0.878					0.875
"Green Self-identity"	0.187**	0.583				0.784
"Subjective Norms"	0.185**	0.652	0.627			0.788
"Environmental Attitudes"	0.128**	0.096*	0.224**	0.827		0.912
"Green Purchase	0.157**	0.124**	0.325**	0.264**	0.661	0.823

	Environmental Awareness	Green Self-identity	Subjective Norms	Environmental Attitudes	Green Purchase Intention	SR AVE
Intention"						
"Environmental awareness–Environmental attitude, Green self-identity–Environmental attitude, Subjective norms–Environmental attitude, Environmental attitude–Green purchase intention, and Environmental awareness–Green self-identity, presented bilateral correlation at 0.01". "** level (bilateral) and Green self-identity–Subjective norms did not present correlation". Note: "**Significant correlation at the 0.01 level bilaterally. * Significant correlation at the 0.05 level bilaterally".						

TABLE 4: Results of hypotheses testing.

Hypotheses	Relation	β	p-Value	Hypotheses
H1	Environmental Awareness-Enviromental Attitude	0.123	0.059	Rejected
H2	Green self- identity-Environmental Attitude	0.27	0.013 *	Accepted
H3	Subjective Norms-Environmental Attitude	0.199	**	Accepted
H4	Environmental Awareness-Green self- identity	0.113	**	Accepted
H5	Subjective Norms-Green self- identity	0.004	0.654	Rejected
H6	Environmental Attitude-Green Purchase Intention	0.25	**	Accepted
"Goodness-of-fit indices: X2 (gl) = 354.241(129), X2/g = 2.668, NFI = 0.961, TLI = 0.969, CFI = 0.975, RMSEA= 0.047". "** The correlation is significant at the 0.01 level (bilateral). * The correlation is significant at the 0.05 level (bilateral)".				

Source: By author

4. 3 Structural model
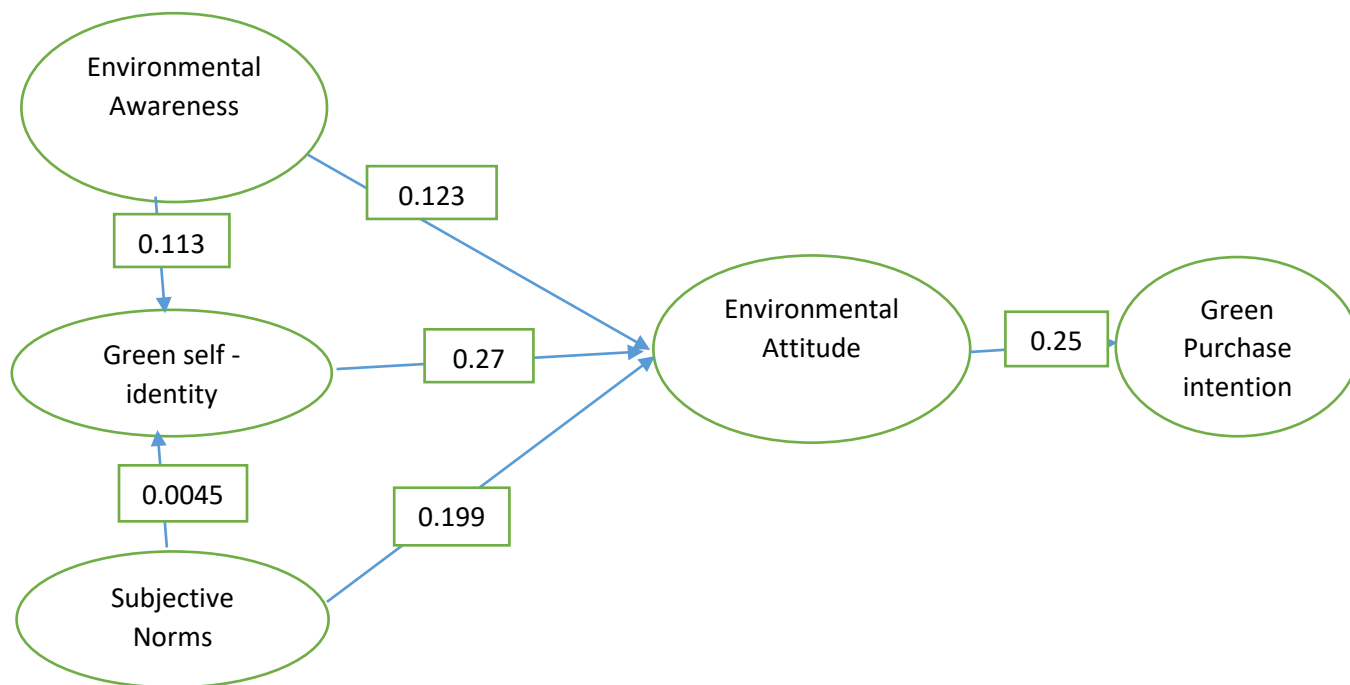
Figure 2: Values of hypothesis model

In Table 4, the hypotheses testing results provide valuable insights into the relationships within the proposed conceptual framework. Hypotheses H2, H3, H4, and H6, which respectively posit connections between "Green Self-identity" and "Environmental Attitude" ($\beta = 0.27$, $p < 0.05$), "Subjective Norms" and "Environmental Attitude" ($\beta = 0.199$, $p < 0.05$), "Environmental Attitude" and "Green Purchase Intention" ($\beta = 0.25$, $p < 0.05$), and "Environmental Awareness" and "Green Self-identity" ($\beta = 0.113$, $p < 0.05$), are supported with statistically significant beta coefficients and p-values below the 0.05 threshold, indicating acceptance of these hypotheses. These findings substantiate the influence of environmental awareness (Chen and Chang, 2012), self-identity, subjective norms (Icek Ajzen, 1991), and attitudes(Adhitiya and Astuti, 2019) individuals' intentions to make green purchases (Yusiana et al., 2021). Conversely, Hypotheses H1 and H5, suggesting relationships between "Environmental Awareness" and "Environmental Attitude" and between "Subjective Norms" and "Green Self-identity," are not supported based on non-significant p-values, leading to their rejection. The results demonstrate that the dataset satisfies key goodness-of-fit indices: $X2$ (gl) = 354.241(129), yielding an $X2/g$ ratio of 2.668, and achieving favourable values for other indices, including NFI = 0.961, TLI = 0.969, CFI = 0.975. These indices collectively indicate a well-fitting model, providing confidence in the reliability and validity of the proposed conceptual framework.

5. DISCUSSION

In the current academic and business landscapes, there is a growing focus on understanding the factors influencing the consumption of organic products, particularly among millennials. Previous research has highlighted discrepancies between millennials' attitudes and their actual intentions to make environmentally conscious purchases (Biswas and Roy, 2015). This study aims to contribute valuable insights by shedding light on the motivating factors that shape millennials' attitudes toward the intention of purchasing organic products.

The research model utilized in this study confirmed the impact of attitude on intentions to buy organic products. Moreover, it facilitated the identification of personal factors that inspire environmental attitudes among millennials intending to make eco-friendly purchases. However, statistical analyses led to the rejection of Hypothesis 1, indicating that Environmental Awareness (EA) does not influence the Environmental Attitude (EAT) of millennials in Bangalore. This implies that Bangalore millennials may believe that achieving social or political changes is not necessary for improving consumer awareness, and strict laws against pollution are not required since consumers should take individual responsibility for environmental protection.

Although studies examining the connection between Environmental Awareness (EA) and Environmental Attitudes (EAT) are limited, the outcomes of this study are in concordance with (Maichum et al., 2016), indicating that Environmental Awareness (EA) may not always translate into personal actions supporting environmentally aligned consumption. This contradicts previous research that posited EA as a crucial predictor stimulating Green Purchase Intentions (GPI).

Hypothesis 2 is confirmed, illustrating that Green Self-Identity (GSI) has a positive impact on the Environmental Attitudes (EAT) of millennials in Bangalore. This implies that millennials in the region, considering themselves green consumers, are influenced by their inclination towards organic products, leading to an increased environmental attitude. This finding aligns with existing research suggesting that GSI promotes positive actions and attitudes toward environmental protection. Regarding Social Norms (SNs), the statistical analyses conducted in this study support the acceptance of Hypothesis 3 (H3), asserting that SNs have a positive influence on millennials' Environmental Attitude (EAT). This discovery emphasizes that the opinions and approval of friends, family, and colleagues significantly shape the EAT of Bangalore millennials, underscoring the impact of social circles on their attitudes toward environmental protection.

In the final analysis, the study examined the association between Environmental Attitudes (EAT) and Green Purchase Intentions (GPI), with Hypothesis 6 being affirmed. This implies that EAT has a positive influence on GPI among millennials, signifying their perception of organic products as contributing to nature conservation. This discovery substantiates the notion that the attitudes of millennials play a substantial role in shaping Green Purchase Intentions (GPI), contradicting research that challenges the direct influence of attitudes on GPI (Tarabieh, 2021). Remarkably, the study uncovered that while Environmental Awareness (EA) does not exert an influence on Environmental Attitudes (EAT), it does impact Green Self-Identity (GSI). The acceptance of Hypothesis 4 suggests that millennials in Bangalore may not necessarily need EA to develop pro-environmental attitudes but do require it to identify themselves as environmentally conscious consumers. Contrary to anticipated outcomes, the research did not confirm a positive impact of Subjective Norms (SNs) on the Green Self-Identity (GSI) of millennials. Hypothesis 5 has been rejected based on these findings. This suggests that the viewpoints of friends and family concerning the acquisition of organic products do not influence the formation of Green Self-Identity (GSI) among millennials in Bangalore. This contradicts the findings by (Vu et al., 2022), who discovered that Subjective Norms (SNs) act as a mediator in the

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connection between Green Self-Identity (GSI) and consumer attitudes

The confirmation of relationships between variables, such as the positive influence of Green Self-Identity (GSI) on Environmental Attitude (EAT) and the impact of Social Norms (SNs) on EAT, enriches the theoretical understanding of the complex interplay of factors shaping environmentally conscious intentions. The rejection of Hypothesis 1, indicating that Environmental Awareness (EA) does not directly influence EAT, challenges established assumptions and calls for a reevaluation of the role of awareness in shaping attitudes. The nuanced findings related to GSI in Hypothesis 5, highlighting the influence of EA on identity rather than attitudes, contribute to a more refined understanding of the psychological mechanisms underlying green consumer behaviour. These theoretical insights provide a foundation for future research to explore and expand upon the intricate relationships identified in this study.

The positive impact of GSI on EAT suggests that fostering a sense of identity as environmentally conscious consumers may be an effective strategy to influence attitudes and, subsequently, purchasing intentions. Furthermore, the role of Social Norms in shaping EAT underscores the importance of social influence in driving environmentally friendly behaviours among millennials. Marketers can leverage social connections and approval within peer groups to promote green products and initiatives. The rejection of Hypothesis 5, indicating that SNs do not impact Green Self-Identity, prompts businesses to reconsider the assumed role of social influence in shaping consumers' green identities. Overall, the study provides actionable insights for businesses and policymakers to tailor strategies that resonate with the unique psychological dynamics influencing millennials' green consumption intentions.

5 1 Theoretical implications

This study advances our knowledge of the relationship between environmental awareness, green self-identity, subjective norms, and their impact on millennials' environmental views and green buying intentions. The identification of green self-identity and subjective standards as key determinants of environmental attitudes emphasises the psychological and social aspects of sustainable consumption. The rejection of environmental awareness as a direct driver of environmental attitudes calls into question long-held ideas and argues that awareness plays a more complex role in developing green identities than views. This observation calls into question existing ideas that emphasise awareness's direct influence on pro-environmental behaviour. Furthermore, the study emphasises the significance of green self-identity in instilling favourable environmental attitudes, implying that self-concept congruence with environmental principles is critical for encouraging sustainable behaviour. The observed favourable effect of subjective standards on environmental attitudes supports the importance of social

forces in creating environmental consciousness. These findings provide a theoretical foundation for future study into the complex psychological mechanisms driving environmentally conscious consumer behaviour, emphasising the need to consider many, interconnected components rather than single predictors.

5.2 Managerial implications

From a managerial standpoint, the study provides significant data for organisations and regulators looking to encourage sustainable consumption among millennials. The findings indicate that cultivating a green self-identity is critical for developing favourable environmental attitudes and intentions. Marketers should concentrate on efforts that increase customers' identification with environmental principles while emphasising the personal advantages of being an ecologically responsible consumer. Furthermore, leveraging social norms by demonstrating peer and community support for green behaviours can improve the impact of marketing campaigns. Businesses may utilise testimonials, endorsements, and social proof to alter millennial views towards organic products. The denial of subjective standards' influence on green self-identity suggests that direct social pressure is less successful in shaping green identities. Instead, efforts should focus on personal responsibility and the benefits of sustainable consumption. Overall, the study offers actionable insights for establishing targeted marketing tactics and policies that align with the psychological and social factors that influence millennials' green buying intentions, thereby building a sustainable culture.

6. CONCLUSION

This study sheds light on the variables influencing millennials' views and intentions to purchase organic products in Bangalore. The findings emphasise the importance of green self-identity and subjective standards in forming environmental attitudes, which then positively influence green purchasing intentions. Contrary to popular belief, environmental knowledge does not directly impact environmental views, but it does play an important part in establishing a green self-identity. This suggests that, while awareness is crucial, it must be combined with identity and social forces to successfully encourage sustainable purchase. The study emphasises the importance of companies and politicians promoting a green self-identity and using social norms to influence millennial purchase behaviours. Understanding the psychological and social processes at play allows for the development of tailored programmes to promote sustainable consumption and encourage organic product purchases.

6.1 Limitations and future scope

Despite its merits, the research has some flaws that must be addressed. The cross-sectional design restricts the capacity to infer causality across factors, hence additional longitudinal

research is required to demonstrate more solid causal linkages. The concentration on millennials in Bangalore may restrict the findings' applicability to other demographic groups and places, highlighting the necessity for studying with various populations. The use of self-reported data may involve response biases, such as social desirability bias, which might impair the accuracy of the results. Mixed-method techniques, including qualitative methodologies, may give a more complete knowledge of the elements that influence green buying intentions.

Future studies should broaden the scope to include a wider variety of demographic characteristics, such as income, education, and cultural variations, to improve the findings' generalizability and depth. Exploring other moderating variables that may influence the correlations investigated in this study might provide a more sophisticated knowledge of sustainable consumption behaviours. In-depth interviews and focus groups are examples of qualitative research that can reveal underlying reasons and impediments to sustainable consumption that quantitative approaches cannot capture. Finally, studying the efficacy of certain marketing tactics and policy measures in fostering green self-identity and leveraging societal norms might give useful insights for firms and governments seeking to build a sustainable culture.

REFERENCES

[1.] Adhitiya, L. and Astuti, R.D. (2019), "The Effect of Consumer Value on Attitude Toward Green Product and Green Consumer Behavior in Organic Food", *IPTEK Journal of Proceedings Series*, Vol. 0 No. 5, p. 193.

[2.] Ahmed, N., Li, C., Khan, A., Qalati, S.A., Naz, S. and Rana, F. (2020), "Purchase intention toward organic food among young consumers using theory of planned behavior : role of environmental concerns and environmental awareness", *Journal of Environmental Planning and Management*, Routledge, Vol. 0 No. 0, pp. 1–27.

[3.] Amallia, B.A., Effendi, M.I. and Ghofar, A. (2021), "The Effect of Green Advertising, Trust, and Attitude on Green Purchase Intention: An Evidence from Jogjakarta, Indonesia", *International Journal of Creative Business and Management*, Vol. 1 No. 1, p. 66.

[4.] Arli, D., Tan, L.P., Tjiptono, F. and Yang, L. (2018), "Exploring consumers' purchase intention towards green products in an emerging market: The role of consumers' perceived readiness", *International Journal of Consumer Studies*, Vol. 42 No. 4, pp. 389–401.

[5.] Barbarossa, C. and De Pelsmacker, P. (2016), "Positive and Negative Antecedents of Purchasing Eco-friendly Products: A Comparison Between Green and Non-green Consumers", *Journal of Business Ethics*, Vol. 134 No. 2, pp. 229–247.

[6.] Barbu, A., Catană, Ștefan A., Deselnicu, D.C., Cioca, L.I. and Ioanid, A. (2022), "Factors Influencing Consumer Behavior toward Green Products: A Systematic Literature Review", *International Journal of Environmental Research and Public Health*, Vol. 19 No. 24, available at:https://doi.org/10.3390/ijerph192416568.

[7.] Biswas, A. and Roy, M. (2015), "Green products: An exploratory study on the consumer behaviour in emerging economies of the East", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 87 No. 1, pp. 463–468.

[8.] Chand, V.S. and Fei, C. (2021), "Self-brand connection and intention to purchase a counterfeit luxury brand in emerging economies", *Journal of Consumer Behaviour*, Vol. 20 No. 2, pp. 399–411.

[9.] Chekima, B., Bouteraa, M., Ansar, R., Lada, S. and Fook, L.M. (2023), "Determinants of Organic Food Consumption in Narrowing the Green Gap", pp. 1–15.

[10.] Chen, C.C., Chen, C.W. and Tung, Y.C. (2018), "Exploring the consumer behavior of intention to purchase green products in Belt and Road countries: An empirical analysis", *Sustainability (Switzerland)*, Vol. 10 No. 3, available at:https://doi.org/10.3390/su10030854.

[11.] Chen, H.S., Liang, C.H., Liao, S.Y. and Kuo, H.Y. (2020), "Consumer attitudes and purchase intentions toward food delivery platform services", *Sustainability (Switzerland)*, Vol. 12 No. 23, pp. 1–18.

[12.] Chen, Y.S. and Chang, C.H. (2012), "Enhance green purchase intentions: The roles of green perceived value, green perceived risk, and green trust", *Management Decision*, Vol. 50 No. 3, pp. 502–520.

[13.] Choi, D. and Johnson, K.K.P. (2019), "Influences of environmental and hedonic motivations on intention to purchase green products: An extension of the theory of planned behavior", *Sustainable Production and Consumption*, Elsevier B.V., Vol. 18 No. xxxx, pp. 145–155.

[14.] Choi, S. and Kim, I. (2021), "Sustainability of nature walking trails : predicting walking tourists ' engagement in pro-environmental behaviors", No. May, available at:https://doi.org/10.1080/10941665.2021.1908385.

[15.] Corner, A., Markowitz, E. and Pidgeon, N. (2014), "Public engagement with climate change : the role of human values", Vol. 5 No. June, pp. 411–422.

[16.] D'Souza, C., Taghian, M., Lamb, P. and Peretiatkos, R. (2006), "Green products and corporate strategy: an empirical investigation", *Society and Business Review*, Vol. 1 No. 2, pp. 144–157.

[17.] Dong, K., Li, J. and Dong, X. (2023), "Chinese Journal of Population , Resources and Environment How do green product exports affect carbon emissions ? Evidence from China", *Chinese Journal of Population, Resources and Environment*, Elsevier, Vol. 21 No. 2, pp. 43–51.

[18.] Frank, P. and Brock, C. (2019), "'Green cannibalism' or an 'organic inside job'? Empirical insights into the rivalry of ethical grocery types", *Psychology and Marketing*, Vol. 36 No. 6, pp. 597–617.

[19.] Gan, C., Wee, H.Y., Ozanne, L. and Kao, T.H. (2008), "Consumers' purchasing behavior towards green products in New Zealand", *Innovative Marketing*, Vol. 4 No. 1, pp. 93–102.

[20.] Gatersleben, B., Murtagh, N. and Abrahamse, W. (2014), "Contemporary Social Science : Journal of the Academy of Social Sciences Values , identity and pro-environmental behaviour", No. May 2015, pp. 37–41.

[21.] Han, H. (2020), "Theory of green purchase behavior (TGPB): A new theory for sustainable consumption of green hotel and green restaurant products", *Business Strategy and the Environment*, Vol. 29 No. 6, pp. 2815–2828.

[22.] Harland, P., Staats, H. and Wilke, H.A.M. (2007), "Basic and Applied Social Psychology Situational and Personality Factors as Direct or Personal Norm Mediated Predictors of Pro-environmental Behavior : Questions Derived From Norm-activation Theory Situational and Personality Factors as Direct

or Personal", No. December 2014, pp. 37–41.

[23.]Hong, I.H., Chiu, A.S.F. and Gandajaya, L. (2021), "Impact of subsidy policies on green products with consideration of consumer behaviors: Subsidy for firms or consumers?", *Resources, Conservation and Recycling*, Elsevier B.V., Vol. 173 No. May, p. 105669.

[24.]Hosta, M. and Zabkar, V. (2021), "Antecedents of Environmentally and Socially Responsible Sustainable Consumer Behavior", *Journal of Business Ethics*, Springer Netherlands, Vol. 171 No. 2, pp. 273–293.

[25.]Hunecke, M., Blöbaum, A., Matthies, E. and Höger, R. (2001), "Environment and Behavior", available at:https://doi.org/10.1177/00139160121973269.

[26.]Icek Ajzen. (1991), "The Theory of Planned behavior", *Organizational Behavior and Human Decision Process*, Vol. 50 No. 11, pp. 179–211.

[27.]Juan, H., Rivera, P. and Barcellos-paula, L. (2024), "Personal Variables in Attitude toward Green Purchase Intention of Organic Products".

[28.]Kamalanon, P., Chen, J.S. and Le, T.T.Y. (2022), "'Why do We Buy Green Products?' An Extended Theory of the Planned Behavior Model for Green Product Purchase Behavior", *Sustainability (Switzerland)*, Vol. 14 No. 2, pp. 1–28.

[29.]Khan, S.N. and Mohsin, M. (2017), "The power of emotional value: Exploring the effects of values on green product consumer choice behavior", *Journal of Cleaner Production*, Elsevier B.V., Vol. 150, pp. 65–74.

[30.]Le-Anh, T. and Nguyen-To, T. (2020), "Consumer purchasing behaviour of organic food in an emerging market", *International Journal of Consumer Studies*, Vol. 44 No. 6, pp. 563–573.

[31.]Lin, Y.H. (2023), "Determinants of Green Purchase Intention: The Roles of Green Enjoyment, Green Intrinsic Motivation, and Green Brand Love", *Sustainability (Switzerland)*, Vol. 15 No. 1, available at:https://doi.org/10.3390/su15010132.

[32.]Lopes, M. and Gomes, S. (2023), "Willingness to pay more for green products : A critical challenge for Gen Z", Vol. 390 No. January, available at:https://doi.org/10.1016/j.jclepro.2023.136092.

[33.]Mahapatra, K. and Gustavsson, L. (2008), "Innovative approaches to domestic heating: Homeowners' perceptions and factors influencing their choice of heating system", *International Journal of Consumer Studies*, Vol. 32 No. 1, pp. 75–87.

[34.]Maichum, K., Parichatnon, S. and Peng, K.C. (2016), "Application of the extended theory of planned behavior model to investigate purchase intention of green products among Thai consumers", *Sustainability (Switzerland)*, Vol. 8 No. 10, pp. 1–20.

[35.]Majhi, R. (2022), "Behavior and perception of younger generation towards green products", *Journal of Public Affairs*, Vol. 22 No. 1, available at:https://doi.org/10.1002/pa.2288.

[36.]Mustafa, S., Hao, T., Jamil, K., Qiao, Y. and Nawaz, M. (2022), "Role of Eco-Friendly Products in the Revival of Developing Countries' Economies and Achieving a Sustainable Green Economy", *Frontiers in Environmental Science*, Vol. 10 No. July, pp. 1–14.

[37.]Mutea, E.M. (2015), "Socio-economic factors influencing adoption of improved biomass energy technologies in rural and urban households in Kitui, Kenya", available at: http://41.204.161.209/handle/11295/94631.

[38.]Rahnama, H. and Rajabpour, S. (2017), "Identifying effective factors on consumers' choice behavior toward green products:

the case of Tehran, the capital of Iran", *Environmental Science and Pollution Research*, Environmental Science and Pollution Research, Vol. 24 No. 1, pp. 911–925.

[39.]Schultz, P.W., Nolan, J.M., Cialdini, R.B., Goldstein, N.J. and Griskevicius, V. (2014), "The Constructive , Destructive , and Reconstructive Power of Social Norms", pp. 429–434.

[40.]Schultz, W. (2001), "THE STRUCTURE OF ENVIRONMENTAL CONCERN : CONCERN FOR SELF , OTHER PEOPLE , AND THE BIOSPHERE", available at:https://doi.org/10.1006/jevp.2001.0227.

[41.]Shabbir, M.S., Sulaiman, M.A.B.A., Al-Kumaim, N.H., Mahmood, A. and Abbas, M. (2020), "Green marketing approaches and their impact on consumer behavior towards the environment—a study from the UAE", *Sustainability (Switzerland)*, Vol. 12 No. 21, pp. 1–13.

[42.]Shin, S. and Ki, E.J. (2019), "The effects of congruency of environmental issue and product category and green reputation on consumer responses toward green advertising", *Management Decision*, Vol. 57 No. 3, pp. 606–620.

[43.]Siyal, S., Ahmed, M.J., Ahmad, R., Khan, B.S. and Xin, C. (2021), "Factors influencing green purchase intention: Moderating role of green brand knowledge", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 20, available at:https://doi.org/10.3390/ijerph182010762.

[44.]Suban, S.A. (2022), "Bibliometric analysis on wellness tourism – citation and co-citation analysis", *International Hospitality Review*, available at:https://doi.org/10.1108/ihr-11-2021-0072.

[45.]Suban, S.A. (2023), "Spa tourism: understanding the relationship of tourist`s emotional experience, destination image, satisfaction, and intention to recommend using an integrated model", *International Journal of Spa and Wellness*.

[46.]Suban, S.A., Madhan, K. and Shagirbasha, S. (2021), "A bibliometric analysis of Halal and Islamic tourism", *International Hospitality Review*, Vol. ahead-of-p No. ahead-of-print, available at:https://doi.org/10.1108/ihr-05-2021-0038.

[47.]Sun, Y., Li, T. and Wang, S. (2022), "'I buy green products for my benefits or yours': understanding consumers' intention to purchase green products", *Asia Pacific Journal of Marketing and Logistics*, Vol. 34 No. 8, pp. 1721–1739.

[48.]Sun, Y. and Xing, J. (2022), "The Impact of Social Media Information Sharing on the Green Purchase Intention among Generation Z", *Sustainability (Switzerland)*, Vol. 14 No. 11, available at:https://doi.org/10.3390/su14116879.

[49.]Tarabieh, S.M.Z.A. (2021), "The impact of greenwash practices over green purchase intention: The mediating effects of green confusion, Green perceived risk, and green trust", *Management Science Letters*, Vol. 11, pp. 451–464.

[50.]Thøgersen, J. and Noblet, C. (2012), "Does green consumerism increase the acceptance of wind power ?", *Energy Policy*, Elsevier, Vol. 51, pp. 854–862.

[51.]Tian, Z., Sun, X., Wang, J., Su, W. and Li, G. (2022), "Factors Affecting Green Purchase Intention: A Perspective of Ethical Decision Making", *International Journal of Environmental Research and Public Health*, Vol. 19 No. 18, available at:https://doi.org/10.3390/ijerph191811151.

[52.]Tseng, S.C. and Hung, S.W. (2013), "A framework identifying the gaps between customers' expectations and their perceptions in green products", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 59, pp. 174–184.

[53.]Turner, J.C. (1979), "Social comparison and group interest in ingroup favouritism", Vol. 9 No. February 1978, pp. 187–204.

[54.]Vu, D.M., Ha, N.T., Ngo, T.V.N., Pham, H.T. and Duong,

C.D. (2022), "Environmental corporate social responsibility initiatives and green purchase intention: an application of the extended theory of planned behavior", *Social Responsibility Journal*, Vol. 18 No. 8, pp. 1627–1645.

[55.] Wang, H., Ma, B. and Bai, R. (2019), "How Does Green Product Knowledge Effectively Promote Green Purchase Intention ?", pp. 1–13.

[56.] Wei, S., Ang, T. and Jancenelle, V.E. (2018), "Willingness to pay more for green products: The interplay of consumer characteristics and customer participation", *Journal of Retailing and Consumer Services*, Elsevier Ltd, Vol. 45 No. August, pp. 230–238.

[57.] Whitmarsh, L. (2010), "Behavioural responses to climate change : Asymmetry of intentions and impacts", *Journal of Environmental Psychology*, Elsevier Ltd, Vol. 29 No. 1, pp. 13–23.

[58.] Woo, E. and Kim, Y.G. (2019), "Consumer attitudes and buying behavior for green food products: From the aspect of green perceived value (GPV)", *British Food Journal*, Vol. 121 No. 2, pp. 320–332.

[59.] Yang, Y.C. (2017), "Consumer Behavior towards Green Products", *Journal of Economics, Business and Management*, Vol. 5 No. 4, pp. 160–167.

[60.] Yin, S., Wu, L., Du, L. and Chen, M. (2010), "Consumers' purchase intention of organic food in China", *Journal of the Science of Food and Agriculture*, Vol. 90 No. 8, pp. 1361–1367.

[61.] Yusiana, R., Widodo, A. and Hidayat, A.M. (2021), "Green Purchase Intention: An Investigation Green Brand Knowledge and Green Perceived Value of Bioplastic Products in Bandung - Indonesia", *Inclusive Society and Sustainability Studies*, Vol. 1 No. 2, pp. 24–32.

[62.] Zhang, L., Li, D., Cao, C. and Huang, S. (2018), "The in fl uence of greenwashing perception on green purchasing intentions : The mediating role of green word-of-mouth and moderating role of green concern", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 187, pp. 740–750.

[63.] Zhao, H.H., Gao, Q., Wu, Y.P., Wang, Y. and Zhu, X.D. (2014), "What affects green consumer behavior in China? A case study from Qingdao", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 63, pp. 143–151.

[64.] Zhou, Z., Zheng, F., Lin, J. and Zhou, N. (2021), "The interplay among green brand knowledge, expected eudaimonic well-being and environmental consciousness on green brand purchase intention", *Corporate Social Responsibility and Environmental Management*, Vol. 28 No. 2, pp. 630–639.

[65.] Zyadin, A., Natarajan, K., Igliński, B., Iglińska, A., Kaczmarek, A., Kajdanek, J., Trishkin, M., *et al.* (2021), "Farmers' perceptions of the challenges facing the biomass market in Poland; a case study from South and Central Poland", *Biofuels*, Taylor & Francis, Vol. 12 No. 7, pp. 829–837.

Navigating the E-Highway: Unmasking Consumer Choices in India's Electric Two-Wheeler Revolution

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ABSTRACT

This study investigates consumer adoption factors for electric two-wheelers (ETWs) in India, driven by rising fuel prices and environmental concerns. By examining consumer demographics, financial status, environmental awareness, and technology preferences, this research identifies key motivations and barriers impacting ETW purchase decisions.

Using a comprehensive survey, we assess how factors such as initial cost, long-term savings, charging infrastructure, environmental impact, and advanced features influence ETW adoption across different age groups, income levels, and occupations. Additionally, the role of social networks, government incentives, and safety perceptions is explored to understand their influence on consumer readiness. Concerns around battery longevity and replacement costs, a frequently cited limitation, are also addressed to gauge their impact on the overall appeal of ETWs.

This research provides actionable insights for policymakers, manufacturers, and stakeholders, offering data to support informed strategies that address consumer concerns and promote the adoption of ETWs. By understanding these factors, the study aims to contribute to building a robust ETW ecosystem in India, advancing a sustainable transition to cleaner energy alternatives.

1. INTRODUCTION

Navigating the E-Highway of Indian Mobility - Consumer Choices in Electric Two-Wheeler Adoption

India's metropolitan landscape is about to change. An increasing number of people are questioning the traditional two-wheeler, which has long been seen as a symbol of independence and convenience, as fuel prices and environmental concerns rise. The silent, elegant, and emission-free electric two-wheeler (ETW) is a contender that promises a greener future. Nevertheless, despite the obvious allure of sustainability and potential financial advantages, consumer adoption is still minimal. To fully realize the potential of the ETW industry, it is imperative to comprehend the intricate interplay between aspirations and practicalities that influences the choices made by Indian customers in this domain.

The literature that is currently available sheds light on the factors influencing ETW adoption globally. While Sharma et al. (2022) emphasizes the attraction of long-term cost reductions despite the initial high cost, Gupta et al. (2023) echo Singh et al. (2023) in underlining the relevance of environmental consciousness as a motivation. However, there are challenges in the form of concerns about the infrastructure needed for charging (Raj & Kumar, 2022) and issues about battery anxiety (Das & Ghosh, 2020; Patel et al., 2021).

The presentation of the social and cultural nuances of the Indian context is distinctive. According to Kumar et al. (2023), age, income, and occupation are examples of demographic factors that matter. Mishra et al. (2022) claim that social influence from recommendations from friends and family is a powerful motivator. As Dasgupta & Sengupta (2021) indicate, government interventions such enticing subsidies and incentives have been demonstrated to enhance adoption rates.

There is still a gap, though. Even if previous research provides insightful information, it often presents a broad or global perspective that ignores the more nuanced aspects of the psyche of Indian consumers. This study delves deeper, focusing on understanding the key factors that encourage and hinder ETW adoption in the Indian market.

Through a comprehensive survey, we aim to deconstruct the intricate web of individual attitudes, perceptions, and decision-making processes that influence consumer decisions. We investigate individual viewpoints on cost-benefit trade-offs, environmental challenges, technology allure, social media power, and political laws, going beyond demographics. Additionally, we explore significant domains that are often neglected in earlier research, like concerns about batteries and safety.

By analysing both quantitative data and qualitative insights, this research seeks to present a more comprehensive picture of Indian consumers' opinions toward ETWs. To help stakeholders like manufacturers, legislators, and infrastructure developers hasten the ETW revolution in India, we attempt to identify major drivers and barriers.

Keywords: Sustainability, Eco friendly transport, E-vehicle, E-2W

2. REVIEW OF LITERATURE

Directing passengers in the right direction
Demographics Matter: Younger, wealthier urbanites are leading the movement, according to Kumar et al. (2023).
Social Influence: According to Mishra et al. (2022), peer recommendations are a powerful source of motivation.
Urban Landscapes Affect Purchasing Decisions: Singh & Sharma (2022) draw attention to the manner in which commute patterns and cityscapes influence customer decisions.
Media Shapes Perception: As noted by Agarwal et al. (2021), brand image and media representations
Government education programs are suggested by Mohan et al. (2023) as a means of reducing range anxiety through awareness-building activities.
Cooperation is Key: Manufacturers, lawmakers, the media, and the financial sector must all work together, according to Roychowdhury & Ghosh (2023).

Getting Over Obstacles using Policy Tools
Dasgupta & Sengupta (2021) highlight how subsidies make things easier and more accessible in terms of affordability.
Brand Trust Clears the Path: Jain et al. (2022) stress that consistent communication and service are the foundation of a customer's confidence.
Targeted Campaigns: Srivastava & Singh (2023) endorse campaigns that highlight benefits and tackle problems.
Developing Infrastructure Is Critical: Charging stations ought to be brought into homes and businesses, claim Kumar & Kumar (2022).
Financial Innovation Drives the Ride: Banerjee & Mitra (2023) recommend battery leasing plans to raise affordability.

Green Dreams Are the Engine's Fuel
Environmental Enthusiasts: Singh et al. (2023) show rising eco-consciousness pushing riders towards ETWs.
Long-Term Savings: Sharma et al. (2022) ensure that lower operating costs will offset the original investment.
Tech-Savvy Riders: Roy et al. (2021) claim that advanced technologies like connectivity and braking attract tech-savvy consumers.

Practical Difficulties in the Way
Exorbitant Entry Fee: Gupta et al. (2023) warn that a high initial outlay could put a stop to the journey.
Charging Anxieties: Raj & Kumar (2022) express worry over convenience and poor infrastructure.
Battery Issues Remain: Das & Ghosh (2020) and Patel et al. (2021) highlight issues with replacement costs, safety, and range.

Growing environmental consciousness and the possibility of long-term cost reductions present tremendous opportunities for India's electric two-wheeler (ETW) market (Singh et al., 2023; Sharma et al., 2022). However, there are several barriers standing in the way of consumer acceptability. High upfront costs remain a major obstacle despite the long-term financial benefits (Gupta et al., 2023). When there is no infrastructure for charging, potential customers worry about usability and practicality, which causes anxiety (Raj & Kumar, 2022). Concerns also persist about the constraints on battery range, possible replacement prices, and safety issues such as battery fires (Das & Ghosh, 2020; Patel et al., 2021).

Demographics have a vital impact, with younger, high-income urban professionals reporting increased interest in ETWs (Kumar et al., 2023). Social influence through recommendations from friends and family greatly impacts buying decisions, underlining the usefulness of peer networks (Mishra et al., 2022). Government initiatives, including appealing incentives and subsidies, greatly boost adoption rates, showing their vital role in market expansion (Dasgupta & Sengupta, 2021).

In addition to these basic components, there are additional variables. Building consumer confidence requires a strong brand reputation, consistent after-sales assistance, and efficient communication efforts that address concerns (Jain et al., 2022; Srivastava & Singh, 2023). Moreover, the appropriateness of ETWs for various metropolitan environments and transportation patterns affects consumer choices, suggesting the need for tailored infrastructure development and promotion (Singh & Sharma, 2022). Consumer sentiments are also shaped by elements such as brand reputation and media coverage (Agarwal et al., 2021).

In conclusion, even though it is clear that ETWs have the potential to contribute to a sustainable future in India, consumer purchasing behavior is a complex tapestry woven with concerns as well as reasons. To realize the full potential of this industry, it will be necessary to address high initial costs, expand the infrastructure for charging, allay concerns about batteries, and improve public views of safety. By leveraging influencing elements like social networks, demography, and successful government initiatives, adoption can be expedited even more. Manufacturers, policymakers,

the media, and the financial sector must collaborate to build a robust ETW ecosystem and pave the way for a cleaner, greener future for India's transportation landscape (Mohan et al., 2023; Das et al., 2022; Kumar & Kumar, 2022; Singh & Singh, 2021; Roychowdhury & Ghosh, 2023; Banerjee & Mitra, 2023).

3. METHODOLOGY

RESEARCH DESIGN

The research strategy for this study was a cross-sectional descriptive method with a non- experimental qualitative survey. The study was conducted throughout India using a sample of 124 students. This form allows for a snapshot examination of the current state of the selected variables, which facilitates a comprehensive understanding of the subject matter. The non-experimental qualitative survey approach can yield rich, contextual data that illuminates participant experiences and perspectives. The broad geographic focus enhances the data' generalizability and contributes to a more inclusive and representative portrayal of the issue being studied among Indian students in general.

SAMPLING DESIGN

Participants in this research who were at least eighteen years old made up the study population. Using a simple random sampling technique, 124 individuals were selected as a sample from this cohort. A structured questionnaire was distributed to the chosen respondents as part of the data gathering procedure. Due to the equal possibility of inclusion for all members of the research population, this approach ensures an unbiased and representative sample. The accuracy and comprehensiveness of the data collected were enhanced by the structured questionnaire's ability to facilitate systematic data gathering. This sampling technique aims to provide a strong foundation from which meaningful and significant findings can be extracted in the next research report.

QUESTIONNAIRE DESIGN

The study employed a semi-structured questionnaire, with one section drawn from earlier studies. The questionnaire was divided into two sections: Q1-4 gathered socioeconomic data, and Q5–13 assessed consumer awareness of electric 2-wheeler purchase behaviour. A 5-point Likert scale, ranging from "Strongly Agree" to "Strongly Disagree," was used to help gather the data. This scale allowed for the capturing of nuanced opinions on the subject. This comprehensive approach was designed to ensure a detailed analysis of the study area by providing a comprehensive understanding of consumer purchase behaviour with respect to electric two-wheelers.

4. OBJECTIVES

This study attempts to provide an explanation for why people choose electric scooters or bikes over alternative possibilities. Our objective is to ascertain the causes of people's decisions and the reasoning behind their mental processes.

- To examine how money affects decisions while considering the costs of investing in, using, and preserving electric two-wheelers. Also examine the ways in which government incentives influence people's choices.

- To analyse consumer opinions regarding the technology of electric two-wheelers, including batteries, charging, and overall performance. Analyse how advancements in technology affect consumer preferences.

- To understand how culture, way of life, and societal trends impact the adoption of electric two-wheelers. Analyse how society norms and peer pressure impact customers' attitudes.

- To identify potential barriers to adoption, including as a lack of model variety, limitations with the charging infrastructure, and anxiety about range. Examine how these barriers differ in different places and among different demographic groups.

- To provide insightful recommendations to industry stakeholders, including legislators, manufacturers, and others, based on the research findings. Boost consumer acceptance and encourage the widespread adoption of electric two-wheelers.

5. DATA INTERPRETATION AND ANALYSIS

- This pie chart illustrating the variety of responses given to the statement "The initial cost of an electric two-wheeler is justified by its long-term cost savings" is displayed in relation to the statement. It's interesting to note that 46.8% disagree, indicating a sizeable percentage of the public does not think that the initial cost of electric two-wheelers is justified by long-term savings.

The 29.8% neutral view suggests that the evaluation is unclear, but the 12.1% agreement shows that a smaller but significant fraction understands the long-term economic benefits. The multiple considerations that must be made, such as the fact that electric two-wheelers

have greater starting expenses but lower operating and maintenance costs over time, underscore how challenging the decision-making process is. This absence of a firm consensus emphasizes the ambiguous nature of public opinion regarding the economic viability of electric two- wheelers, necessitating more research into individual.

- This pie chart shows respondents' perspectives about how important they think cutting- edge technology features like regenerative braking and smart connection are when making car purchases. 54% of respondents strongly agree or agree, indicating that these qualities are highly regarded.

- Meanwhile, 18.5% adopt a neutral stance, suggesting that they are not convinced of the importance of this technology. Surprisingly, 27.5% disagree or strongly disagree, suggesting that the majority does not value these attributes. The attractiveness of modern technology features lies in their ability to enhance driving pleasure, safety, and convenience. Preferences are influenced by price, simplicity, and privacy concerns. In essence, the decision of which advanced features to prioritize or overlook is very subjective and reflects a range of customer perspectives.

- The pie chart illustrates how important government subsidies and incentives are to respondents, as 46.8%

of them strongly agree or agree that these financial incentives influence their decision to purchase an electric two- wheeler. Meanwhile, 21% of respondents express neutrality, demonstrating a lack of faith in these incentives' efficacy. Remarkably, 32.2% of respondents disagree or strongly disagree, indicating that a sizable portion of respondents do not believe that government incentives are necessary for them to make decisions. The

findings show that while a significant majority believes these subsidies are essential to government support and the affordability of the adoption of electric vehicles, a significant portion is either apathetic or has conflicting views, possibly as a result of factors like desire to pay more or environmental concerns.

- According to the pie chart, the majority of respondents (51.6%) were concerned about the lifespan and replacement cost of batteries for electric cars (EVs), highlighting the perceived significance of this factor in EV adoption. 25% of the indifferent people question its importance, although just 16.9% of them dismiss such concerns. The expensive price and potential degradation

of EV batteries over time are most likely the causes of concern. There will always be concerns over battery lifespan and replacement costs because technology is always evolving. Individuals who don't care may believe that future advancements will alleviate their worries because they believe the overall advantages of electric vehicles (EVs), like lower emissions and operating costs, surpass any possible battery-related problems. This advanced understanding demonstrates how many moving parts influence how the public views and uses electric vehicles.

6. FINDINGS

HYPOTHESIS 1:

Null Hypothesis (H0): Long-term savings and initial cost have no discernible effects on the decision to purchase an electric two-wheeler. In a similar vein, there is no clear relationship between the importance of cutting-edge technological features (such smart connection and regenerative braking) and the decision-making process.

Alternative Hypothesis (H1): Considering both the initial outlay and continuous savings has a major impact on the decision to purchase an electric two-wheeler. Moreover, there is a strong relationship between the importance of cutting-edge technological features (such smart networking and regenerative braking) and the decision-making process.

FINDING 1:

The chi-square test results indicate a strong connection between the factors influencing the decision to purchase an electric two-wheeler. With a test statistic of 58.957, 16 degrees of freedom, and a p-value of 0.000 (less than 0.05), the null hypothesis is rejected. Interestingly, the biggest gaps between expected and actual counts suggest that "long-term cost savings" and "initial cost" have the most effects. On the other hand, "smart connection" and "regenerative braking" have comparatively less of an effect. In summary, respondents prioritize cost factors, particularly upfront and continuing expenses, when deciding which electric two-wheeler to buy.

HYPOTHESIS 2:

Null Hypothesis (H0): There is no appreciable association between the decision to buy an electric two-wheeler and government incentives and subsidies, and the perceived upfront cost justification for long-term savings is equivalent to chance.

The alternative hypothesis states that government incentives and subsidies have a major impact on people's decisions to buy electric two-wheelers (H1). Furthermore, the perceived early cost justification for long-term savings being different from chance indicates a strong influence on customer decision-making.

FINDING 2:

Given that the chi-square test gives a p-value of 0.000 (< 0.05) with a statistic of 51.458 and 16 degrees of freedom, we may reject the null hypothesis. This implies that government incentives, subsidies, and the justification of upfront expenditures by long-term savings all have an important effect on the decision to buy an electric two-wheeler.

It's interesting to note that the respondents who most strongly agreed that both factors had an impact also had the largest gaps between the observed and expected figures, indicating that these factors should be given more weight when making judgments. On the other hand, those who disagree with both variables don't vary much, which suggests a lower importance.

Both government incentives/subsidies and upfront cost justification through long-term savings have a significant impact on the decision. If you firmly concur, purchasing an electric two-wheeler is more likely.

HYPOTHESIS 3:

Null Hypothesis (H0): The availability of charging stations has no discernible impact on the decision to buy an electric two-wheeler. Furthermore, there is no obvious connection between government subsidies and incentives and the decision to purchase an electric two-wheeler.

Alternative Hypothesis (H1): The accessibility of charging stations has a major impact on the decision to buy an electric two-wheeler. In addition, the decision to purchase an electric two- wheeler is heavily impacted by government grants and incentives.

FINDING 3:

Availability of Charging Stations:

With 16 degrees of freedom, the chi-square value is 64.327, and the p-value is 0.000, which is less than 0.05. As a result, the null hypothesis can be rejected, and it can be said that there is a statistically significant correlation between the choice to buy an electric two-wheeler and the accessibility of charging stations.

According to the table, people are more likely to buy an electric two-wheeler if they consider the availability of charging stations to be a "major factor" or "somewhat important factor" in their decision than if they consider it to be "not very important" or "not at all important."

Government Incentives/Subsidies:

With 16 degrees of freedom, the chi-square value is 38.772, and the p-value is less than 0.05 at 0.001. Thus, we can rule out the null hypothesis and come to the conclusion that government incentives and subsidies have a statistically significant impact on people's decisions to buy electric two-wheelers.

According to the table, people are more likely to buy an electric two-wheeler if they think government incentives and subsidies make the upfront cost of the vehicles "much more justifiable" or "somewhat more justifiable" than if they think they make the costs "not very justifiable" or "not at all justifiable."

HYPOTHESIS 4:

Null Hypothesis (H0): There is no significant correlation between the openness to consider Electric Two-Wheelers as a viable alternative for the next vehicle purchase and the opinions of friends, family, or coworkers' effect on the decision-making process. Stated differently, the correlation that has been seen can only be attributed to chance.

Alternative Hypothesis (H1): There is a significant relationship between the influence of friends, family, or coworkers on one's decision-making process and one's openness to considering electric two-wheelers as a practical option for one's next car purchase. The chi-square test result of 0.002 suggests that the observed correlation might not be completely random and could instead indicate a substantial relationship between these two variables.

FINDING 4:

The research rejected the null hypothesis, which states that there is no significant relationship between these two factors. This suggests that people's acceptance of electric two-wheelers and their level of respect for other people's opinions while making automobile purchases are statistically correlated.

The chi-square test result of 0.002 suggests that the observed connection is unlikely to be the product of pure chance and may indicate a substantial relationship between the two variables. People who are more receptive to electric two-wheelers also often report that their decisions are positively influenced by the opinions of those around them.

7. MANAGERIAL IMPLICATIONS

The study's findings have a number of managerial implications for promoting the adoption of electric two-wheelers. First off, the cost aspects' essential rating highlights how crucial it is for manufacturers and policymakers to focus on cost-effective strategies, especially when it comes to early expenses and long-term savings. Potential for long-term savings, affordability, and attractive pricing structures can all have a big impact on the decisions that customers make.

Government incentives and subsidies become significant considerations when making decisions. Legislators and managers should collaborate to support and grow these kinds of programmes since they significantly raise the perception of electric two-wheelers' viability among consumers. If these incentives are emphasized in sales presentations and marketing collateral, their influence may be considerably higher.

The importance of being able to access charging stations highlights the need for infrastructure development. Managers operating in the electric two-wheeler industry should engage with relevant stakeholders, including governmental agencies and private companies, in order to enhance and expand the charging infrastructure. Stressing the usefulness of charging stations in marketing initiatives can provide you a competitive advantage.

The relationship between customer acceptability and the effect of other people's judgements demonstrates the importance of social variables. Managers can utilise this information to create campaigns that emphasize the shift towards electric two-wheelers, encourage positive word-of-mouth, and use social media marketing strategies. Electric two-wheelers may become more appealing if an eco-friendly mobility hub is established in the town.

Managers in the industry should prioritize messaging related to cost, collaborate with legislators to maintain incentives, invest in charging infrastructure, and leverage societal factors in order to effectively market and encourage the adoption of electric two-wheelers.

8. CONCLUSION

The study provides significant new information on the factors influencing consumers' choices to purchase electric two-wheelers. The findings indicate a strong correlation between consumer preferences and crucial elements such as cost considerations, policy incentives, charging station accessibility, and social impacts.

Prospective buyers clearly place a high value on cost considerations, particularly initial costs and long-term savings. To encourage adoption, manufacturers and lawmakers should highlight price, highlight potential savings, and employ alluring pricing strategies. In order to improve the financial feasibility of electric two-wheelers for consumers, it is imperative that government subsidies and incentives be maintained and expanded.

The availability of charging stations seems to be a significant factor influencing purchasing decisions. By collaborating to enhance and broaden the infrastructure that supports these vehicles, industry stakeholders may position the ease of charging electric two-wheelers as a competitive advantage.

The study also demonstrates a connection between the influence of other people's viewpoints and customer approval. This highlights the importance of social factors in decision-making. Supervisors are required to implement social media marketing strategies and community-development initiatives in order to create positive PR and showcase the organization's shift towards environmentally sustainable mobility solutions.

In summary, the study's management implications provide industry stakeholders with useful advice on how to promote the use of electric two-wheelers. By addressing these essential components, concerned parties can contribute to the overall goal of developing a more widely used and ecologically beneficial mode of transportation.

9. LIMITATION

The study project has several constraints, the most significant of which are related to sample size, geographic scope, timeframe, and budgetary constraints. Even while the 124-person sample size provides useful information, it might be challenging to attain full representativeness, especially in a country as large and diverse as India. While a wide geographic distribution is the goal of the

PAN India geographical restriction, bias could be created accidentally if the survey is primarily circulated inside restricted networks, potentially eliminating opinions from a range of demographic and socioeconomic backgrounds. The scope and depth of data collection are restricted, despite the two months being efficient, which could impede the examination of dynamic trends or long-term consequences. Additionally, the restricted resources can stop the application of cutting-edge research techniques, broad outreach initiatives, or in-depth analyses.

These financial restrictions can have an effect on the general reliability and generalizability of the findings. Moreover, the tight circulation among friends may induce response bias since people with comparable traits may influence one another's responses. To properly assess the research findings and understand the extent to which the findings can be used given the constraints, it is essential to recognise these limitations.

10. ACKNOWLEDGMENT

REFERENCES

[1.] Bhalla, P., Ali, I. S., & Nazneen, A. (2018). A study of

consumer perception and purchase intention of electric vehicles. European Journal of Scientific Research, 149(4), 362-368. Chan, C. C. (1993). An overview of electric vehicle technology. Proceedings of the IEEE, 81(9), 1202-1213.

[2.] Chan, C. C., Chau, K. T., & Chau, K. T. (2001). Modern electric vehicle technology (Vol. 47). Oxford University Press on Demand.

[3.] Ding, N., Prasad, K., & Lie, T. T. (2017). The electric vehicle: a review. International Journal of Electric and Hybrid Vehicles, 9(1), 49-66.

[4.] Junquera, B., Moreno, B., & Álvarez, R. (2016). Analyzing consumer attitudes towards electric vehicle purchasing intentions in Spain: Technological limitations and vehicle confidence. Technological Forecasting and Social Change, 109, 14.

[5.] Propelling Electric Vehicles in India: Technical study of Electric Vehicles and Charging Infrastructure (BEE)

[6.] Ding, N., Prasad, K., & Lie, T. T. (2017). The electric vehicle: a review. International Journal of Electric and Hybrid Vehicles, 9(1), 49-66.

[7.] Situ, L. (2009, May). Electric vehicle development: the past, present & future. In 2009 3rd International Conference on Power Electronics Systems and Applications (PESA) (pp. 1-3). IEEE.

[8.] Sripad, S., Mehta, T., Srivastava, A., & Viswanathan, V. (2019). The Future of Vehicle

[9.] Electrification in India May Ride on Two Wheels. ACS Energy Letters, 4(11), 2691-2694. Kindler Vol. XXI • Nos. 1 & 2 • January-June 2021, July-December 2021 52

[10.] Tu, J. C., & Yang, C. (2019). Key factors influencing consumers' purchase of electric vehicles. Sustainability, 11(14), 3863.

[11.] Wadekar, S. Motors and Batteries for Electric Vehicle: A Review.

[12.] Yong, J. Y., Ramachandaramurthy, V. K., Tan, K. M., & Mithulananthan, N. (2015). A

[13.] review on the state-of-the-art technologies of electric vehicle, its impacts and prospects. Renewable and sustainable energy reviews, 49, 365-385

[14.] Directing passengers in the right direction Demographics Matter: Younger, wealthier urbanites are leading the movement, according to Kumar et al. (2023).

[15.] Social Influence: According to Mishra et al. (2022), peer recommendations are a powerful source of motivation.

[16.] Urban Landscapes Affect Purchasing Decisions: Singh & Sharma (2022) draw attention to the manner in which commute patterns and cityscapes influence customer decisions.

[17.] Media Shapes Perception: As noted by Agarwal et al. (2021), brand image and media representations.

[18.] Government education programs are suggested by Mohan et al. (2023) as a means of reducing range anxiety through awareness-building activities.

[19.] Cooperation is Key: Manufacturers, lawmakers, the media, and the financial sector must all work together, according to Roy Chowdhury & Ghosh (2023).

[20.] Green Dreams Are the Engine's Fuel Environmental Enthusiasts:

[21.] Singh et al. (2023) show rising eco-consciousness pushing riders towards ETWs.

[22.] Long-Term Savings: Sharma et al. (2022) ensure that lower operating costs will offset the original investment.

[23.] Tech-Savvy Riders: Roy et al. (2021) claim that advanced technologies like connectivity and braking attract tech-savvy consumers.

[24.] Getting Over Obstacles using Policy Tools Dasgupta & Sengupta (2021) highlight how subsidies make things easier and more accessible in terms of affordability.

[25.] Brand Trust Clears the Path: Jain et al. (2022) stress that consistent communication and service are the foundation of a customer's confidence.

[26.] Targeted Campaigns: Srivastava & Singh (2023) endorse campaigns that highlight benefits and tackle problems.

[27.] Developing Infrastructure Is Critical: Charging stations ought to be brought into homes and businesses, claim Kumar & Kumar (2022).

[28.] Financial Innovation Drives the Ride: Banerjee & Mitra (2023) recommend battery leasing plans to raise affordability.

[29.] Practical Difficulties in the Way Exorbitant Entry Fee: Gupta et al. (2023) warn that a high initial outlay could put a stop to the journey.

[30.] Charging Anxieties: Raj & Kumar (2022) express worry over convenience and poor infrastructure.

A Bibliometric and Visual Analysis of Astrotourism

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ABSTRACT

Purpose: This study highlights the importance of the field of tourism and hospitality sector to gain knowledge and trends in the astrotourism field. Sustainability is a main issue which is currently being discussed in the astrotourism field.

Research methodology: The study analyzed 127 research papers, PRISMA approach was used to establish inclusion and exclusion criteria. R studio and Bibliometric were used to visualize the relationship between papers and research.

Findings: The bibliometric findings revealed "Costa C" as the most productive and efficient author who has made significant contributions to astrotourism research. Additionally, we discovered that the USA stands at the forefront of astrotourism studies. Mediterranean Archaeology is the major source in the field of astrotourism.

Limitations: The scope of our literature selection is confined to a limited source namely the Scopus database.

Future scope: Future studies should endeavor to explore a more diverse range of sources and research areas to gain a comprehensive understanding of astrotourism's multifaceted nature.

List of abbreviations

AGAA: Astronomy Geographic Advantage Act

CBT: Community-based tourism

LED: Local Economic Development

IDC: Industrial Development Corporation

IDP: Industrial Development Plan

MDG: Millennium Development Goals

SOR: Stimulus-Organism-Response

VRIO:

SDG: Sustainable Development Goals

UNESCO: United Nations Educational, Scientific and Cultural Organization

WHC: World Heritage Centres

Article highlights

- The study analyzed 127 research papers, PRISMA approach was used to establish inclusion and exclusion criteria. R studio and Bibliometric was used to visualize the relationship between papers and research.

- The bibliometric findings revealed "Costa C" as the most productive and efficient author who has made substantial contributions to astrotourism research. Additionally, we discovered that the USA stands at the forefront of astrotourism studies.

- Performing a content analysis of the literature published from the last 11 years (2012-2024 onwards) and identified three clusters based on common themes.

- These clusters will help researchers to choose their area of interest for future studies. Lastly, we identified future research avenues that will guide researchers in their investigations.

1. INTRODUCTION

Sustainable tourism is a topic of worldwide attention among researchers and practitioners (Ruhanen et al., 2015).

Consumes centered on the delicate balance of economic, sociocultural, and environmental sustainability (Jafari, 2001; Mihalic, 2016; Novelli, 2005) and intergenerational equity (Aronsson, 2000; Rasoolimanesh and Jaafar, 2017). However, despite continuing demands for sustainable tourism techniques, places throughout the world endure to suffer from the injurious effects of unrestricted development. Examples of destinations under increasing burden from 'overtourism' include Italy (Dickinson, 2018; Eaglescliffe, 2019) and Maya Bay, Thailand (Ellis-Petersen, 2018; Smith, 2018), both of which have suffered expressively as a result of excessive and unsustainable visitor numbers.

Light pollution is a global issue, reducing the ability to see stars. This new type of waste involves unexpected cultural, environmental, and energy repercussions. Light pollution, particularly in metropolitan areas, has been linked to decreased visibility of stars. Light pollution disturbs ecosystems and may have harmful health impacts. Increased light pollution may alter food webs and ecosystems, according to some experts (Longcore and Rich, 2004). Tourism destinations can effectively compete by differentiating the niche products that are offered by particular destinations (Huang et al., 2010). Tourist are greatly impacted by the evaluation of new experiences and products, which makes them extremely concerned and knowledgeable about making travel-related decisions (Novelli, 2005, Damijanic and Sergo, 2013).

Astronomical tourism is a multidimensional phenomenon existing at the intersection of several kinds of social connections (Charlier and Bourgeois, 2013). The unpolluted night sky provides an exclusive opportunity for ecotourism, bringing tourists closer to nature and driving sustainable rural development (Jacobs et al., 2020). According to Fayos-Sola (2014), astrotourism involves exploiting unpolluted night skies and scientific knowledge to engage in a cultural, astronomical and environmental activities. This niche tourist activity allows visitors to observe celestial events with or without equipment including telescopes, binoculars etc. Living in cities with light pollution can make it difficult to perceive celestial objects (Weaver, 2011; Soleimani et al., 2019).

Astrotourism, also known as astronomical tourism, involves visiting destinations with dark skies and minimal light pollution (Collision, 2012). Astrotourism is a unique and sustainable kind of tourism that utilizes the sky as its primary resource (Rodrigues et al., 2015; Kunjaya et al., 2019). It may also be classified as special-interest tourism (SIT) (Soleimani et al., 2019). It involves visiting the astronomical observatories, getting familiar with astronomy- related and enjoying celestial events like star gazing, meteor shower, Milky Way, sunrise, sunset etc work and instruments for personal pleasure and entertainment (Weaver, 2011, Belij and Tedic, 2015). Astrotourism's environmental impact on the location is linked to light pollution control. Efficient use of artificial light reduces CO2 emissions. Astrotourism can help restore the natural heritage of the night sky, which is often overlooked by over 85% of Europeans (Bogard, 2013; Bara et al., 2021).

Our study aligns with the idea that a starry sky might enhance an area's tourism offerings by introducing new items and incorporating them as a territorial resource (Weaver, 2011). Including the starry sky as a resource in territorial development strategies and plans opens up opportunities for astrotourism (Weaver, 2011). Reducing light pollution in the sky can generate more cash, create jobs, and promote socio-economic development (Challeat and Lopostolle, 2014). A clear starry sky, sometimes called as a "dark sky" (Sancez and Martinez, 2014), may be a valuable resource for tourism (Benos et al., 2016). However, there is a paradox surrounding the dark sky and its implications. The sky may drive sustainable development in local areas through developing tourism (Rodrigues et al., 2015; Govender, 2011).

Astronomers, scholars, ecologists and other groups are working together to protect the night sky, which is becoming increasingly popular. Global initiatives have resulted in the establishment of starlight parks and dark-sky reserves often located in natural locations with minimal air pollution and distance from light pollution sources. Astrotourism plays a vital role in promoting, using, and protecting the night sky due to increased consumption (Iwaniszewski, 2015; Cooper et al., 2018). This study aimed to perform a literature analysis on astrotourism to evaluate existing research and identify academic contributions up to 2024. Literature reviews help researchers identify priority concerns, understudied regions, and potential future study subjects. This survey helps advance the subject of astrotourism by addressing the following research questions:

What is the current publication trend in astrotourism?

Who are the most influential authors and their research papers?

What is this area's most influential journals, publishers and affiliations?

What is the intellectual structure and revealing significant themes in this area of research?

2. THEORETICAL BACKGROUND

There are several theories and models have been used to explain astrotourism such as Maslow's theory, Cognitive appraisal theory, and SOR and VRIO framework. Mehrabian and Russell developed the stimulus- organism- response (SOR) concept in 1974 (Mehrabian and Russell, 1974). Thus, one can argue that the stimuli received during an astrotourism event will develop cognitive and emotional states in the tourist's mind, and those states will lead to a response, such as the recommendation to others and loyalty

to the astrotourism, by combining the cognitive appraisal theory with the S(stimuli)- O(organism)-R(response) framework (Rodrigues et al, 2023).

Cinzano et al. (2001) characterize light pollution refers to intrusive artificial light created by improper lighting design. This includes sky glow, glare, and light trespass. Excessive light from streetlights and cities disrupts animals, stargazing, sleep patterns, and professional astronomy, while also wasting significant energy (Gallaway *et al*., 2009).

Paskova *et al*. (2021) emphasize Astrotourism is not only a viable new tourism sector in the market, but it also has significant implications wildlife conservation, environmental education, and space exploration. It causes individuals to think of the universe as a component of nature and vice versa. Astrotourists see light pollution as not just interfering with their astrotourism experience, but also as a severe threat to the proper functioning of the planet's ecosystems.

Li, (2021) emphasizes that developing stargazing tourism can give areas with rare starry night skies a sustained economic advantage in terms of resources.

3. RATIONALE FOR THE STUDY

Now a days, environmental pollution is a major issue and creates a disturbance in the ecological system. This study provides the framework that helps tourist's behavior to clean the environment and also encourages sustainability and promotes the scientific system. With the help of this study, people will be aware of the destination and tell us about the potential of a specific area. For society, tourism serves many things like education, sustainability, protection of the environment, and memorable experiences. The behavior of the tourist encourages the potential of this special type of tourism. Today our society faces the main challenges of environmental protection and recovery. So, this study will help us to protect the environment and improve the quality of experience. This unique tourism will help to conserve the environment, mobility transportation, waste avoidance, and well behaviour toward conservation. This tourism is different from the common tourism and only a few people take an interest in it. During the time of the event, the tourist experience is more than expected which will lead to the tourist revisit and this will increase the opportunity of the entrepreneurs. Finally, this study helps us to find new opportunities for bridging science and combining sky features with earth facilities to attract more tourists and deliver unique tourism products.

4. METHODS AND MATERIALS

Data analysis

Astrotourism is a recently researched topic, so it is important to evaluate existing research to establish objectives for future studies (Ibrahim *et al*., 2012; Ibrahim *et al*., 2015; Moher *et al*., 2015; Snyder, 2019). To collect as many articles as possible, a search was undertaken by means of Elsevier's Scopus, the major bibliographic database accessible to subscribers. Scopus has 1.4 billion references cited since 1970, including 70 million papers and 16 million authors outlines (Tapada *et al*., 2021).

We used the Scopus database to gather bibliographic data, concentrating on articles about astrotourism. Then, we analyzed the collected data for the bibliometric analysis technique. We used the Bibliometrix package by Aria and Cuccurullo (2017) and the Biblioshiny software of RStudio for bibliometric analysis. This made it possible for us to learn important lessons from the astrotourism-related articles. We found some exciting patterns and trends in astrotourism research through our analysis. We observed significant authors who have contributed significantly, tracked the volume of papers published annually, and investigated the influence of various nations and writers. We also examined international cooperation in this area. We can determine the gaps in the literature and the evolution of research themes in this field with the aid of bibliometric analysis.

Defining search term

We utilized a variety of keywords in our bibliometric analysis to ensure a comprehensive search of the literature regarding astrotourism. These keywords included "Astrotourism" OR "Revisit and Recommendation" OR "Dark sky tourism" OR "Celestial events". Our goal in utilizing these keyword variations was to encompass a range of viewpoints and facets surrounding astrotourism. We aimed to cover a range of terminology and expressions used in the literature to characterize astrotourism by incorporating these diverse keywords. This strategy aids in making sure that our search is comprehensive and finds a variety of relevant studies.

Search delimiting criteria

On October 2024, we collected data for this study (Figure 2). We included the records spanning the last 30 years, from 1994 to 2024. We focused on all subject areas such as social science, economics and finance, multidisciplinary, business management and accounting, psychology, and art & humanities etc. We include books, articles, reviews, conference papers, and book chapters.

Data retrieval for bibliometric analysis

We came across a pool of 155 research works in the final set. We used a strict procedure by applying the PRISMA approach to ensure clarity and maintain the focus on the most pertinent studies. First, we have exclusively included papers that are available in the English language to ensure that reading and analysis are feasible. After that, we carefully examined each article's keywords and abstracts, eliminating 18 documents that had no relevance to this field. After gaining access to the full text papers, a second round of refining was carried out, during which articles whose goals

did not align with the requirements of our study were excluded altogether. A few of the papers were removed from the study because they were not accessible. In the end, 127 documents were available for bibliometric analysis.

5.   RESULT AND DISCUSSION

Trend publication and main important information

Table 1 summarizes articles in the fields of astrotourism especially related to sustainability, revisit and light pollution. This study employed 127 scientific materials, which included articles, conference paper, and article reviews. From Table 1, we can see that the topics of the study cover the years 1994-2024. Figure 3 shows that 2023 will have the most papers on tourist sustainability, with 15 publications.

Figure 1 Data analysis process

Sources (s): Authors computations

Figure 2 Inclusion exclusion criteria for retrieval of data for bibliometric analysis using PRISMA
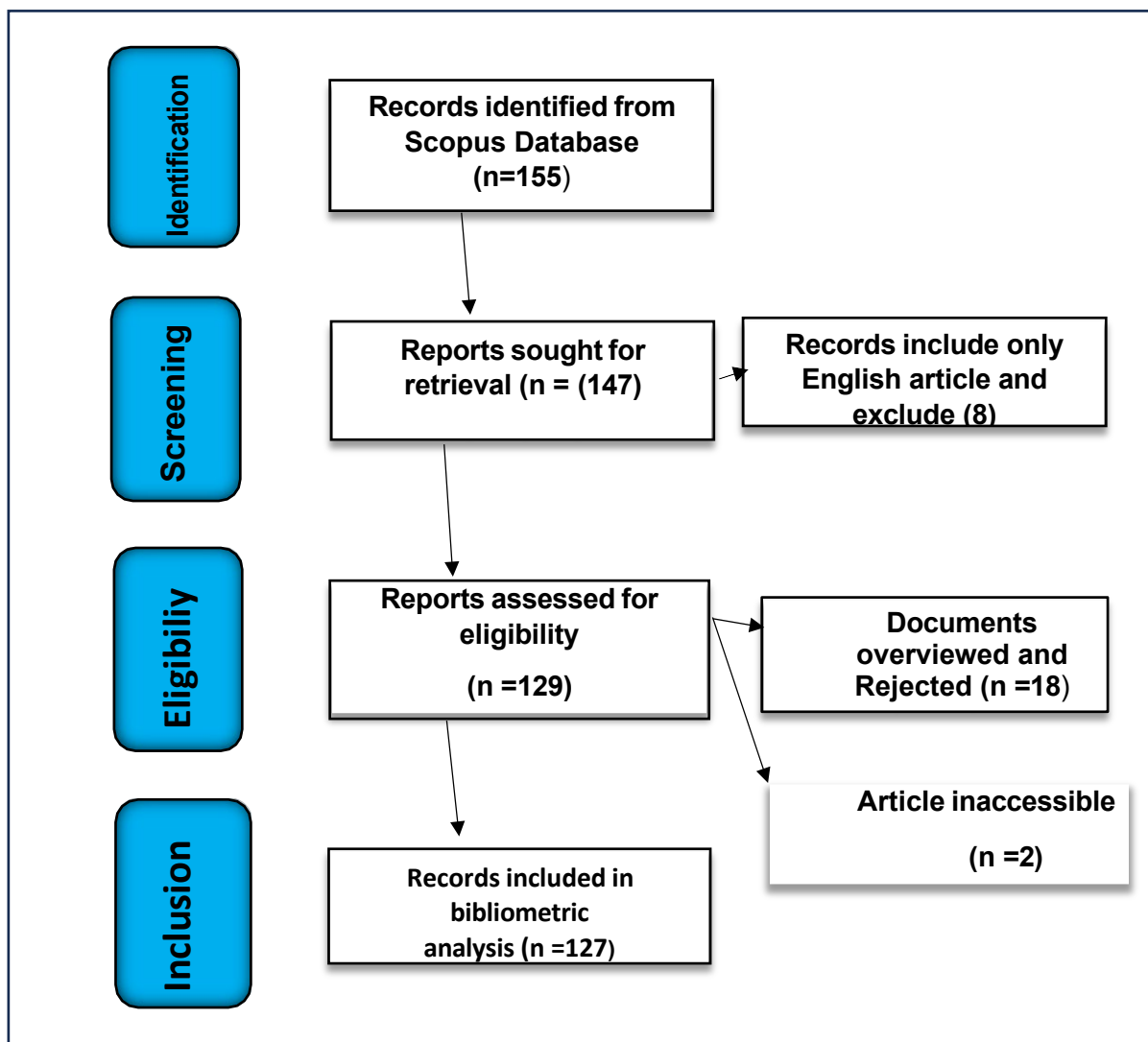
Table 1. Main information of the data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1994:2024
Sources (Journals, Books, etc)	103
Documents	127
Annual Growth Rate %	5.51
Document Average Age	7.01
Average citations per doc	5.677
References	5366
DOCUMENT CONTENTS	
Keywords Plus (ID)	427
Author's Keywords (DE)	427
AUTHORS	
Authors	306
Authors of single-authored docs	41
AUTHORS COLLABORATION	
Single-authored docs	41
Co-Authors per Doc	2.64
International co-authorships %	14.96
DOCUMENT TYPES	
article	86
book	1
book chapter	14
conference paper	17
note	1
review	8

Publication sources information and most-contributing authors

Bradford's Law shown in Figure 4, explains that the most significant journals for astrotourism, are the essential journal published such as Mediterranean Archaeology, Proceedings of the International Astronomical Union, Sustainability, Astronomische Nachrichten and Handbook of Archaeoastronomy and Ethnoastronomy. Figure 5 analyzes the study's emphasis. This depicts Lotka's Law, which measures how frequently writers submit to journals (Lopez-Fernandez *et al*., 2015). Figure 5 illustrates the results of the study. The study included 283 authors, accounting for 92.5% of the whole number of authors. Figure 6 illustrates the 10 authors contributions to studies on astrotourism research. The statistics show that Costa, C. is the most popular production between 2021and 2023. Loureiro, SMC. is the second most popular product searched for in the study between 2022 and 2023. The third most prevalent author

Marques, CP. From 2021 to 2023. Marques, CS. and Rodrigues, A are the fourth and fifth most popular, respectively. Figure 7 displays the author's country of origin.

This study focused on only three countries of production (SCP): USA, India, and Portugal.

Figure 3 Annual scientific production
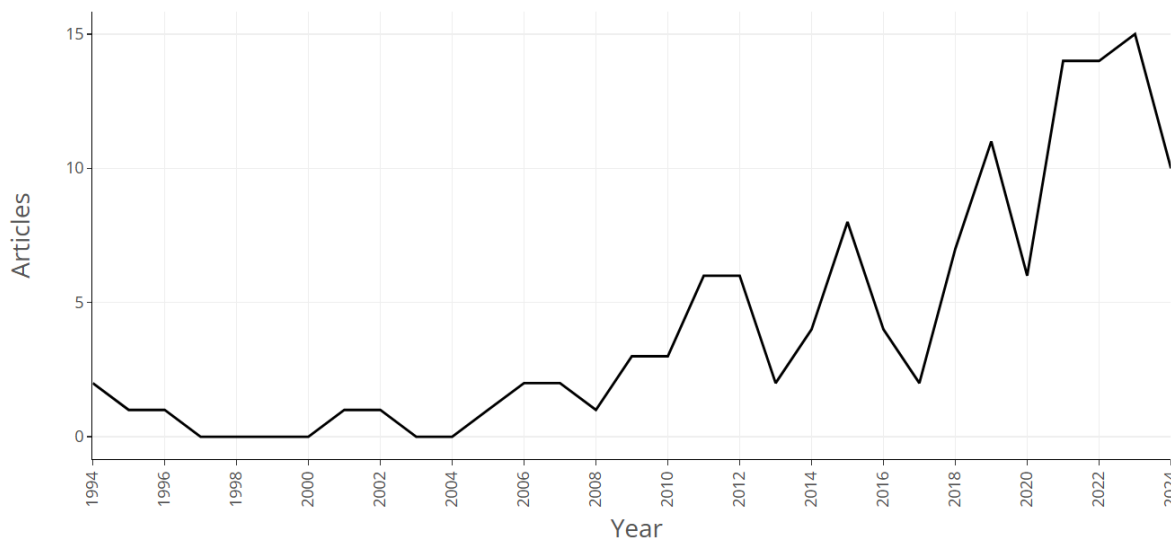
Source (s): Authors computations

The institutional and geographic scientific production

Figure 8 shows the distribution of scientific publications by organizations. The survey identifies the top ten institutions in the subject of study for publications. Los Alamos National Laboratory from New Mexico is the top publisher of scholarly publications on astrotourism with 6 articles., Utah state University from USA has the second highest number of scientific publications with 6 articles. Vikram Sarabhai Space Centre University from karela has published 6 papers, Western Sydney university with 6 publications and Auburn University in the USA has published 5 publications. Campus Universitario De Santiago University, in Spain, published 5. Indonesian National Institute of Aeronautics and Space University in Indonesian had 5 publications, while Universidade DE Aveiro University in the Portugal had 5. University of Muhammadiyah North Sumatera Indonesia, Yonsei University (4, 4). Figure 9 shows that the ten nations that have contributed the most important scientific documents are represented in the articles. The USA is the most producing nation with 56 documents. Portugal is the second nation with 46 articles, whereas India follows with 27 documents. China is fourth with 20 articles. Spain is with 20 articles, Indonesia and Australia with 18 and 13 documents. In addition, Turkey and UK published 12, 9 scientific documents and France with 7 articles.

Thematic issues and trend topics

Figure 10 shows the treemap utilized by the authors for this research. The authors utilized keywords to specify the number of words in the abstract of their work. The larger words in the abstract represent their frequency of use. Figure 9 shows that the Celestial event is the most frequently used in this study (12 times, or 8% of all terms). The word light pollution appeared 12 times, or 8% of all terms). The word astronomy ranked third in the treemap and has a frequency of 8 times, or 5% of all the terms and astrotourism ranked fourth in the treemap and has a frequency of 6(4%).

This section discusses some of the current trends in astrotourism. Figure 11 illustrates the evolution of astrotourism between 2006 and 2023. The authors used the most trending word such as light pollution (12), times in 2023. The authors addressed astrotourism (6) times, in 2022. The phrase tourism was used (5) times in the year 2021. However, the authors identified several trending topics for 2016 and 2014 such as celestial events and astronomy. The word sizes indicate the relevance of the keywords. The results indicate that the words appear in four clusters. The main important node in cluster one known as the red cluster. The red cluster is related to light pollution which contains expressions such as pollution, luminance, night, spatiotemporal analysis, etc. Blue cluster is related to astrotourism which contains expressions such as dark sky, light sources, core elements, citizen science, application programs, high quality. The third cluster is related to celestial events which contains celestial objects, moon, planets and stars. The fourth cluster is orange cluster containing tourist behaviour, tourist destination, tourism development, tourism management. The last cluster containing humans, astronomy and review.

Author keyword analysis

Author keywords were the best indicators of the content and theme followed by the studies. They indicated the research questions under study and the main focus area of the study. In our study, we did the keyword analysis to see the research flow in the astrotourism area. We built the author keyword cloud (Fig.12) from initially extracted 127 articles using Biblioshiny software. The word cloud (Fig. 13) size represents the frequency of occurrence, and location represents the proximity to each other. We found that celestial events, light pollution and astrotourism are most frequently occurring and used together. From the word cloud, we can conclude that most of the studies reflect factors that give rise to the requirement of astrotourism like; experiences, experiences cooperation, stargazing, celestial phenomena. Next, we can see the word that explains increasing astrotourism encourages behavioural loyality, satisfaction, etc. Keyword analysis also helped us to form the clusters in cluster analysis. Thematic map (Fig. 14) helps us to perform content analysis and identify future gaps.

Figure 4 Bradford's law
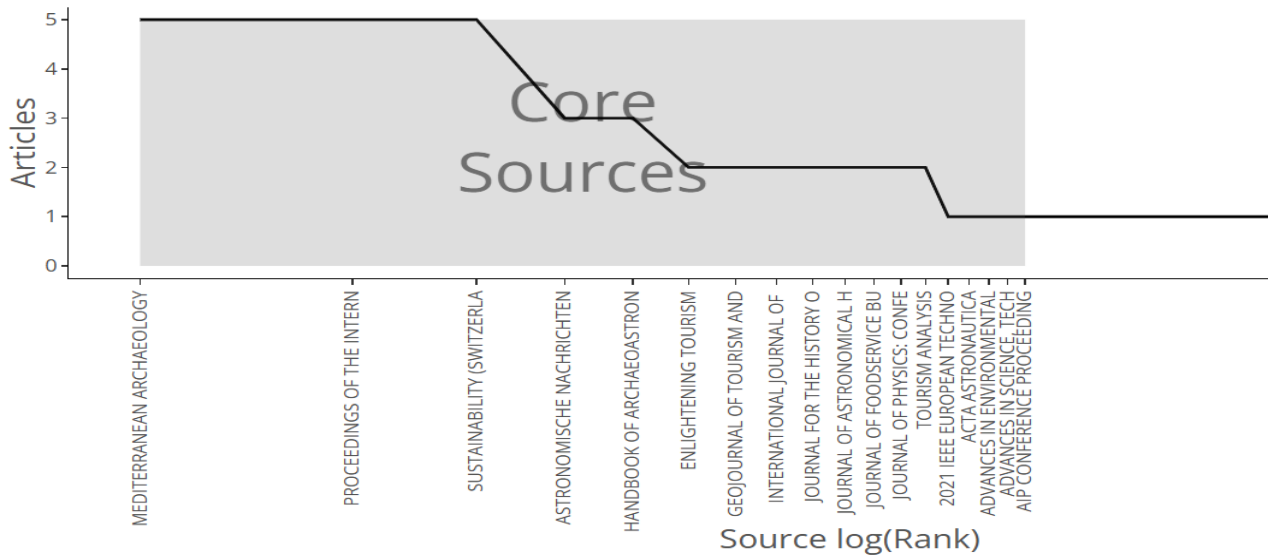
Source(s): Authors computation

Figure 5 The Frequency distribution by Lotka's law
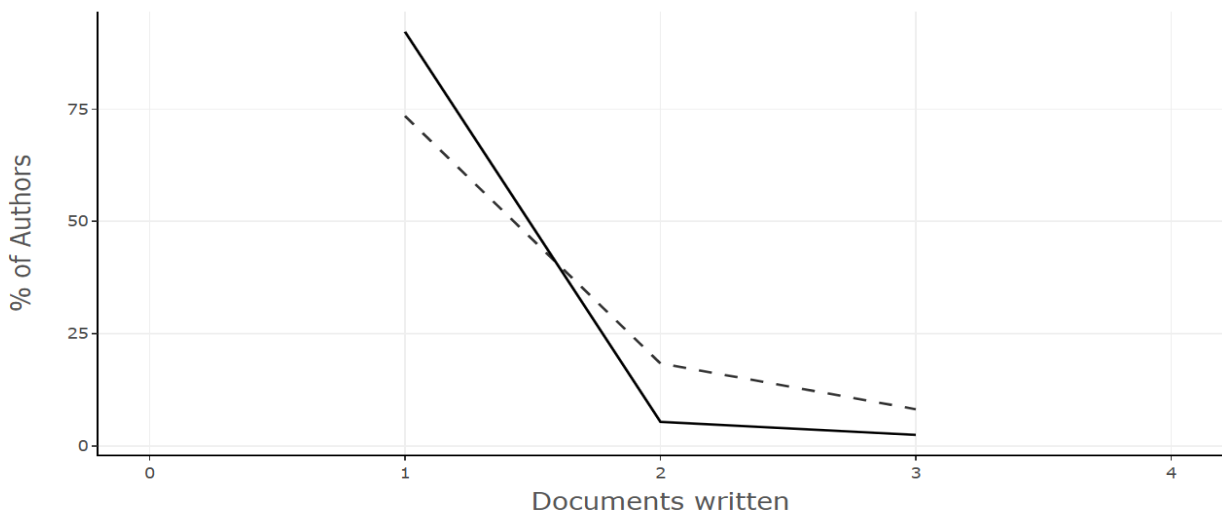
Figure 6 The author's productions over time (2021- 2023)
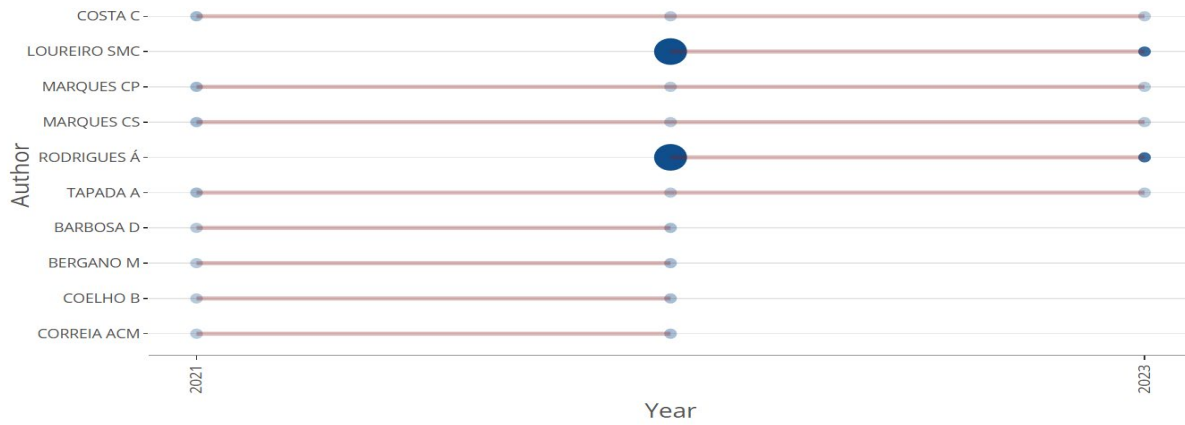
Source(s): Authors computations

Figure 7 The corresponding authors country
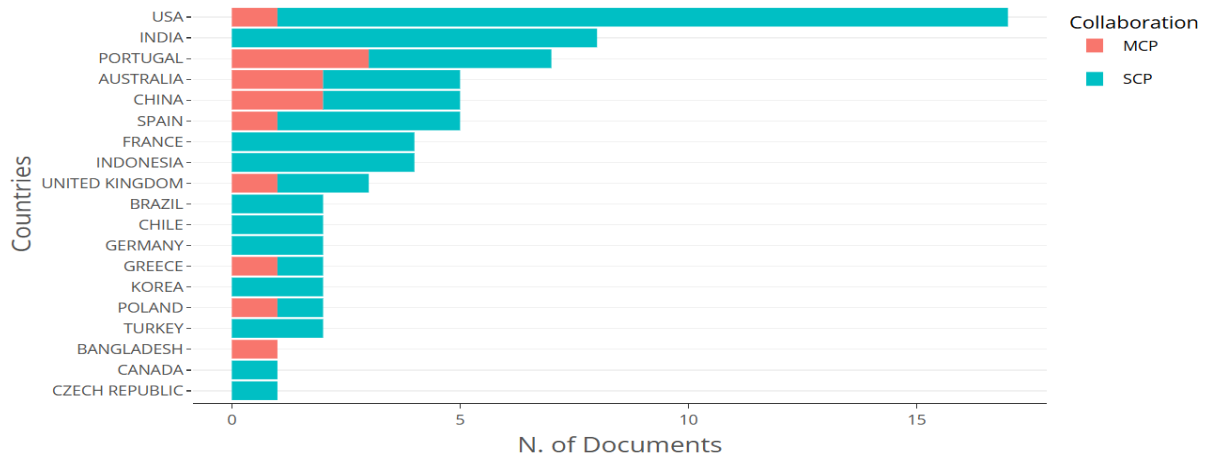
Source(s): Authors computations

Figure 8 The most relevant affiliations
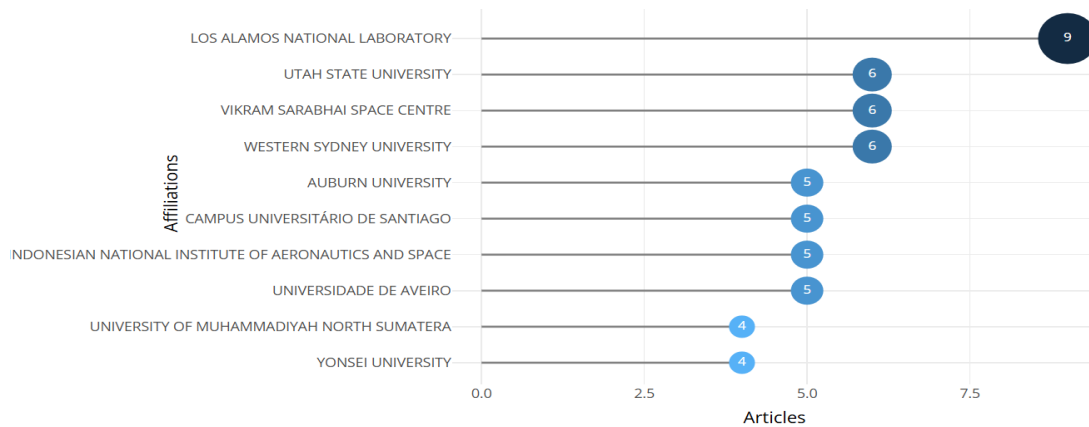
Source(s): Authors Computations.

Figure 9 Scientific production by country
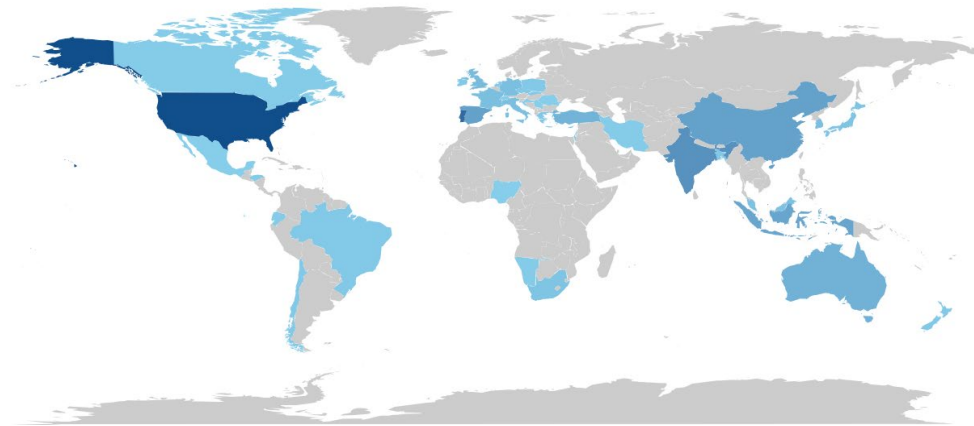
Source(s): Authors computations

Figure 10 Treemap analysis
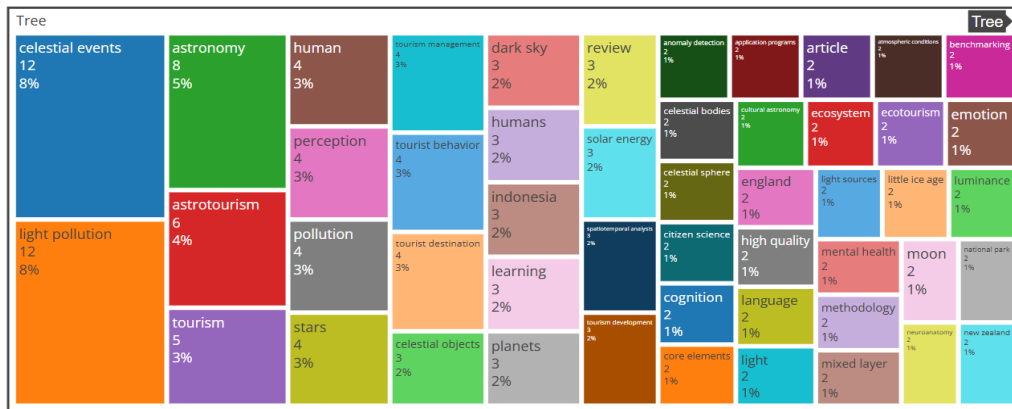
Source(s): Authors computations `

Figure 11 Trend topic

Figure 12 Co- citation network

Figure 13 Word cloud

Figure 14 Thematic map
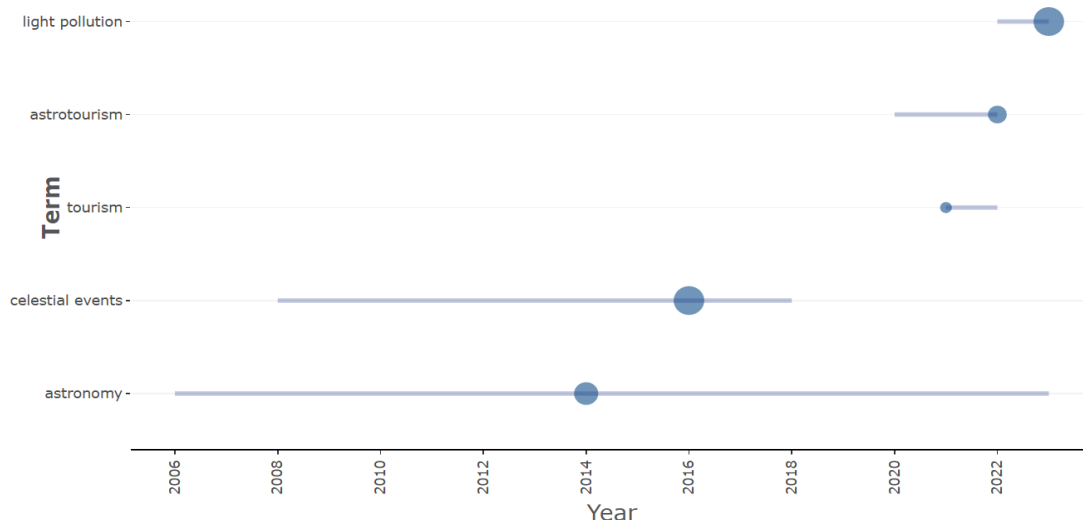
Discussion and future research

This study examines sustainability in the field of astrotourism using bibliometric analysis. It seeks to answer the research issues stated in this study. The research reveals a keywords and global association among authors and papers. The utmost productive authors and institutes, the most specific journals in the subject of astrotourism, and also discuss the trend in the field from past publications.

The data presented provides a full summary of the scientific literature examined in this investigation. The collection comprises 155 scientific publications, including conference papers, articles, and article reviews. The analysis covers literature published from 1994 to 2024, indicating a significant rise in scholarly production within this time span. Bradford's Law highlights the need of publishing in key journals, such as Mediterranean Archaeology. Furthermore, Lotka's legal study demonstrates active interaction by 283 authors.

Including notable contributions such as Costa, C., Loureiro, SMC. Countries including the USA, India, and Portugal have contributed to scientific research on this issue. Los Alamos National Laboratory, Utah State University and Vikram Sarabhai Space Centre University make significant contributions to the topic. The findings emphasize significant journals, authors, and contributions globally. According to themes, mostly papers focused on the main aspects, the first one is light pollution, celestial event and astrotourism. Cinzano et al. (2001) characterize light pollution as "one of the most rapidly increasing alterations to the natural environment," implying that humanity is enveloping itself in a "luminous fog". Light pollution refers to extreme or intrusive artificial light created by improper lighting design. This includes sky glow, glare and light trespass. Excessive light from streetlights, residences, and cities disrupts animals, stargazing, sleep patterns, and professional astronomy, while also wasting significant energy (Gallaway *et al.*, 2009). According to Davis et al. (2001), light pollution reduces melatonin synthesis in women, increasing the risk of breast cancer. According to Kerenyi et al. (1990), light pollution disrupts deep sleep and reduces melatonin

synthesis. Light pollution is similar to other pollutants and environmental problems that have been carefully studied by economists (Baumol, and Oates, 1971; Wirl, 2007; Sobotta e*t al.*, 2007; Picazo-Tadeo and Reig-Martinez, 2007; Shimshack *et al.*, 2007). Light pollution has become a commonly accepted term for the undesirable or detrimental impacts of artificial evening illumination (Hölker *et al.*, 2010). Astronomers utilized anti-waste tactics at the time to battle excess artificial nighttime brightness, which is when 'the conflict began on its current character' (Sperling, 1991). Developing a cohesive and successful framework for the issues of evening illumination requires unique considerations. Beyond utility, the symbolic implications of lighting technologies have actively influenced their usage and adoption (Nye, 2006).

The second main aspect is astrotourism where we discuss sustainability and revisit intentions. These results highlight the exclusive value of stargazing tourism for travelers. Developing stargazing tourism can give areas with rare starry night sky a sustained economic advantage in terms of resources (Li, 2021). This study expands on the S-O-R paradigm by including cognitive appraisal theory and new stimuli, including cognitive and emotional states beyond dominance, pleasure, and arousal (Rodrigues *et al.*, 2023). The study creates that awe had a direct impact on tourist satisfaction and a mediated effect on behavioral intentions (Rodrigues *et al.*, 2022). The study suggests that any site with astrotourism resources may be promoted as an alternative tourism niche, focusing on carrying capacity and scientific features. Visits are driven by both internal and extrinsic motives (Joseph, 2021). The structural model demonstrates that novelty and meaningfulness impact hedonic value, which in turn influences loyalty. Novelty and meaningfulness account for 62.6% of the variability in hedonic value and 31.3% in loyalty intentions (Rodrigues, 2022). Future work is needed to extend the sample size and apply existing models to other cultures. Future studies should endeavor to explore a more various range of sources and research areas to advance a inclusive understanding of astrotourism's multifaceted nature.

TABLE 2 The most impactful articles based on the number of citations

Authors name	Cited by	TC per year	Summary of findings	Source title
Carl Iain Cater	45	3	The article also examines how these sites are managed and the issues that come with this niche. This theoretical bridge is valuable for watching tourist groups in action and reveals the enormous potential that advancements in space tourism have for the tourism industry as a whole.	Tourism management
David itchell, Terral gallaway	22	3.6	These tourism spending will result in $2.4 billion in increased salaries and nearly 10,000 new employments for	Tourism review

Authors name	Cited by	TC per year	Summary of findings	Source title
			the region each year. Furthermore, because dark skies are an even more prominent natural amenity during the non-summer months, they have the potential to improve visitor numbers to national parks year-round, resulting in more efficient use of local community and tourism-related resources throughout the year.	
Aurea Rodrigues, Sandra Maria Correia Loureiro, Girish Prayag	19	6.333	The findings show that awe has a direct effect on visitor satisfaction and an indirect effect on behavioral intentions when tourist satisfaction is mediated.	International journal of tourism management
Radoslava Kanianska, Jana Skvareninova, Stanislav Kaniansky	11	2.2	In addition to nature and dark-sky conservation, the results can be applied to land management, planning, and sustainable astrotourism development to guarantee socioeconomic development.	Land
Goldy SP; Jones NM; Piff PK	11	3.667	These results suggest that by evoking wonder and social tendencies that help people align with their collectives, celestial phenomena may serve an essential collective purpose.	Psychological Science
Varela Perez AM	11	5.5	This Review talks about how light pollution is making it harder for both amateur and professional astronomers to observe the night sky. Astronomical observations are being negatively impacted by the rapidly growing use of artificial light at night, radio interference, and satellite constellations. These factors are also limiting scientific discoveries, cultural connections to the night sky, and astrotourism potential. There is discussion of possible mitigating techniques to protect the night sky.	Science
Paskova M; Budinska N; Zelenka J	11	2.75	In conclusion, astrotourism has significant possibilities for environmental education, nature preservation, and space exploration in addition to being a promising new tourism niche.	Sustainability (Switzerland)
Zielinska-Dabkowska KM; Xavia K	10	2.5	Finding important areas for further research is the goal of this study; an action plan to increase the influence of new technologies is desperately needed, both domestically and internationally. In addition to allowing for ongoing professional and amateur nighttime observations for the now and the future, this is essential for New Zealand to become a Dark Sky Nation and to protect humanity's right to view the night sky.	Sustainability (Switzerland)
Aurea Rodrigues, Sandra Maria Correia Loureiro, Girish Prayag	11	5.5	By incorporating the cognitive appraisal theory and, more importantly, cognitive and emotional states not used in previous research, this study adds to the S-O-R framework.	Anatolia
Joseph S; Ulahannan JP; Piramanayagam	4	1.33	According to the study, every location with astrotourism resources can be turned into a unique tourism niche from the standpoint of alternative tourism, giving carrying capacity levels and scientific considerations the weight they deserve because both internal and external factors drive visitors.	New Space
Khetrapal N; Bhatia D	4	1.33	With a particular focus on Khajuraho, we further emphasize that ALAN should be swapped out for night lighting techniques to optimize the nighttime travel experience for individuals who draw inspiration from the night sky to recreate the historical significance of heritage.	Canadian
Aurea L.O Rodrigues, Sandra Maria Correia	3		The structural model's outcome demonstrates how novelty and meaningfulness impact hedonic value, which in turn	Consumer behaviour in

Authors name	Cited by	TC per year	Summary of findings	Source title
Loureiro			impacts loyalty. Novelty and meaningfulness account for 31.3% of the variation in loyalty intentions and 62.6% of the variation in hedonic value.	tourism and hospitality

As per thematic analysis, not much work has been done on quadrants three and fourth, while few scholars have worked on quadrants one and two. astrotourism, light pollution, dark skies, behavioural intentions, destination image, archaeoastronomy eclipses, history of astronomy are under explored. With the help of content analysis, we can get future suggestions in this particular field. Tourism research based on assessment element emotions is highly inexhaustible in evaluating positive emotions, such as in this study. It would be fascinating to conduct further studies to investigate under what situations a tourism experience may be stressful or bring negative emotions (Rodrigues et al., 2023).

The demands of tourists were not considered. Developing spirituality, desert, and adventure tourism, as well as stargazing, will lead to increased human activity and infrastructural development. This will ruin the pristine night sky (Li, 2021). The awe captured at one astrotourism event in Portugal may not be representative of many travelers experiences. Third, only good emotional states were caught, despite the fact that awe may have negative features as well. The lack of capturing visitor status, whether first-time or repeat, may have impacted the level of wonder experienced at the event. Future research should look at how wonder inspires pro-environmental behavior toward astrotourism places (Rodrigues et al., 2021).

6. THEORETICAL IMPLICATIONS

A bibliometric analysis can provide significant insights for academics studying sustainability. This research helps scholars understand new trends in the subject and incorporates thematic analysis and important works on these themes. It improves comprehension of the theme's relevance and can inform future tourism aids. It identifies key tools, journals, and conceptual themes such as light pollution, astrotourism, astronomy, tourism development, tourist destination, tourism management, tourist behaviour, perception and solar eclipse. These findings will likely shape future research in this area. The study on sustainability in astrotourism has significant and diverse theoretical consequences. Astrotourism can lead to sustainable socioeconomic development in these forgotten areas. The research highlights the light pollution control strategies, the importance of consumer interaction, memorable experiences, and pleasure in boosting revisit and recommendation intentions adding to the field's theoretical knowledge. Customer behavior and satisfaction in service consumption and tourism emphasizes the impact stargazing, solar eclipse, and visitor experience. This provides valuable insights into the general nature of customer satisfaction in tourism sector.

7. PRACTICAL CONTRIBUTION

Bibliometric analysis in astrotourism can provide numerous practical implications. The study is robust and useful for identifying trends, research gaps, and developing themes in the context of astrotourism. With the help of this analysis, stakeholders can understand the evolution of astrotourism research, identifying key publication and citation patterns, helping to emerging trends and areas needing further exploration. Scholars may utilize this information to shape future study agendas and contribute to knowledge in certain areas. This research has implications for astrotourism practitioners, including destination managers, entrepreneurs, and local authorities, to ensure success in this niche tourism industry. Understanding the most influential works allows tourist boards and companies to customize their marketing efforts to certain populations interested in astronomy and tourism. Bibliometric results can help educational institutions in developing programs that are consistent with current research, preparing students for careers in this special interest tourism sector. Thematic analysis performs keyword co-occurrence analysis to identify main themes and research gaps. This can help to shape future paths and identify previously unexplored areas. The bibliometric analysis can deliver appreciated insights into the state and direction of astrotourism research, guiding both practitioners and scholars.

8. CONCLUSION

This paper analyzes existing research on revisit intention in astrotourism using bibliometric and content analysis. It presents scientific information on publishing trends, gaps, and prospects for future research. This study identified the significance of numerous parameters. The study analyzed 127 research papers, PRISMA approach was used to establish inclusion and exclusion criteria. R studio and Bibliometric were used to visualize the relationship between papers and research. The bibliometric findings revealed "Costa C" as the most productive and efficient author who has made substantial contributions to astrotourism research. Additionally, we discovered that the USA stands at the forefront of astrotourism studies. Mediterranean Archaeology is the major source in the field of astrotourism. Los Alamos National Laboratory had the most influential affiliation and USA and India were highly producing countries. The researchers identified distinct clusters and named them according to the commonality and research theme of the study. Three clusters were extracted based on content analysis. These clusters will help researchers to choose their area of interest for future studies.

Lastly, we identified future research avenues that will guide researchers in their investigations. The study has significant drawbacks. While the study has made valuable contributions, it has several drawbacks. Firstly, papers from the Scopus database were used in this study. Using several database sources improves coverage of primary material in a study. We believe the Web of Science database offers a big assortment of documents that can provide precise representation when reviewed. To broaden the study's scope, consider using other databases like WOS. Future research should go beyond peer-reviewed English literature on the Scopus to get broader findings. Future research should incorporate comprehensive reviews of relevant work to give an evolutionary picture of methodological procedures and analytical tools utilized in astrotourism.

REFERENCES

[1.] Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics, 11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

[2.] Aronsson, L. (2000). *The development of sustainable tourism* (pp.-193). https://www.cabidigitallibrary.org/doi/full/10.5555/20001810091

[3.] Bará, S., Falchi, F., Lima, R. C., & Pawley, M. (2021). Keeping light pollution at bay: a red-lines, target values, top-down approach. *Environmental Challenges*, *5*, 100212. https://doi.org/10.1016/j.envc.2021.100212

[4.] Baumol, W. J., & Oates, W. E. (1971). The use of standards and prices for protection of the environment. *In The Economics of Environment: Papers from Four Nations* 53-65. https://link.springer.com/chapter/10.1007/978-1-349-01379-1_4

[5.] Belij, M., & Tadić, M. (2015). Astrotourism-possibilities for development in Serbia. *Bulletin of the Serbian Geographical Society*, *95*(3), 59-73. https://doi.org/10.2298/GSGD1503059B

[6.] Bénos, R., Challéat, S., Lapostolle, D., Dupuy, P. O., Poméon, T., Milian, J., & Girard, F. (2016). La protection de la nuit d'un haut lieu touristique de montagne: la Réserve internationale de ciel étoilé du Pic du Midi comme nouvelle ressource territoriale. *Nouveaux territoires touristiques: invention, reconfigurations, repositionnements*, 55-82.

[7.] Bogard, P. (2013). *The end of night: searching for natural darkness in an age of artificial light*. Hachette UK. https://lccn.loc.gov/2012027287

[8.] Challéat, S., & Lapostolle, D. (2014). (Ré) concilier éclairage urbain et environnement nocturne: les enjeux d'une controverse sociotechnique. *Natures Sciences Sociétés*, *22*(4), 317-328. https://doi.org/10.1051/nss/2014045

[9.] Charlier, B., & Bourgeois, N. (2013). "Half the park is after dark". Dark sky parks and reserves: New concepts and tools to grant nature heritage status. *Espace géographique (English Edition)*, *42*(3), 186-198 http://dx.doi.org/10.3917/eg.423.0200

[10.] Cinzano, P., Falchi, F., & Elvidge, C. D. (2001). The first world atlas of the artificial night sky brightness. *Monthly Notices of the Royal Astronomical Society*, *328*(3), 689-707. https://doi.org/10.1046/j.1365-8711.2001.04882.x

[11.] Collison Ph D, F. M. (2012). Astronomical tourism: An often-overlooked sustainable tourism segment.

[12.] Cooper, C., Fayos-Solà, E., Jafari, J., Lisboa, C., Marín, C., Perdomo, Y., & Urosevic, Z. (2019). Case studies in technological innovation. *The future of tourism: Innovation and sustainability*, 111-127. https://doi.org/10.1007/978-3-319-89941-1

[13.] Ellis-Petersen, H. (2018). Thailand bay made famous by The Beach closed indefinitely. *The Guardian*, 3.

[14.] Fayos Solá, E., Marín, C., & Jafari, J. (2014). Astrotourism: No requiem for meaningful travel. http://www.pasosonline.org/

[15.] Gallaway, T., Olsen, R. N., & Mitchell, D. M. (2010). The economics of global light pollution. *Ecological economics*, *69*(3), 658-665. https://doi.org/10.1016/j.ecolecon.2009.10.003

[16.] Govender, M. (2011). *Conditional cash transfers as a means of addressing poverty in South Africa* (Doctoral dissertation, University of South Africa). http://hdl.handle.net/10500/5303

[17.] Hölker, F., Moss, T., Griefahn, B., Kloas, W., Voigt, C. C., Henckel, D., ... & Tockner, K. (2010). The dark side of light: a transdisciplinary research agenda for light pollution policy. *Ecology and Society*, *15*(4). https://www.jstor.org/stable/26268230

[18.] https://adsabs.harvard.edu/full/2011IAUS..260..577G

[19.] https://www.smh.com.au/traveller/inspiration/overtourism-in-venice-this-is-what-it-is-really-like-to-travel-in-august-its-busiest-month-20180821-h148w6.htm

[20.] Huang, J. Z., Li, M., & Cai, L. A. (2010). A model of community-based festival image. *International Journal of Hospitality Management*, *29*(2), 254-260. https://doi.org/10.1016/j.ijhm.2009.10.010

[21.] Ibrahim, I. A., Ahmad, M. R., Safiai, M. H., & Mujani, W. K. (2012). Islamic Astronomy and the Establishment of Al-Khawarizmi Complex in Malaysia. *Advances in Natural and Applied Sciences*, *6*(3), 316-321. http://www.aensi.org/anas.html

[22.] Ibrahim, I. A., Safiai, M. H., & Jamsari, E. A. (2015). Functions of astrofiqh observatories in Malaysia in solving astrofiqh issues. *astronomy.* Doi:10.5901/mjss.2015.v6n1s1p112

[23.] Iwaniszewski, S. (2015). Astrotourism and archaeoastronomy. *Handbook of Archaeoastronomy and Ethnoastronomy*, 287. https://ui.adsabs.harvard.edu/link_gateway/2015hae..book..287I/doi:10.1007/978-1-4614-6141-8_21

[24.] Jacobs, L., Du Preez, E. A., & Fairer-Wessels, F. (2020). To wish upon a star: Exploring Astro Tourism as vehicle for sustainable rural development. *Development Southern Africa*, *37*(1), 87-104. https://doi.org/10.1080/0376835X.2019.1609908

[25.] Joseph S, Ulahannan J P and Piramanayagam, S (2022). Importance–Performance Analysis of Destination Attributes of an Emerging Astrotourism Destination in Kerala, India. *New Space*, *10*(1), 101-111. https://doi.org/10.1089/space.2021.0032

[26.] Jafari, J. (2001). The scientification of tourism. In V. L. Smith and M. Brent (Eds.), Hosts and guests revisited: Tourism issues of the 21st century (pp. 28–41). Cognizant Communication Corporation https://www.researchgate.net/publication/313056032_The_scientification_of_tourism

[27.] Kunjaya, C., Sukmaraga, A. A., & Arsono, T. (2019, May). Possibility of astronomical phenomena to be used to support tourism industry. In *Journal of Physics: Conference Series* (Vol. 1231, No. 1, p. 012025). IOP Publishing.

https://iopscience.iop.org/article/10.1088/1742-6596/1231/1/012025

[28.] Li T (2021). Universal therapy: A two-stage mediation model of the effects of stargazing tourism on tourists' behavioral intentions. *Journal of Destination Marketing & Management*, *20*, 100572. https://doi.org/10.1016/j.jdmm.2021.100572

[29.] Longcore, T., & Rich, C. (2004). Ecological light pollution. *Frontiers in Ecology and the Environment*, *2*(4), 191-198. https://doi.org/10.1890/1540-9295(2004)002[0191:ELP]2.0.CO;2

[30.] López-Fernández, M. C., Serrano-Bedia, A. M., & Pérez-Pérez, M. (2016). Entrepreneurship and family firm research: A bibliometric analysis of an emerging field. *Journal of Small Business Management*, *54*(2), 622-639. https://www.tandfonline.com/doi/abs/10.1111/jsbm.12161

[31.] Mehrabian A. and Russell J A. (1974). An Approachto Environmental Psychology, Cambridge, MA: MITPress. *MehrabianAn Approach to Environmental Psychology1974*. https://psycnet.apa.org/record/1974-22049-000

[32.] Mihalic, T. (2016). Sustainable-responsible tourism discourse–Towards 'responsustable'tourism. *Journal of cleaner production*, *111*, 461-470. https://doi.org/10.1016/j.jclepro.2014.12.062

[33.] Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... & Prisma-P Group. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic reviews*, *4*, 1-9. https://link.springer.com/article/10.1186/2046-4053-4-1

[34.] Novelli, M. (Ed.). (2005). Niche tourism: Contemporary issues, trends and cases. *Routledge*. https://doi.org/10.4324/9780080492926

[35.] Nye, D. (1992). Electrifying America: Social meanings of a new technology.

[36.] Pásková, M., Budinská, N., & Zelenka, J. (2021). Astrotourism–exceeding limits of the earth and tourism definitions?. *Sustainability*, *13*(1), 373. https://doi.org/10.3390/su13010373

[37.] Picazo-Tadeo, A. J., & Reig-Martinez, E. (2007). Farmers' costs of environmental regulation: Reducing the consumption of nitrogen in citrus farming. *Economic Modelling*, *24*(2), 312-328. https://doi.org/10.1016/j.econmod.2006.08.002

[38.] Packing and Preparing for Travel - WanderWisdom

[39.] Rodrigues, A. L., Rodrigues, A., & Peroff, D. M. (2015). The sky and sustainable tourism development: A case study of a dark sky reserve implementation in Alqueva. *International Journal of Tourism Research*, *17*(3), 292-302. https://doi.org/10.1002/jtr.1987

[40.] Robinson, M., & Novelli, M. (2005). Niche Tourism. Contemporary issues, trends and cases. *Information and Communication Technologies in Tourism*, *2001*, 294-302.

[41.] Rodrigues Á, and Loureiro SMC (2022). Analyzing the strength of novelty and meaningfulness in astrotourism experiences: The mediating role of hedonism. *Consumer Behavior in Tourism and Hospitality*, *17*(4), 453-467. https://doi.org/10.1108/CBTH-01-2022-0027

[42.] Rodrigues Á, Loureiro SMC, Lins de Moraes M, and Pereira RG(2023). Memorable tourism experience in the context of astrotourism. *Anatolia*, *34*(2), 235-247. https://doi.org/10.1080/13032917.2021.2015695

[43.] Rasoolimanesh, S. M., & Jaafar, M. (2017). Sustainable tourism development and residents' perceptions in World Heritage Site destinations. *Asia Pacific Journal of Tourism Research*, *22*(1), 34-48. https://doi.org/10.1080/10941665.2016.1175491

[44.] Ruhanen, L., Weiler, B., Moyle, B. D., & McLennan, C. L. J. (2015). Trends and patterns in sustainable tourism research: A 25-year bibliometric analysis. *Journal of Sustainable Tourism*, *23*(4), 517-535. https://doi.org/10.1080/09669582.2014.978790

[45.] Sánchez, D. G., & Martínez, L. M. (2014). Potencialidades del turismo astronómico como dinamizador del turismo de interior en la Comunitat Valenciana. In *XVII Congreso Internacional de Turismo Universidad Empresa. Del Territorio al Destino Turístico: Retos y Claves de Éxito* (pp. 257-272). Tirant lo Blanch.

[46.] Shimshack, J. P., Ward, M. B., & Beatty, T. K. (2007). Mercury advisories: information, education, and fish consumption. *Journal of Environmental Economics and Management*, *53*(2), 158-179. https://doi.org/10.1016/j.jeem.2006.10.002

[47.] Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, *104*, 333-339. https://doi.org/10.1016/j.jbusres.2019.07.039

[48.] Sobotta, R. R., Campbell, H. E., & Owens, B. J. (2007). Aviation noise and environmental justice: The barrio barrier. *Journal of Regional Science*, *47*(1), 125-154. https://doi.org/10.1111/j.1467-9787.2007.00503.x

[49.] Soleimani, S., Bruwer, J., Gross, M. J., & Lee, R. (2019). Astro-tourism conceptualisation as special-interest tourism (SIT) field: A phenomonological approach. *Current Issues in Tourism*, *22*(18), 2299-2314. https://doi.org/10.1080/13683500.2018.1444021

[50.] Sperling, N. (1991, January). The disappearance of darkness. *In International Astronomical Union Colloquium* (Vol. 112, pp. 101-108). Cambridge University Press. https://doi.org/10.1017/S0252921100003821

[51.] Smith, O. (2018). The idyllic cove from The Beach is closing due to overtourism. *The Telegraph, May*, *31*, 3.

[52.] Taormina, R. J., & Gao, J. H. (2013). Maslow and the motivation hierarchy: Measuring satisfaction of the needs. *The American journal of psychology*, *126*(2), 155-177. https://doi.org/10.5406/amerjpsyc.126.2.0155

[53.] Tapada, A., Marques, C. S. D. E., Costa, C., & Marques, C. P. (2021). Astrotourism: A literature review and framework for future research. *A Pathmaking Journal,* 11(2),291-331).

[54.] Težak Damijanić, A., & Šergo, Z. (2013). Determining travel motivations of wellness tourism. *Ekonomska Misao i Praksa*, *22*(1), 3-20. https://hrcak.srce.hr/104525

[55.] Weaver, D. (2011). Celestial ecotourism: New horizons in nature-based tourism. *Journal of Ecotourism*, *10*(1), 38-45. https://doi.org/10.1080/14724040903576116

[56.] Wirl, F. (2007). Energy prices and carbon taxes under uncertainty about global warming. *Environmental and Resource Economics*, *36*, 313-340.

[57.] Packing and Preparing for Travel - WanderWisdom

TRACK 2: HUMAN RESOURCE MANAGEMENT

Exploring the Influence of Servant Leadership on Innovative Work Behaviour: The Role of Perceived Diversity and Inclusion Practices in the Workplace

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ABSTRACT

In the ever-evolving field of organizational behaviour, understanding the influence of leadership on employee attitudes, behaviours, and performance is essential for fostering innovative work behaviour. This study investigates the influence of Servant Leadership (SL) on Innovative Work Behaviour (IWB), focusing on the mediating roles of perceived Diversity (PD) and Inclusion practices (IP). It further explores the serial mediation of PD and IP in enhancing the relationship between SL and IWB. This research employs a longitudinal methodology, targeting teaching professionals in undergraduate and postgraduate management programs at deemed universities in Tamil Nadu, India. The investigation utilizes snowball sampling, a non-probability technique, disseminating Google Forms through teaching community WhatsApp groups. Participant anonymity is maintained via an introductory message in the form. The final sample after validation and data cleaning comprises 523 participants. Covariance based Structural equation modelling (CB-SEM) was used to analyse the direct and indirect effects using SMART PLS 4.1.0.6 software. The results of analysis reveal that SL has a direct and significant positive impact on IWB. Both PD and IP serve as a serial mediator in the relationship between SL and IWB. Individually, and also combinedly each mediator demonstrated a positive effect on the relationship. The research also aligns with Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth) and Goal 10 (Reduced Inequalities), highlighting the role of inclusive leadership in driving equitable economic progress. Practical implications suggest that organizations should prioritize SL and IP to promote sustainable organizational growth and innovation.

Keywords: Servant Leadership, Innovative Work Behaviour, Diversity and Inclusion, Perceived Diversity, Sustainable Development Goals, Economic progress.

1. INTRODUCTION

In the context of organisational behaviour, the relevance of the correlates of leadership style and employee attitudes, work behaviour and also productivity is central. SL, a notion which has been widely discussed, is especially interesting as it works on the basic philosophy of helping others first, and caring for the work culture as well as the welfare of employees (Greenleaf, 1977). This leadership style began gaining popularity as organisations started transforming. SL is depicted by leaders who tend to employees, support their growth, and promote inclusive culture. Unlike traditional hierarchy model, this approach minimizes focus on goals of organisation and instead emphasizes self-empowerment of team members and trusting and cooperative climate. In terms of academics, SL can be critical for improving IWB by establishing an atmosphere that favours novelty, risk, and the adoption of different concepts. In SL, which is described as the interest of a certain leader for the development and wellbeing of the team, the impression is radically different from that given by the ordinary pattern of leadership where the interests of the organisation predominate (Spears, 2004). SL demonstrates a more well-rounded approach towards team members and instead of overriding all needs of an

organisation, fosters policies that respect and advance needs of employees; as a result, an atmosphere of creativity thrives (Liden et al., 2008). Since competition is critical for the sustainability of companies, IWB that is defined as implementing new ideas in organisations has become of high importance. Workplace diversity and inclusion have been given much attention since organisations understand that it is this diversity that facilitates innovation and improved performance. PD consists of diversity heterogeneity of employees based on differences such as gender, ethnicity, age and cultural background among others. Such diversity in the academic institutions supports solving of issues and making decisions from a wide range of perspectives. Teams having diverse members are better placed to comprehend the needs of customers from different populations and therefore promote new ways of serving customers or new ways of working for the organisation (Tajfel & Turner, 1986). Practices of inclusion at the workplace tend to revolve around creating a culture in which all employees feel valued and respected and are willing to give their best in enhancing the performance of the organisation. These are important in tapping the different competencies, perspectives, and experiences that exist in the organisation. IP can ensure that there is equal opportunity across all employees in terms of

participating and contributing towards the innovations that are there in the organisation.

The term "PD and IP" describes how staff members view organisational initiatives to foster an inclusive workplace that supports and capitalizes on a range of viewpoints (Roberson, 2006). According to Shore et al. (2011), good diversity and inclusion policies can substitute a sense of community among staff members, lessen feelings of exclusion, and encourage cooperation and innovation. Although there is a growing interest in the intersection of leadership, diversity, and innovation, not much research has ever been conducted to investigate the combined effects of servant leadership and perceived diversity and IP on IWB. Therefore, this study aims to fill that gap. Research indicates that PD and IP can be a critical mediating factor between leadership styles and employee outcomes. In this regard, organisations that prioritize diversity and IP are more inclined to foster an inclusive culture where employees feel valued and respected, thereby enhancing their willingness to engage in innovative behaviours (Nishii, 2013).

Furthermore, servant leaders are in a good position to promote D&I projects and foster an innovative workplace because of their emphasis on empathy, moral behaviour, and community building (van Dierendonck, 2011). Few studies have looked at the combined effects of servant leadership and PD and IP on IWB, despite the growing interest in the relationship between leadership, diversity, and innovation. By examining the mediating role of PD and IP in the workplace and examining the impact of servant leadership on IWB, this study seeks to close this gap. In particular, this study aims to explore three key research questions:

RQ1: How does servant leadership directly impact innovative work behaviour?

RQ2: In what way do perceive diversity and inclusion practices act as intermediaries between servant leadership and innovative work behaviour?

RQ3: What actionable insights can organisations utilise to nurture innovation through effective leadership and inclusive strategies?

By investigating these inquiries, this research enhances the existing body of knowledge on leadership and innovation, providing valuable insights for academics and professionals seeking to improve organisational performance through supportive and inclusive leadership approaches.

Within the educational sector, where student care is crucial, servant leadership can elevate the student experience by fostering a culture of service and attentiveness.

Managers who prioritize their staff's needs can cultivate a committed and motivated workforce, leading to exceptional customer service and a positive institutional reputation.

Theoretical Background and Hypothesis Development

The academic institutions, characterized by its diverse workforce and dynamic environment, requires leadership styles that instigate innovation and foster inclusivity. This section outlines the theoretical background for understanding SL and its relationship to IWB, as well as the mediating roles of PD and IP. SL, first conceptualized by Greenleaf (1977), emphasizes the leader's role as a servant to their employees, prioritizing their growth, well- being, and development. Servant leadership theory represents a paradigm shift in leadership thought. Unlike traditional leadership models that prioritize organisational goals, control, and authority, servant leadership places the primary focus on serving others. The core philosophy behind servant leadership is that leaders should prioritize the well-being, development, and growth of their followers, with the belief that this will ultimately benefit the organisation as a whole. Servant leadership has gained significant traction in organisational contexts due to its ability to enhance employee satisfaction, trust, and engagement (Liden et al., 2008). By prioritizing the needs of employees, servant leaders create a supportive and empowering work environment, which in turn leads to higher levels of organisational commitment, job performance, and innovation (Van Dierendonck, 2011). They create a psychologically safe environment where employees are not afraid to make mistakes, take risks, and contribute creatively (Yoshida et al., 2014). Previous studies have shown that leadership is essential in creating an environment that supports innovation (Amabile et al., 2004). Specifically, servant leaders cultivate an atmosphere of trust and psychological safety, which are vital elements in motivating employees to engage in innovative activities. By empowering workers and encouraging their participation, servant leaders establish the necessary conditions for nurturing creativity and innovation (Liden et al., 2014). IWB involves the creation, advocacy, and execution of novel ideas, processes, or products within an organisation (De Jong & Den Hartog, 2010). It consists of three primary phases: Idea Generation, which involves conceptualizing new solutions; Idea Promotion, which entails garnering support for these ideas; and Idea Implementation, which focuses on transforming ideas into practical outcomes (Scott & Bruce, 1994). The unique approach of servant leaders, emphasizing fairness, empathy, and empowerment, makes them particularly well-suited to promote diversity and inclusion (D&I). Their support of inclusive practices generates a psychologically safe environment for employees from varied backgrounds, motivating them to share their distinct viewpoints (Greenleaf, 1977; Parris & Peachey, 2013). In contemporary organisational research, D&I have emerged as crucial concepts, acknowledged for their significant influence on enhancing innovation, employee engagement, and overall organisational efficacy. The theoretical foundations of D&I can be examined through the diversity paradigm (Cox, 1993) and inclusion frameworks (Shore et al., 2011), which together offer a comprehensive basis for

comprehending how diverse workforces can be utilized to achieve organisational success. These principles also align closely with the United Nations' Sustainable Development Goals (SDGs), specifically Goal 8 (Decent Work and Economic Growth) and Goal 10 (Reduced Inequalities), highlighting the importance of IP in driving equitable economic advancement and innovation. Blau's (1964) social exchange theory (SET) elucidates how positive interactions between leaders and employees cultivate trust and reciprocity. Through their ethical conduct and dedication to employee growth, servant leaders implant a sense of obligation in employees to reciprocate via increased engagement and innovative contributions (Cropanzano & Mitchell, 2005).

Servant leadership creates belief, psychological safety, and empowerment, which are essential for IWB, while D&I practices ensure that diverse perspectives are valued and integrated. Drawing on these theories, the conceptual model posits that servant leadership fosters IWB through the mediating effects of PD and IP, providing a holistic understanding of how leadership can drive innovation in dynamic organisational contexts. This theoretical framework integrates servant leadership theory, SET, and the D&I paradigm to explore their combined effects on IWB.

Servant Leadership (SL) and Innovative Work Behaviour (IWB)

The concept of SL prioritizes the development, independence, and welfare of followers, with leaders placing their team members' needs above their own. This leadership approach cultivates an environment that encourages innovation, analytical thinking, and risk-taking, allowing employees to devise novel solutions to problems (Liden, Wayne, Liao, & Meuser, 2014). By empowering their followers and providing support that enhances self-efficacy, servant leaders motivate their team members, which is crucial for fostering IWB (Greenleaf, 1977; Hunter et al., 2013). Moreover, SL creates an atmosphere of psychological safety, where team members feel comfortable expressing ideas and taking risks without fear of negative repercussions, thus promoting creativity and innovation (Edmondson, 1999; Yoshida et al., 2014). Studies also demonstrate that SL plays a significant role in establishing a collaborative culture, encouraging team members to share diverse viewpoints and engage in joint problem- solving efforts (Eva et al., 2019). This collaborative environment not only enhances the flow of knowledge but also empowers employees to take the initiative and engage in proactive behaviours that lead to innovation (Neubert et al., 2008). Empirical studies demonstrate that servant leaders who focus on employee development and provide meaningful feedback significantly influence employees' motivation to explore new ideas and implement creative solutions (Van Dierendonck, 2011; Lemoine et al., 2019). Therefore, first hypothesis is formulated that aligns with the above existing literature.

H1: SL has a direct and positive relationship to IWB.

Perceived Diversity (PD) as a Mediator

The concept of servant leadership prioritizes the development, independence, and welfare of followers, with leaders engaging their team members' needs above their own. This leadership approach creates an environment that encourages innovation, analytical thinking, and risk- taking, allowing employees to devise novel solutions to problems (Liden et al., 2014). By empowering their followers and providing support that enhances self-efficacy, servant leaders motivate their team members, which is crucial for fostering IWB (Greenleaf, 1977; Hunter et al., 2013). Moreover, SL creates an atmosphere of psychological safety, where team members feel comfortable expressing ideas and taking risks without fear of negative repercussions, thus promoting creativity and innovation (Edmondson, 1999; Yoshida et al., 2014). Studies also demonstrate that SL plays a significant role in establishing a collaborative culture, encouraging team members to share diverse viewpoints and engage in joint problem-solving efforts (Eva et al., 2019). Thus, the second hypothesis is proposed based on these literature support.

H2: PD mediates the relationship between SL and IWB

Inclusion Practices (IP) as a Mediator

Inclusion is different from diversity. It is explained as, the extent to which employees feel valued and integrated into the organisational fabric (Nishii, 2013). IP refer to organisational efforts to ensure that all employees, regardless of background, have equal opportunities to contribute, innovate, and succeed within the organisation (Nembhard & Edmondson, 2006). Servant leaders, with their focus on individualized consideration, are likely to foster an inclusive environment by encouraging participation and ensuring that all voices are heard (Chiniara & Bentein, 2016). Previous studies have demonstrated that leaders who prioritize the growth and well-being of their subordinates are more likely to create a work environment where inclusive practices thrive (Choi et al., 2017). When employees perceive that they are included, they are more likely to involve in innovative behaviours, as they feel psychologically safe to express new ideas and challenge the status quo (Carmeli et al., 2010). In educational institutions, servant leaders are expected to adopt an inclusive academic climate, encouraging diverse participation and the recognition of all members' contributions. Therefore, it is hypothesized that:

H3: IP mediate the relationship between SL and IWB.

Serial Mediation of Perceived Diversity (PD) and Inclusion Practices (IP)

The combined effect of diversity and IP is expected to have a powerful impact on IWB. Servant leadership not only promotes diverse work environments but also ensures that these diverse groups are effectively included and their

contributions valued (Liden et al., 2014). The serial mediation model suggests that servant leadership first promotes diversity practices, which then lead to IP, and ultimately foster IWB. By ensuring that diverse employees are both represented and included, organisations can tap into a wide range of ideas, which fosters an innovative culture (Shore et al., 2011). Hence, we propose:

H4: Perceived diversity and inclusion practices serially mediate the relationship between servant leadership and innovative work behaviour.
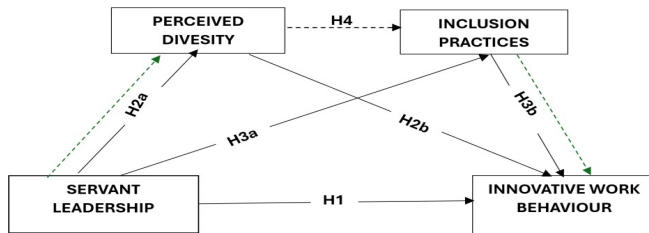
Figure I: Conceptual Model 1

The figure 1 depicts the clear visualization of hypothesized relationships and model structure.

2. METHODOLOGY

Sampling Procedure

The study employs a quantitative, cross-sectional research design among faculty members in Deemed universities across Tamil Nadu. Using snowball sampling, data was collected via Google Forms shared through professional links, WhatsApp groups, and institutional networks targeting Assistant Professors, Associate Professors and Professors teaching UG and PG management programs.

Data collection occurred in two stages: the initial phase gathered information on demographics, servant leadership, and IWB, while the second phase conducted four weeks later was collected responses on mediating variables specifically IP and perceived workforce diversity. Ethical considerations were adhered to, with informed consent obtained, anonymity ensured, and data used solely for research purposes. The researcher targeted 650 samples, out of which 523 valid responses were received by removing duplicates, incomplete responses, and outliers, ensuring reliability and accuracy. This resulting to a response rate of 80.46%. Data analysis was conducted using SPSS 25 for descriptive statistics, reliability checks, and correlation analysis, while Smart PLS 4 was employed for structural equation modelling to test the serial mediation hypotheses. This methodological approach ensures robust analysis to explore the complex dynamics between servant leadership, workforce diversity, IP, and IWB.

Measures

The standard measurement scales and items used to operationalize the constructs in the study. The constructs include SL, Workplace Diversity, IP, and IWB. Each construct is measured using validated scales adapted from existing literature, with items assessed on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Servant Leadership (SL)

SL, as conceptualized by Patterson (2003), emphasizes leaders' focus on serving and empowering their followers. This construct is operationalized with items that assess leaders' altruism, empowerment, and trust with these sample items of "My leader encourages autonomy and independence in work tasks" "My leader empowers team members to take initiative and make decisions" "My leader ensures that team members have the resources they need to succeed".

Perceived Diversity (PD)

As defined by Dennis and Bocarnia (2005), includes dimensions such as age, gender, race, ethnicity, physical and mental ability, and innovation-driven diversity. The sample items include "There are equal opportunities for career advancement for employees of all genders" "Teams with diverse backgrounds in my workplace are more likely to produce creative solutions" "My workplace is accommodating to employees with different physical abilities" Inclusion Practices (IP) Based on Mor Barak (2005), assess the psychological safety, involvement, authenticity, and promotion of diversity within the organisation. The sample items include "Differences in background and perspectives are recognized and valued here" "I feel included in my work group's activities and decisions" "I feel encouraged to express my true self at work"

Innovative Work Behaviour (IWB)

IWB is measured by Scott et al. (1994), encompasses the processes of idea exploration, generation, championing, and implementation. The sample items includes "I enjoy thinking outside the box and coming up with creative ideas" "I take initiative to put new ideas into practice" "I actively seek out new technologies, processes, and methodologies that could benefit our work"

Respondents Profile

The respondents' demographic and professional profiles are summarized in Table 1. The sample, comprising 523 participants, reflects a diverse representation in terms of age, gender, professional cadre, and work experience. A majority of the respondents (53.6%) fall within the 30–40 age group, followed by 36.4% in the 20–30 age group, indicating a workforce predominantly in their early to mid-career stages. Female respondents (57.3%) slightly outnumber males (42.7%), demonstrating a balanced gender distribution. In terms of professional designation, professors constitute the largest group (54.5%), followed by associate professors (28.2%) and assistant professors (12.7%), highlighting the

inclusion of senior academic professionals. Work experience is fairly evenly distributed, with the highest representation in the 3–5 years category (36.4%), followed closely by those with 5–7 years (34.5%) and 0–3 years (29.1%). These varied respondent profile ensures a complete understanding of perspectives from individuals at different career stages and hierarchical levels within the academic sector.

TABLE 1: Frequency Distribution of Sample Data

Parameter	Description	Frequency	Percentage (%)
Age	20-30	190	36.4
	30-40	280	53.6
	40-50	53	10.0
Gender	Male	223	42.7
	Female	300	57.3
Professional Cadre	Assistant Professor	66	12.7
	Associate Professor	148	28.2
	Professor	285	54.5
Working Experience	0-3	152	29.1

3-5		190	36.4
5-7		181	34.5

Note: Data presented in this table are from the authors' own analysis

3. RESULTS

Measurement Model Assessment

The measurement model's reliability and convergent validity were assessed using Smart PLS with the CB-SEM algorithm, and the results from Table 2 indicate strong support for the constructs' validity. All factor loadings exceeded the recommended threshold of 0.708 (Hair et al., 2014), confirming the significant contribution of each item to its respective construct. For instance, items under SL ranged from 0.813 to 0.870, while PD, Inclusion IP, and IWB also confirmed robust loadings. Composite Reliability (CR) values ranged from 0.908 to 0.967, exceeding the threshold of 0.70 (Nunnally & Bernstein, 1994), indicating a high degree of internal consistency among the measurement items. Additionally, the Average Variance Extracted (AVE) values for all constructs ranged between 0.667 and 0.748, surpassing the 0.50 threshold (Fornell & Larcker, 1981), thereby confirming convergent validity. These findings validate the constructs of SL, PD, IP, and IWB, ensuring their reliability and fitness for further structural model testing.

TABLE 2: Item Loadings, Composite Reliability, and Average Variance Extracted

Constructs	Items	Factor Loadings	CR	AVE
Servant Leadership (SL)	SL1	0.843	0.946	0.726
	SL2	0.842		
	SL3	0.870		
	SL4	0.869		
	SL5	0.849		
	SL6	0.854		
	SL7	0.813		
Perceived Diversity (PD)	PD1	0.788	0.931	0.687
	PD2	0.751		
	PD3	0.758		
	PD4	0.886		
	PD5	0.873		
	PD6	0.886		
	PD7	0.866		
	PD8	0.885		
Inclusion Practices (IP)	IP1	0.884	0.967	0.748
	IP2	0.891		
	IP3	0.880		
	IP4	0.895		
	IP5	0.913		
	IP6	0.892		
	IP7	0.886		
	IP8	0.850		
	IP9	0.845		
	IP10	0.854		
	IP11	0.849		
Innovative Work Behaviour (IWB)	IWB1	0.772	0.908	0.667
	IWB2	0.808		
	IWB3	0.847		
	IWB4	0.820		
	IWB5	0.841		
	IWB6	0.807		

Note: CR = Composite Reliability, AVE = Average Variance Extracted. *Source: Data presented in this table are from the authors' own analysis* 3

Table 3 presents the results of discriminant validity for the constructs in the model, evaluated using both the HTMT ratio and the Fornell-Larcker criterion. The HTMT values for all constructs, including SL, PD, IP, and IWB, are below the threshold value of 0.85, indicating that the constructs are distinct and not highly correlated, thus fulfilling the criteria for discriminant validity (Henseler et al., 2015). Furthermore, the Fornell-Larcker criterion shows that the square root of the Average Variance Extracted (AVE) for each construct exceeds its highest correlation with any other construct, further confirming discriminant validity. Specifically, the diagonal values for each construct, such as 0.876 for IP, 0.816 for IWB, 0.839 for PD and 0.894 fir SL are higher than the off-diagonal correlations, demonstrating that the constructs are sufficiently dissimilar (Fornell & Larcker, 1981).

TABLE 3: Discriminant Validity Assessment

Constructs	IP	IWB	PD	SL
HTMT Ratios				
IP	1			
IWB	0.438	1		
PD	0.402	0.728	1	
SL	0.447	0.490	0.477	1
Fornell-Larcker Criterion				
IP	**0.876**			
IWB	0.440	**0.816**		
PD	0.380	0.728	**0.839**	
SL	0.436	0.494	0.484	**0.849**

Note: IP – Inclusive Practices, IWB– Innovative Work Behaviour, PD- Perceived Diversity, and SL – Servant Leadership.

Structural Model Assessment

The research employed Structural model assessment in SmartPLS to evaluates the relationships between latent constructs, ensuring validity, significance, and predictive power of hypothesized paths in complex research models. The Figure II portray the structural model of the research. model structure.
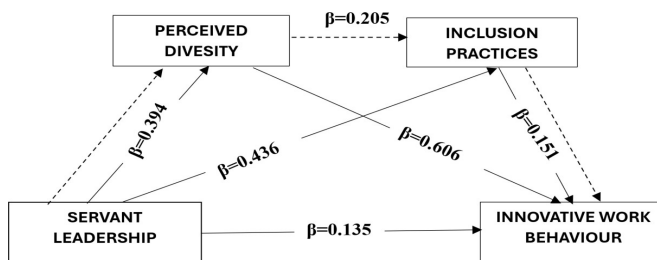
Figure II: Structural Model

Direct Path Analysis

Table 4 exhibits the path analysis results, that demonstrates the direct relationship of the hypothesis development. The path coefficient for H1 (SL → IWB) is β = 0.135 (t = 3.342, p = 0.000), indicating a small but significant positive relationship at the 1% significance level. This suggests that higher levels of SL foster IWB among employees. Similarly, H2a (SL → PD) shows a moderate positive effect with β = 0.394 (t = 8.105, p = 0.000), supporting the idea that SL enhances employees' perceptions of diversity. H2b (SL → IP) reveals a moderate to strong positive relationship with β = 0.436 (t = 6.841, p = 0.000), suggesting that SL significantly promotes IP within organisations. For H3a (PD → IWB), the path coefficient of β = 0.606 (t = 10.739, p = 0.000) indicates a strong positive relationship, highlighting that PD significantly boosts IWB. The relationship for H3b (IP → IWB) has a path coefficient of β = 0.151 (t = 2.452, p = 0.014), signifying a small but significant positive effect at the 5% significance level, demonstrating that IP contribute to IWB, albeit to a lesser extent than PD. These findings align with existing research (Chin, 1998; Cohen, 1988; Hair et al., 2014) on the importance of leadership, diversity, and inclusion in fostering innovation (Chung et al., 2020; Van Dierendonck, 2011). Collectively, the results highlight that SL not only directly influences IWB but also indirectly promotes innovation by enhancing PD and IP.

TABLE 4: Path Analysis Results

Hypothesis	Relationship	(β)	SE	t-Value	P-Value	Result
H1	SL → IWB	0.135	0.044	3.342	0.000**	Supported
H2a	SL → PD	0.394	0.049	8.105	0.000**	Supported
H2b	SL → IP	0.436	0.064	6.841	0.000**	Supported
H3a	PD → IWB	0.606	0.056	10.739	0.000**	Supported
H3b	IP → IWB	0.151	0.062	2.452	0.014*	Supported

Note: ** denotes significant at 1% level, * implies significant at 5% level.

Serial Mediation Analysis

The mediation analysis discloses significant pathways through which SL influences IWB via PD and IP. The individual mediation results show that SL enhances IWB through PD (β = 0.238, t = 7.305, p = 0.000) and through IP (β = 0.066, t = 2.444, p = 0.015). These findings suggest that when servant leaders foster an environment that promotes D&I, employees are more likely to engage in innovative behaviours. Additionally, the path IP → PD → IWB (β = 0.126, t = 3.590, p = 0.000) highlights that IP improve

diversity perceptions, which subsequently drive innovation. The serial mediation results further illustrate that SL indirectly influences IWB through a sequential process involving IP and PD (SL → IP → PD → IWB, β = 0.055, t = 3.617, p = 0.000), indicating that IP foster diversity perceptions, enhancing innovation outcomes. Similarly, SL impacts PD via IP (SL → IP → PD, β = 0.091, t = 3.827, p = 0.000). These significant relationships, supported by confidence intervals that do not include zero.

TABLE 5: Mediation Analysis Results

Indirect Path	β	S.E	T-Value	P-Value	Confidence Interval (2.5%–97.5%)	Result
SL → PD → IWB	0.238	0.033	7.305	0.000 **	0.178 – 0.306	Supported
SL → IP → PD → IWB	0.055	0.015	3.617	0.000 **	0.030 – 0.091	Supported
SL → IP → IWB	0.066	0.027	2.444	0.015 *	0.018 – 0.126	Supported
SL → IP → PD	0.091	0.024	3.827	0.000 **	0.050 – 0.143	Supported
IP → PD → IWB	0.126	0.035	3.590	0.000 **	0.062 – 0.203	Supported

Note: ** denotes significant at 1% level, * implies significant at 5% level.

4. DISCUSSION

The results of this study provide important insights into the role of SL in fostering IWB, both directly and indirectly, through the mediating roles of PD and IP. The findings reveal the intricate ways in which leadership styles and organisational practices contribute to innovation, supporting the critical role of diversity and inclusion in the innovation process. Directly, the study finds that SL positively influences IWB. This is consistent with prior research highlighting that SL creates a supportive and empowering environment for employees, which is conducive to creativity and innovative behaviour. Van Dierendonck (2011) emphasized that servant leaders prioritize employee well-being and development, thus fostering an environment that nurtures creativity and encourages risk-taking—key components of innovation. Additionally, Liden et al. (2014) argue that SL's focus on empowering employees and creating a trust-based relationship contributes to a work environment where individuals feel valued and are more likely to contribute innovative ideas.

The mediation analysis reveals that SL indirectly influences IWB through PD and IP. This suggests that the role of diversity in fostering innovation has been widely recognized in the literature. Chung et al. (2020) and Van Knippenberg et

al. (2013) assert that diverse teams are more innovative because they bring a variety of perspectives, leading to more creative problem- solving and idea generation. By enhancing perceptions of diversity, SL encourages employees to think outside the box and approach challenges with novel solutions. This aligns with the finding that inclusive work environments, which value diverse perspectives, facilitate innovation by allowing employees to contribute freely and collaboratively (Nembhard & Edmondson, 2006; Choi et al., 2017).

Furthermore, the study shows that SL promotes IWB by implementing IP. By encouraging inclusivity, servant leaders foster a work atmosphere where all staff members are accepted, feel appreciated, and are free to express their opinions without worrying about prejudice or exclusion. Employees are more likely to offer innovative ideas when they feel psychologically comfortable and engaged in decision making processes, according to Nembhard and Edmondson (2006), who emphasized the significance of participation in encouraging innovative behaviours. In a similar vein, Choi et al. (2017) discovered that inclusive leadership techniques greatly boost worker creativity by enabling group problem-solving and lowering communication obstacles. The sequential and interrelated character of these connections is further highlighted by the serial mediation effect of SL → IP → PD → IWB. The SL → IP → PD pathway also highlights how SL promotes IP, which in turn affects how employees perceive diversity. This outcome is in conformity with the findings of Ashikali and Groeneveld (2015), who maintained that leadership is essential for assessing how people perceive diversity and organisational culture, neither of which have an impact on worker engagement and productivity. Servant leaders that emphasise inclusion foster an environment where a range of viewpoints and ideas are respected, which produces innovative results. With the goal to foster innovative behaviours, organisations should concentrate on leadership practices that underscore diversity and inclusion, fostering an atmosphere where staff members feel appreciated and encouraged to take risks (Nembhard & Edmondson, 2006; Choi et al., 2017). Overall, the results of this study align with and extend previous research on the role of leadership in promoting innovation. SL, by fostering inclusion and diversity, creates an environment that encourages creativity, idea generation, and risk-taking, all of which are critical for innovation.

Theoretical Implications

This study makes an important contribution to leadership and innovation theories by investigating how SL promotes IWB among academics at recognised universities. By emphasising the mediating functions of IP and PD, it extends our comprehension of how SL influences innovation by fostering varied and inclusive learning environments. The results highlight that innovation is fuelled by both direct leadership

support and the development of an inclusive and diverse environment, both of which are essential for creativity in educational institutions. By showing that diversity views and IP buffer this relationship, this study expands on our knowledge of the relationship between SL and IWB. By demonstrating how leadership indirectly affects innovation through these elements, the serial mediation model further complicates the situation. By creating an environment conducive to academic independence, teamwork, and creativity, academic leaders can foster innovation in research and teaching, which are vital for the success of higher education institutions.

Practical Implications

This study adds significantly to leadership and innovation theories by investigating how SL promotes IWB among academics at designated universities. It provides a deeper understanding of how SL promotes creativity by highlighting the mediating roles of IP and PD. According to the research, fostering an inclusive and diverse environment is just as important for creativity and innovative thinking in the deemed universities as providing direct leadership assistance or encouraging innovation in academic settings. This study highlights the significance of organisational climate in fostering innovation by proving that the relationship between SL and IWB is mediated by PD and IP.

Limitation and further scope for research

Although this study offers insightful information about the connections among PD, IP, SL, IWB, it has a number of drawbacks. First off, the findings may not be as applicable to other areas or industries due to the focus on academicians at Tamil Nadu's deemed universities. More thorough insights would be obtained by broadening the sample to include scholars from various university and educational contexts, as well as private institutions and business settings. Second, the study can be incorporated with moderating variables such as cultural intelligence, proactive personality and team climate. Furthermore, relying just on self-reported data may induce biases, thus future study might include alternative data sources, such as peer or supervisor ratings, to improve validity. For academic institutions and organisations hoping to promote innovation through inclusive practices and strong leadership, this would provide more useful information.

5. CONCLUSION

In summary, this research helps in understanding better how SL can stimulate IWB of academics in deemed universities. Relative to these findings, the importance of leadership participation whether as command or as supportive is noted, more so when PD and IP are involved. SL advocates for a leadership style that serves the employees first and at the same time provides a framework for innovation which is very important in the highly competitive atmosphere of higher education. This research adds to the literature in that it explains that SL enhances creativity and invention through

the fostering of the appropriate environment. Besides, the serial mediation model reflects the complex relationships, which operate to promote an environment for innovation, that are perceived to be interlinked in their chronological structure. Given that more and more social sciences university's attach great importance to the excellence of research and academic performance, the findings of this paper can be applied by the academic leaders to change the prevailing practices to be able to enhance collaboration and thereby, innovation. In an ultimate sense then, the adoption of SL in the context of institutions of higher education can make advancement in the area of innovation greatly increasing the performance of the management courses in the educational institutions.

REFERENCES

[1.] Amabile, T. M., Schatzel, E. A., Moneta, G. B., & Kramer, S. J. (2004). Leader behaviors and the work environment for creativity: Perceived leader support. *The Leadership Quarterly, 15*(1), 5–32. https://doi.org/10.1016/j.leaqua.2003.12.001

[2.] Ashikali, T., & Groeneveld, S. (2015). Managing diversity in public organisations: The influence of diversity policies and practices on diversity climate. *Public Administration, 93*(3), 641–658. https://doi.org/10.1111/padm.12135

[3.] Carmeli, A., Reiter-Palmon, R., & Ziv, E. (2010). Inclusive leadership and employee involvement in creative tasks in the workplace: The mediating role of psychological safety. *Creativity Research Journal, 22*(3), 250–260. https://doi.org/10.1080/10400419.2010.504654 Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In *Modern Methods for Business Research* (pp. 295–336).

[4.] Chiniara, M., & Bentein, K. (2016). Linking servant leadership to individual performance: Differentiating the mediating role of autonomy, competence, and relatedness need satisfaction. *The Leadership Quarterly, 27*(1), 124–141. https://doi.org/10.1016/j.leaqua.2015.08.004

[5.] Choi, S. B., Tran, T. B. H., & Kang, S. W. (2017). Inclusive leadership and employee well- being: The mediating role of person-job fit. *Journal of Happiness Studies, 18*(6), 1877–1901. https://doi.org/10.1007/s10902-016-9801-6

[6.] Chung, Y. W., Lee, S. H., & Jung, H. S. (2020). How servant leadership influences innovative behaviour. *Leadership & Organization Development Journal, 41*(4), 567–581. https://doi.org/10.1108/LODJ-08-2019-0352

[7.] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum. Cox, T. (1993). *Cultural diversity in organizations: Theory, research and practice.* Berrett- Koehler Publishers. De Jong, J. P. J., & Den Hartog, D. N. (2010). Measuring innovative work behavior. *Creativity and Innovation Management, 19*(1), 23–36. https://doi.org/10.1111/j.1467-8691.2010.00547.x

[8.] Dennis, R. S., & Bocarnea, M. (2005). Development of the servant leadership assessment instrument. *Leadership & Organization Development Journal, 26*(8), 600–615. https://doi.org/10.1108/01437730510633692 Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*(2), 350–383. https://doi.org/10.2307/2666999

[9.] Ferdman, B. M., & Deane, B. R. (2014). *Diversity at work: The practice of inclusion.* Jossey- Bass. Fornell, C., & Larcker,

Exploring the Influence of Servant Leadership on Innovative Work Behaviour: The Role of Perceived Diversity and Inclusion Practices in the Workplace

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D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.1177/002224378101800104

[10.] Greenleaf, R. K. (1977). *Servant leadership: A journey into the nature of legitimate power and greatness.* Paulist Press. Groeneveld, S. (2011). Diversity management in public organizations: The role of organizational culture and leadership. *International Journal of Public Sector Management, 24*(6), 553–570. https://doi.org/10.1108/09513551111163652

[11.] Groeneveld, S. (2011). Leading diversity: The influence of organizational leadership on diversity practices and diversity climate. *International Journal of Public Administration, 34*(6), 388–400. https://doi.org/10.1080/01900692.2011.561618

[12.] Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM).* Sage Publications.

[13.] Hunter, E. M., Neubert, M. J., Perry, S. J., Witt, L. A., Penney, L. M., & Weinberger, E. (2013). Servant leaders inspire servant followers: Antecedents and outcomes for employees and the organization. *The Leadership Quarterly, 24*(2), 316–331. https://doi.org/10.1016/j.leaqua.2012.12.001

[14.] Janssen, O. (2000). Job demands, perceptions of effort-reward fairness and innovative work behaviour. *Journal of Occupational and Organizational Psychology, 73*(3), 287–302. https://doi.org/10.1348/096317900167038

[15.] Liden, R. C., Wayne, S. J., Liao, C., & Meuser, J. D. (2014). Servant leadership and serving culture: Influence on individual and unit performance. *Academy of Management Journal, 57*(5), 1434–1452. https://doi.org/10.5465/amj.2013.0034

[16.] Liden, R. C., Wayne, S. J., Zhao, H., & Henderson, D. (2008). Servant leadership: Development of a multidimensional measure and multi-level assessment. *The Leadership Quarterly, 19*(2), 161–177. https://doi.org/10.1016/j.leaqua.2008.01.006

[17.] Mor Barak, M. E. (2005). *Managing diversity: Toward a globally inclusive workplace.* SAGE Publications. Nembhard, I. M., & Edmondson, A. C. (2006). Making it safe: The effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. *Journal of Organizational Behavior, 27*(7), 941–966. https://doi.org/10.1002/job.413

[18.] Nishii, L. H. (2013). The benefits of climate for inclusion for gender-diverse groups. *Academy of Management Journal, 56*(6), 1754–1774. https://doi.org/10.5465/amj.2009.0823 Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.).

[19.] McGraw-Hill. Parris, D. L., & Peachey, J. W. (2013). A systematic literature review of servant leadership theory in organizational contexts. *Journal of Business Ethics, 113*(3), 377–393. https://doi.org/10.1007/s10551-012-1322-6 Patterson, K. A. (2003). Servant leadership: A theoretical model. *Regent University.*

[20.] Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal, 37*(3), 580–607. https://doi.org/10.2307/256701

[21.] Shore, L. M., Randel, A. E., Chung, B. G., Dean, M. A., Ehrhart, K. H., & Singh, G. (2009). Inclusion and diversity in work groups: A review and model for future research. *Journal of Management, 37*(4), 1262–1289. https://doi.org/10.1177/0149206309335187

[22.] Spears, L. C. (2004). Practicing servant-leadership. *Leader to Leader, 2004*(34), 7–11. https://doi.org/10.1002/ltl.94

[23.] Tajfel, H., & Turner, J. C. (1986). The social identity theory of intergroup behavior. In S. Worchel & W. G. Austin (Eds.), *Psychology of intergroup relations* (pp. 7–24). Nelson-Hall. Van Dierendonck, D. (2011). Servant leadership: A review and synthesis. *Journal of Management, 37*(4), 1228–1261. https://doi.org/10.1177/0149206310380462

Declaration

"Conscious Organizations" Finally Important: A Study of Green HRM

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ABSTRACT

In recent days the perils of environmental damages have forced many organisations to concentrate on environmental initiatives. One of the important dimensions of the organisations have been human resource management. It is also a fact the an organisations have to be "Conscious" to think about employees, customer, society and environment at large. If organisations are only bothered about bottom- line and not conscious about its actions on environment then it would be difficult to enforce environment initiative in true sense. The purpose of the study to find that if an organisations is conscious then does it have motivated and committed employees? Present study was conducted to see Conscious organisations having GHRM policies also shows employee engagement, motivation, commitment and behaviour.

A literature review was conducted to identify gaps, and a quantitative methodology was used, It was found that there is dearth of study explaining GHRM and employee engagement, employee motivation, employee behaviour and employee Commitment and sustainability. 6 organisations were covered in three tiers of IT sector. Sample size was 150. The model was developed depicting "Conscious organisations" having GHRM and its relation with employee engagement, employee motivation, employee behaviour and employee Commitment and sustainability. Authors found that there is a relation of GHRM and employee behaviour, motivation, engagement and commitment. The model and theory was established that "Conscious" organisations have high engaged,motivated, committed employees.

Though there have been many studies on green HRM, present study is a comprehensive study on the relationship of Green Human Resource Management (GHRM) and whether it has relation with employee behaviour, engagement, motivation, and organizational commitment and sustainability. The goal is to investigate the link between Organisation's direction, GHRM practices and key employee outcomes, which are critical for organizational sustainability. The uniqueness of the study is that it establishes that organisation having GHRM policies are Conscious organisations and having engaged, motivated and committed employees will bring great performance and employees would contribute in organisations growth and therefore it will show that it is profitable to be Conscious rather than Unconscious. The authors have used GHRM as a measure of consciousness in the organisations.

Keywords: Conscious Organisations, Green HRM, Employee behaviour, Employee engagement, employee motivation, employee commitment

1. INTRODUCTION

With growing technology and a growing economy, organisations world over compete to earn profit and, in that race, have neglected its stakeholders be it – internal that is employees as well external that is environment and society. Individual competitive behaviours, which are characteristics for modern society has created imbalances (Lozano,2008). The side effects for the same has been profound in affecting internal and external stakeholders. This shortsightedness has harmed organisations and society and people at large. Organisations around the world are grappling with the need to balance economic growth with sustainability (Zhang et al.,2020). They started incorporating environmental goals into their strategies and policies (Chung,2020). Also, today environmental sustainability is being threatened by global warming, and organisations must act immediately to it in every possible way. Extreme weather, resource depletion, and rising global temperatures have brought attention to how important it is for businesses to reduce environmental harm.

One of the important ways of attaining sustainable goals would be policies related to green practices. Green practices are related to several dimensions of the organisation and one of the important practices are Green Human Resource Practices. Green human resource management (GHRM) practices including training and development, performance appraisal, compensation management play a crucial role in environmental management and organizational sustainability (Amjad et.al,2021). Faisal, (2023), defines Green HRM as a set of organizational policies, practices, and processes that encourage environmentally friendly methods and benefit individuals, businesses, and the environment. Green HRM practices also include green recruitment, green training and development, green performance management, green compensation management, green employee empowerment and participation, and green employee relations.

Organizational performance is also linked with employee behaviour, engagement, motivation and commitment. Organisation's vision towards internal and external

stakeholders is an important indicator about how Conscious organisation is.

Employee performance and organizational performance is closely linked and employee performance is closely linked with employee engagement, motivation, commitment and behaviour. Green human resource practices contribute to the attainment of ESG goals that environment, social and governance goals. Present study explores that whether organisations which are having policies impacting internal stakeholders also are "Conscious" for external stakeholders.

Within the framework of business is being a "Conscious Organisation" important ? The answer to this is simple but not easy because being into a practice that would not give the initial results and takes a lot from the organization in terms of behavior management, implementation, and controlling results takes a lot of effort with no visible output initially. This is just like a "Bamboo seed". The seed takes a lot of effort initially and doesn't show much growth because it was busy setting up its roots and making the base strong for 5 years but post that it grows very aggressively and will remain productive for ages. Similarly implementing green policies into HRM to improve employee engagement, motivation, behavior, and commitment will not have much impact on the organization initially but after some time this will become a reason for the organization to be into long-term sustainability and also bring lots of profitability.

The current study is especially significant since it fills a knowledge vacuum on how Green HRM practices affect essential employee outcomes like engagement, behaviour commitment, and motivation and shows that "Conscious organisations are important as goals related to internal and external stakeholders are met. Authors have tried to study the impact of green hrm policies on employee behaviour, engagement, motivation and commitment and have developed a model. The study was conducted in IT sector in Delhi NCR region.Thus, this study is important to make the organizations aware that planting trees is not the only solution to global warming. We need to think holistically about it.

2. LITERATURE REVIEW

Green HRM and ESG Goals

Chinnamuthu et al, (2016) says that global warming and climatic changes are the major factors affecting green practices and environmentally sustainable initiatives. After the Industrialization and Globalization era, the excessive exhaustion of natural resources is questionable to sustainability. The accountability and responsibility of such happenings are on Government and the stakeholders of the related business. The increased industries should take remedial measures to adhere to global sustainability.

Sachdeva ETA explains that there is a growing need for the alignment of environmental management with human

resource management (HRM) practices called Green HRM Practices. The results of the study have shown that implementing green practices leads to high cost, and adoption of green technology is complex and difficult, and they were considered as the most important barriers. Furthermore, general human resource practices that resist adopting Green HR practices had the lowest importance. Sreedevi states that Human Resources (HR) can generate a competitive advantage and company performance is influenced by a set of effective HR applications. Companies today need to be fast-growing, efficient, profitable, flexible, adaptable, and future-ready and have a dominant market position. Without these, it is virtually impossible to be competitive in today's global economy. HR applications help increase productivity and quality and gain the competitive advantage of a workforce strategically aligned with the organization's goals and objectives. Sonal et al,.explains Green HRM practices are HR activities that focus on being environmental, which means using resources responsibly and encouraging employees to support the organization's goals.

According to Gupta & Verma (2022), the negative impacts of global warming may be considerably reduced by promoting an ecologically sustainable corporate culture through Green Leadership and Green Employee Relations. By emphasizing the effects of these practices, this study emphasizes how important it is for businesses to use Green HRM as a vital instrument for tackling environmental issues worldwide and improving worker productivity and organisational resilience at the same time.

Green HRM and employees Behaviour, engagement, commitment and motivation

Singh & Pandey (2020) state that Green HRM has become one of many organizations, but its success depends on how much the employees adopt Green HRM practices. The study found that Green Recruitment & Selection, Green Employee Relations, Green Induction, and Green Training & Development are important factors that influence employee engagement.

AlKetbi et al, (2024) reviewed the literature and provided good evidence supporting a positive predictive relationship between G-HRM practices and employee green attitudes, employee green satisfaction, client green satisfaction, employee green behavior, and organizational green performance. Green HRM practices are a crucial tool for promoting environment-conscious attitudes and behaviors among employees, which ultimately leads to higher employee satisfaction and improved organizational ecological performance. Salunke et al, (2021) says that Green HRM practices are not effectively aligned with the environment in the companies. The implementation of the Green HRM practices is not widely followed.

Aboramadan, (2022) states that Green human resources management (GHRM) plays a significant role in the

employee for their green behavior. GWE was demonstrated to be a significant intervening mechanism to explain the above-mentioned relationships. The results provide how GHRM may positively contribute to employee green outcomes.

Ababneh, (2021) study invoked the classical theory of person-organization-fit and examines that certain personality traits in moderating the associations between HRM practices and employee engagement with environmental initiatives. The study also indicates that employee engagement is associated with green HRM practices and individual green behavior. Additionally, this study emphasizes the importance of organization-person interaction in fostering employee engagement with environmental initiatives.

Gomes, (2023) studies show that the biospheric value (concern for the environment) influences the link between GHRM practices and how emotionally committed employees feel to their work. This means that GHRM practices have a stronger impact on employees' commitment and engagement when they care more about the environment. This is important because it highlights the role of environmental values in enhancing the effectiveness of GHRM practices.

Green Human Resource Management (GHRM) has emerged as an important strategy for increasing employee motivation and organizational commitment by incorporating environmental management into HR practices. According to research, GHRM practices such as green training, recruitment, and development have a significant impact on employee environmental attitudes and behaviors. When organizations implement GHRM initiatives, they not only promote sustainability but also foster a sense of purpose in their employees, which leads to increased motivation. Green training, for example, provides employees with eco-friendly skills, allowing them to contribute to the organization's environmental goals while increasing job satisfaction and motivation (Khan et al., 2022). GHRM is linked to increased organizational commitment, as employees see these practices as a reflection of the organization's ethical and social responsibilities. The incorporation of green initiatives into HR practices fosters a sustainable culture, making employees feel valued and part of a larger cause, thereby strengthening their loyalty and commitment to the organization (Shoaib et al., 2021). Furthermore, research shows that GHRM improves green human capital, which mediates the relationship between GHRM and organizational commitment, emphasizing the importance of empowering employees to actively participate in sustainable practices. As a result, GHRM plays an important role in motivating employees and developing a committed, environmentally responsible workforce.

Green HRM and Impact on stakeholders and image

At the same time, the impact of Green HRM on employee satisfaction and public image is important. Hence, the companies require healthy initiatives and actions to improve their Green HRM practices with general environmental policies. Equal efforts are required for the actual implementation effectiveness of the Green HRM practices. This will be beneficial for all the stakeholders, including the employees and the public at large.

Gupta et al, (2024) tells us that Good and responsible companies are adopting sustainability measures to manage their impact on the environment. Structural equation modeling revealed that GHRM and work engagement are mediated by managerial support and HRM performance attributions.

Conscientious organisations are aware of how important it is to use green methods to solve environmental issues. To integrate sustainability into HR operations and promote alignment with environmental goals, Sharma et al. (2022) emphasize the need for Green Human Resource Management (GHRM). In a similar vein, Sathasivam et al. (2020) stress that GHRM promotes organisational commitment and employee motivation while advancing sustainability initiatives. These organizations demonstrate their critical role in addressing global warming by embracing policies like recycling, green awards, and resource conservation, which match with international programs like the Paris Agreement and SDGs.

Therefore, encouraging green HRM practices is crucial to tackling the world's environmental problems, especially the negative consequences of global warming. These procedures not only improve worker commitment, motivation, and involvement but also match corporate aims with environmental goals. The data emphasizes how important it is for businesses to implement Green HRM programs to promote environmentally responsible practices and encourage environmental stewardship across all sectors.

GAP Analysis

Though a lot of study has been done on Green HRM and its many dimensions, the literature on the relationship of Green HRM with employee engagement, behavior, motivation, and commitment still lags far behind. Most existing research examines these variables in isolation or only selectively, resulting in a fragmented understanding of how they interact to influence organizational outcomes. For example, while research has highlighted the individual effects of Green HRM practices on employee behavior and satisfaction, there is a scarcity of comprehensive studies that investigate the synergistic effects of Green HRM and the four other variables—engagement, behavior, motivation, and commitment—on organizational goals, particularly Environmental, Social, and Governance (ESG) objectives.

This gap provides an opportunity for a comprehensive investigation into how Green HRM can improve employee engagement, behavior, motivation, and commitment while

driving organizational sustainability and performance. A combined study focusing on these interrelations would not only add to academic discourse but would also provide valuable insights for practitioners seeking to achieve ESG goals through integrated HRM strategies.

3. RESEARCH METHODOLOGY

1. Research Design

This study adopts a quantitative research design to explore the impact of Green Human Resource Management (Green HRM) on employee engagement, behavior, motivation, and organizational commitment in the ITES industry. The research aims to empirically test the proposed hypotheses using statistical tools to determine the relationships among the variables.

2. Research Objectives

- To study the relationship between Green HRM and employee behavior.
- To study the relationship between Green HRM and employee engagement.
- To study the relationship between Green HRM and employee motivation.
- To study the relationship between Green HRM and employee organizational commitment.

3. Hypotheses

The following hypotheses will be tested:

- H0 (1): There is no relation between Green HRM and employee behavior.
- H1 (1): There is a relation between Green HRM and employee behavior.
- H0 (2): There is no relation between Green HRM and employee engagement.
- H1 (2): There is a relation between Green HRM and employee engagement.
- H0 (3): There is no relation between Green HRM and employee motivation.
- H1 (3): There is a relation between Green HRM and employee motivation.
- H0 (4): There is no relation between Green HRM and employee organizational commitment.
- H1 (4): There is a relation between Green HRM and employee organizational commitment.

4. Sample Selection

The sample consists of 150 employees working in the IT sector. Participants are selected using a purposive sampling technique to ensure that they have adequate exposure to Green HRM and employee engagement, behavior, motivation, and organizational commitment in their respective organizations.

5. Data Collection Method

Primary data is collected using a structured questionnaire designed to capture the perceptions and experiences of employees regarding Green HRM, employee engagement, behavior, motivation, and organizational commitment. The questionnaire includes Likert-scale items to measure respondents' attitudes and behaviors.

Secondary data is gathered from existing literature on Green HRM, employee engagement, behavior, motivation, and organizational commitment providing a theoretical foundation for the study.

6. Data Analysis Tools

Data analysis is conducted using SPSS version 29. The following statistical methods are applied:

Descriptive Statistics: To summarize the basic features of the data, providing simple summaries about the sample and the measures.

Correlation Analysis: To examine the strength and direction of the relationship between Green HRM, employee engagement, behavior, motivation, and organizational commitment.

Regression Analysis: To determine the predictive power of Green HRM on employee engagement, behavior, motivation, and organizational commitment, assessing the extent to which these independent variables explain the variance in the dependent variables.

7. Reliability and Validity

To ensure the reliability and validity of the questionnaire, a pilot test is conducted with a small group of employees before the main data collection. Cronbach's alpha is used to measure the internal consistency of the survey items, ensuring that the scales are reliable.

8. Ethical Considerations

The study adheres to ethical guidelines by ensuring voluntary participation, informed consent, and confidentiality of the respondents. The data collected is used solely for research purposes, and participants are assured of their anonymity.

9. Limitations of the Study

The study is limited to a sample size of 150 employees from the ITES industry, which may not fully represent the entire sector. Additionally, the use of self-reported data might introduce bias. Despite these limitations, the research provides valuable insights into the relationships between Green HRM, employee engagement, behavior, motivation, and organizational commitment.

4. DATA ANALYSIS

Correlations

Correlations		GREEN HRM	Employee Engagement	Employee Behaviour	Employee Motivation	Employee Commitment
GREEN HRM	Pearson Correlation	1	.873**	.815**	.781**	.844**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	150	150	150	150	150
Employee Engagement	Pearson Correlation	.873**	1	.800**	.860**	.884**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	150	150	150	150	150
Employee Behaviour	Pearson Correlation	.815**	.800**	1	.838**	.894**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	150	150	150	150	150
Employee Motivation	Pearson Correlation	.781**	.860**	.838**	1	.981**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	150	150	150	150	150
Employee Commitment	Pearson Correlation	.844**	.884**	.894**	.981**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	150	150	150	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

Regression - Green HRM & Employee Engagement Variables Entered/Removeda

Variables Entered/Removed^a			
Model	Variables Entered	Variables Removed	Method
1	GREEN HRM[b]	.	Enter

a. Dependent Variable: Employee Engagement

b. All requested variables entered.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873[a]	.762	.760	.606025

a. Predictors: (Constant), GREEN HRM

ANOVA^a		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	174.113	1	174.113	474.079	<.001[b]
	Residual	54.355	148	.367		
	Total	228.468	149			

a. Dependent Variable: Employee Engagement

b. Predictors: (Constant), GREEN HRM

Coefficients^a		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.178	.180		.985	.326
	GREEN HRM	.970	.045	.873	21.773	<.001

a. Dependent Variable: Employee Engagement

Regression - Green HRM & Employee Behavior Variables Entered

Variables Entered/Removed^a			
Model	Variables Entered	Variables Removed	Method
1	GREEN HRM[b]	.	Enter

a. Dependent Variable: Employee Behaviour

b. All requested variables entered.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.815[a]	.664	.661	.640934

a. Predictors: (Constant), GREEN HRM

ANOVA^a		Sum of Squares	df	Mean Square	F	Sig.
Model						

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	119.969	1	119.969	292.041	<.001[b]
	Residual	60.798	148	.411		
	Total	180.767	149			

a. Dependent Variable: Employee Behaviour

b. Predictors: (Constant), GREEN HRM

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.941	.191		4.933	<.001
	GREEN HRM	.805	.047	.815	17.089	<.001

a. Dependent Variable: Employee Behaviour

Regression - Green HRM & Employee Motivation Variables Entered

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	GREEN HRM[b]	.	Enter

a. Dependent Variable: Employee Motivation

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.781[a]	.611	.608	.800020382175286

a. Predictors: (Constant), GREEN HRM

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	148.541	1	148.541	232.084	<.001[b]
	Residual	94.725	148	.640		
	Total	243.266	149			

a. Dependent Variable: Employee Motivation

b. Predictors: (Constant), GREEN HRM

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.334	.238		1.402	.163
	GREEN HRM	.896	.059	.781	15.234	<.001

a. Dependent Variable: Employee Motivation

Regression - Green HRM & Employee Commitment Variables Entered

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	GREEN HRM[b]	.	Enter

a. Dependent Variable: Employee Commitment

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.844[a]	.712	.710	.650678776049377

a. Predictors: (Constant), GREEN HRM

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	154.896	1	154.896	365.853	<.001[b]
	Residual	62.661	148	.423		
	Total	217.557	149			

a. Dependent Variable: Employee Commitment

b. Predictors: (Constant), GREEN HRM

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.292	.194		1.507	.134
	GREEN HRM	.915	.048	.844	19.127	<.001

a. Dependent Variable: Employee Commitment

5. FINDINGS

The analysis found a **strong positive relationship between Green Human Resource Management (HRM) practices**

and various aspects of employees like engagement, behavior, motivation, and commitment. The correlation analysis shows that Green HRM has significant positive relationships with employee engagement (r = 0.873), employee behavior (r = 0.815), employee motivation (r = 0.781), and employee commitment (r = 0.844), all of which are significant at the 0.01 level. These findings indicate that organizations implementing Green HRM practices are likely to see a considerable improvement in these areas.

The regression analyses emphasize the strength of these relationships. For example, the regression model examining Green HRM and employee engagement yielded an R-squared value of 0.762, indicating that Green HRM accounts for 76.2% of the variance in employee engagement. Similarly, Green HRM is responsible for 66.4% of the variation in employee behavior and 61.1% in employee motivation. Notably, the strongest predictive relationship was between Green HRM and employee commitment, with an R-squared value of 0.712, indicating that Green HRM practices account for 71.2% of the variance in employee commitment.

These findings strongly suggest that **implementing Green HRM practices has a significant impact on key employee outcomes such as engagement, behavior, motivation, and commitment.** The consistent significance levels and high correlation coefficients across these variables highlight the importance of Green HRM in developing a motivated and committed workforce.

6. PROPOSED MODEL

Based on the gap analysis and research findings, it was discovered that, while Green Human Resource Management (GHRM) practices are gaining recognition, many organizations struggle to integrate these practices with employee behavior, motivation, engagement, and commitment in a way that promotes the achievement of their Environmental, Social, and Governance (ESG) objectives. The study also found that organizations that focus on GHRM in isolation, rather than integrating it into their core employee management processes, miss out on an opportunity to gain a competitive advantage. To close this gap, a model is proposed as a managerial implication that will provide organizations with a structured approach to effectively integrating GHRM into their human resource strategies.

The proposed model emphasizes the concept of the **"Conscious Organization", which is defined as an entity that not only implements Green HRM practices but also ensures their full integration into key employee-related areas such as behavior, engagement, motivation, and commitment**. According to the model, this consciousness refers to the organization's deliberate focus on aligning GHRM practices with the overall goal of meeting ESG objectives. These organizations prioritize sustainability in their HR processes and ensure that employees are aligned with the organization's environmental and social goals.

Conscious organizations are strategically positioned to generate long-term value by cultivating a sustainable culture that motivates both employee and organizational performance.

The model connects four key elements of employee management—employee behavior (EB), employee engagement (EE), employee motivation (EM), and organizational commitment (EC)—to GHRM. Organizations that incorporate GHRM into these employee-centric areas are more likely to see positive results in terms of meeting ESG targets. For example, GHRM encourages employees to adopt sustainable behaviors (EB), stay engaged (EE) with the organization's environmental and social missions, remain motivated (EM) by aligning with larger sustainability goals, and become committed (EC) to the organization's overall goals. This, in turn, positions the organization to achieve its environmental, social, and governance objectives, resulting in a competitive advantage.
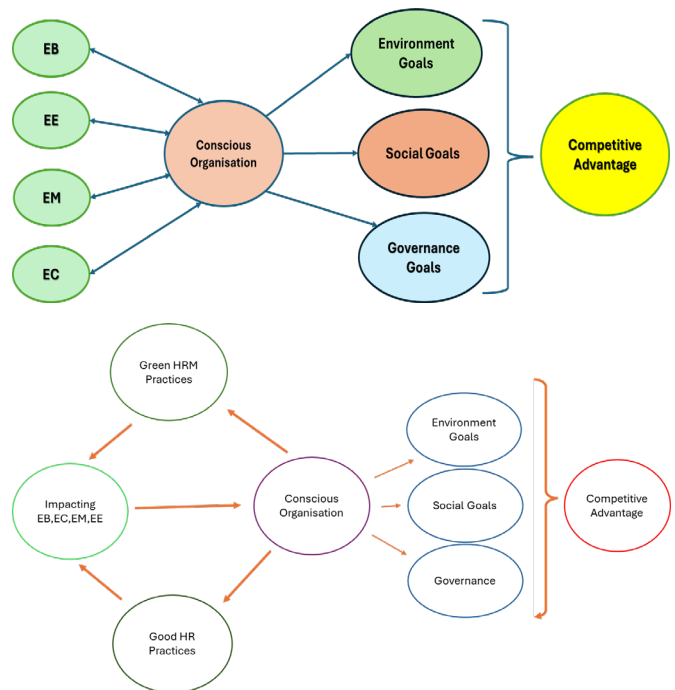
Conscious Organisations having good HR practices and Green HR Practices impacting Employee Engagement(EE), Employee Motivation (EM), Employee Behaviour (EB), Employee Commitment (EC) (depicting internal stakeholder) and then ESG Goals and impacting Competitive advantage

In essence, this model provides a comprehensive framework for organisations to achieve long-term competitive advantages by consciously incorporating GHRM practices into their employee management systems. Organizations can better meet their ESG objectives, create a more sustainable culture, and differentiate themselves in their industries by aligning employee behavior, motivation, engagement, and commitment with sustainability goals.

7. ACADEMIC IMPLICATIONS

The study brings forth an ethical concept in forefront and debates that "ultimately "Conscious "Organisations would be doing profitable sustainable business with engaged, motivated, committed employees. It also gives further scope of research to link GHRM to mental well being of the employees in IT sector. The study is an effort to understand the impact of "Consciousness" in the organisation. The study will have an impact on the way "Consciousness" is perceived in the organisations as it shows that Conscious organisations have engaged employees and therefore would be sustainable organisations in future rather than those organisations which are still not "Conscious".

8. SOCIAL IMPLICATIONS

The study has great social implications as it gives impetus to the thought of "Conscious Organisations" which is concerned about stakeholders. More so when organisations are grappling with allegations of being callous. The authors have developed a theory that "Conscious Organizations" that implements GHRM practices have more motivated, engaged, and committed workforce, which contributes to overall organizational performance and this is possible as these organisations are "Conscious".

9. MANAGERIAL IMPLICATIONS

The managerial implications of this research highlight the strategic importance of incorporating Green Human Resource Management (GHRM) into employee management systems in order to achieve Environmental, Social, and Governance (ESG) objectives. The data analysis revealed that, while many organizations implement GHRM practices, they frequently fail to connect these practices to key employee-related factors such as behavior, motivation, engagement, and commitment. This gap limits their ability to fully capitalize on the competitive advantages provided by sustainability.

The findings show that organizations that consciously integrate GHRM into these employee-focused areas are more likely to succeed in aligning their workforce with broader ESG goals. To address this, the proposed model introduces the concept of a Conscious Organization, which actively integrates GHRM across employee behavior (EB), engagement (EE), motivation (EM), and commitment (EC) to improve organizational performance and meet sustainability targets.

According to this model, focusing on these four variables enables organizations to foster a sustainable work culture, which contributes to meeting ESG goals. The model also demonstrates how conscious alignment leads to a competitive advantage by making organizations more resilient, socially responsible, and environmentally conscious. Managers can improve performance and ensure long-term organizational success by implementing sustainability-driven HR strategies.

10. CONCLUSION AND RECOMMENDATIONS

Integrating GHRM practices with employee engagement, behavior, motivation, and commitment is critical for organizations seeking to achieve their environmental, social, and governance (ESG) objectives. This literature review emphasizes the importance of GHRM in developing an environmentally conscious workforce, increasing employee satisfaction, and improving organizational performance. While various studies have looked into the individual aspects of GHRM and its associated variables, there is still a need to understand how they interact as a unified framework. The evidence suggests that implementing comprehensive GHRM practices not only promotes long-term organizational behavior but also fosters a sense of purpose among employees, ultimately leading to increased organizational commitment and performance. As a result, organizations must recognize the importance of GHRM in improving their ESG initiatives and fostering a sustainable culture.

The authors suggest to Implement structured GHRM policies for recruitment, training, performance management, and employee relations, with a focus on environmental sustainability. This will allow for a more unified approach to environmental responsibility. Training employees on environmental awareness and sustainable practices can empower employees, increase green behavior, and improve job satisfaction.Management can support GHRM initiatives by providing resources and encouraging employees to adopt environmentally friendly practices. This support has the potential to significantly increase employee motivation and commitment. HR practices should align with the organization's sustainability and corporate social responsibility objectives. This alignment will emphasize the significance of GHRM and its role in improving overall organizational performance. By implementing these recommendations, organizations can fully leverage GHRM to build a committed and motivated workforce that supports their sustainability goals and contributes to long-term success.

REFERENCES

[1.] Ababneh, O. M. A. (2021). How do green HRM practices affect employees' green behaviors? The role of employee engagement and personality attributes. Journal of Environmental Planning and Management, 64(7), 1204-1226.

[2.] Aboramadan, M. (2022). The effect of green HRM on employee green behaviors in higher education: the mediating mechanism of green work engagement. International Journal of Organizational Analysis, 30(1), 7-23.

[3.] Amjad, F., Abbas, W., Zia-Ur-Rehman, M., Baig, S. A., Hashim, M., Khan, A., & Rehman, H. U. (2021). Effect of green human resource management practices on organizational sustainability: the mediating role of environmental and employee performance. *Environmental Science and Pollution Research*, *28*, 28191-28206.

[4.] AlKetbi, A., & Rice, J. (2024). The Impact of Green Human Resource Management Practices on Employees, Clients, and Organizational Performance: A Literature Review. Administrative Sciences, 14(4), 78.

[5.] AlKetbi, A., & Rice, J. (2024). The Impact of Green Human Resource Management Practices on Employees, Clients, and Organizational Performance: A Literature Review. Administrative Sciences, 14(4), 78.

[6.] Business Standard. (2024). Tech Mahindra to Implement AI for Profile Screening. Retrieved from

[7.] Chinnamuthu, B., & Gabriel, S. J. (2016). Challenges of green human resource (HR) practices in business processing & outsourcing (BPO) industry in Chennai–a study. International Journal of Recent Research Review, 1, 43-50.

[8.] Chung, K. C. (2020). Green marketing orientation: Achieving sustainable development in green hotel management. *Journal of Hospitality Marketing & Management*, 29(6), 722-738.

[9.] Faisal, S. (2023). Green human resource management—a synthesis. Sustainability, 15(3), 2259

[10.] Gomes, J. F., Sabino, A., & Antunes, V. (2023). The effect of green human resources management practices on employees' affective commitment and work engagement: The moderating role of employees' biospheric value. Sustainability, 15(3), 2190.

[11.] Gupta, A., & Jangra, S. (2024). Green human resource management and work engagement: Linking HRM performance attributions. Sustainable Futures, 7, 100174.

[12.] Lozano, R. (2008). Developing collaborative and sustainable organisations. *Journal of Cleaner Production*, *16*(4), 499-509.

[13.] Sachdeva, V., & Jain, K. Study of Barriers in the Green Human Resource Management Implementation in BPO Industry. Age, 20(24), 25-29.

[14.] Salunke, D. K., Dadas, A. B., & Bagul, D. (2021). A Study of Effective Implementation of Green HRM Policies and Practices by IT Companies. International Interdisciplinary Research Journal, 12(1), 478-487.

[15.] Singh, K. P., & Pandey, K. N. (2020). Green HRM practices and its impact on employee engagement. International Journal of Management (IJM), 11(12), 3350-3364.

[16.] Skill Vertex. (2024). Tech Mahindra Recruitment Process for Freshers 2024. Retrieved from (SkillVertex)ps://www.skillvertex.com/blog/tech-mahindra-recruitment-process/)

[17.] Sonal Singh and Dr. Vikas Nath, An Assessment in the Green HRM Practices with Job Satisfaction and its Impact on Organisational Commitment, International Journal of Management.

[18.] Sreedevi, R. Human Resource Management Application in IT Industry, Thiruvananthapuram.

[19.] Ababneh, K. (2021). The impact of person-organization fit on employee engagement with environmental initiatives: The role of personality traits. *Journal of Environmental Management*, 289, 112468.

[20.] Aboramadan, M. (2022). The role of Green Human Resource Management in influencing employee green behavior: A mediation model. *Sustainability*, 14(1), 58.

[21.] AlKetbi, L., Khamis, S., & Hossain, M. (2024). The impact of Green HRM practices on employee attitudes and organizational performance: A systematic review. *Journal of Cleaner Production*, 328, 137941.

[22.] Chinnamuthu, K., & Chinnamuthu, N. (2016). Environmental sustainability and business: A critical review. *Sustainable Development*, 24(2), 114-122.

[23.] Gomes, F. (2023). The influence of biospheric values on employee commitment and GHRM practices. *Corporate Social Responsibility and Environmental Management*, 30(5), 2743-2752.

[24.] Gupta, R., & Gupta, S. (2024). Managerial support and employee engagement: The mediating role of Green HRM practices. *International Journal of Human Resource Management*, 35(2), 455-475.

[25.] Khan, A., & Qureshi, M. I. (2022). The role of Green HRM in enhancing employee motivation and organizational commitment. *International Journal of Human Resource Management*, 33(8), 1620-1640.

[26.] Salunke, S. & Rao, P. (2021). Barriers to effective implementation of Green HRM practices in organizations. *Journal of Business Research*, 135, 180-187.

[27.] Sachdeva, S. (n.d.). Aligning environmental management with HRM: Barriers and challenges. *Human Resource Management Review*.

[28.] Sreedevi, V. (n.d.). The role of HR in building competitive advantage: A strategic approach. *Strategic HR Review*.

[29.] Shoaib, M., & Khan, I. (2021). The impact of Green HRM on organizational commitment and employee engagement: Mediating role of green human capital. *International Journal of Sustainability in Higher Education*, 22(7), 1345-1363.

[30.] Singh, K. & Pandey, A. (2020). The influence of Green HRM practices on employee engagement. *International Journal of Business and Society*, 21(2), 637-654.

[31.] Sharma, C., Sakhuja, S., & Nijjer, S. (2022). Recent trends of green human resource management: Text mining and network analysis. *Environmental Science and Pollution Research*, *29*(56), 84916-84935.

[32.] Sathasivam, K., Abu Bakar, R., & Che Hashim, R. (2021). Embracing organisational environmental sustainability: Experiences in green human resource management. *Business Strategy & Development*, 4(2), 123-135.

[33.] Liu, Z., Mei, S., & Guo, Y. (2021). Green human resource management, green organization identity and organizational citizenship behavior for the environment: the moderating effect of environmental values. *Chinese Management Studies*, *15*(2), 290-304.

[34.] Zhang, Y., Sun, J., Yang, Z., & Wang, Y. (2020). Critical success factors of green innovation: Technology, organization and environment readiness. *Journal of Cleaner Production*, *264*, 121701.

Empowering Performance: Evaluating Diversity and Inclusivity Training in Private Banks of India

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ABSTRACT

This study examines the effectiveness of diversity and inclusivity training of employees on job performance within private banks in India. The Indian banking industry navigates a rapidly changing demographic landscape, and fostering an inclusive workplace becomes essential for enhancing employee productivity and engagement. The research uses a mixed-methods approach to analyze quantitative performance data alongside qualitative feedback from employees and managers across various banks. The findings reveal that targeted diversity and inclusivity training significantly improves staff teamwork, communication, and innovation. From the statistical analysis, it is observed that the HR Dept in the Private Bank should give more emphasis on the six different areas having the Cumulative variance i.e. Unconscious Biasness (16.58%), Microaggressions (31.84%), Cultural Competence (42.31%), Disability Awareness (50.15%), LGBTQ+ inclusion (57.31%) and interpersonal communication (69.13%) respectively. Then the EFA and ANOVA are done to analyze the significant relationship of each training session with the job performance. Recommendations for the design and implementation of effective training initiatives are provided to optimize the benefits of diversity and inclusivity in this critical sector.

Keywords: Diversity, Inclusivity, Cultural Competence, Disability.

1. INTRODUCTION

Diversity in the workforce will be a greater advantage to the organization if it is managed properly with a systematic organizational assessment (Varkkey, 2010; Gallego and Pucheta, 2020; Galletta et al., 2022). It will help to create some innovative and creative leaders. A diversified workforce includes employees with different cast, cultures, languages, ethnicities, education, job experiences, regions, and religions; so diverse talent is there to be utilized properly (Issa et al., 2022; Castellino and Shinde, 2022). It will be a competitive advantage to the organization as it will make the mission and vision globalized and make more profits (Birindelli et al., 2019; Wirawan and Willim, 2023). It will be a strategic advantage to the organization as it will leverage differences and similarities in the workforce. But without inclusion, diversity is incomplete so for successful diversity management; inclusiveness should be developed in the organization's culture itself (AlSaffar et al., 2023). Diversity management (Singha, 2022) can be successful with three types of approaches: individual, organizational, and ethical. This paper is a modest attempt to show a glance at the diversity and inclusivity concept and the organizational behavior related to it; especially in banks (Birindelli et al., 2019; Cardillo et al., 2021; Wirawan and Willim, 2023). This paper will be helpful for the researchers to study more about the issues and challenges regarding diversity and inclusivity in an organization (Gallego and Pucheta, 2020; Arora and Patro, 2021; Singha, 2022; Issa et al., 2022; Lincoln, 2023) etc. To create a healthy work environment; private banks

must provide diversity and inclusion training. Accepting diversity, whether it be in terms of gender, ethnicity, handicap, sexual orientation, or cultural background; Banks should better understand the diversified culture and serve a wide spectrum of clients in a highly competitive and customer-focused market (Haralayya and Aithal, 2021; AlSaffar et al., 2023; Lincoln, 2023). Furthermore, creating an inclusive workplace increases job happiness, employee engagement, and retention, all of which improve organizational performance (Batae et al., 2021; Royall et al., 2022; Abiib and Mezher, 2023). This paper is an attempt to understand the concepts of diversity and inclusivity and also review the present issues and challenges faced by organizations by implementing the concept. It also empirically investigated the important areas of Diversity and inclusivity where the banking employees need training and its relationship with job performance.

2. REVIEW OF LITERATURE

A Comprehensive Overview Concept of Diversity and Inclusivity

The concept of diversity initiatives started with Equal opportunity with a liberal approach where the important point is discrimination and fairness, then the approach shifted to the radical tradition which includes legitimacy. Slowly the concept is implemented highly in organizations as diversity management in which effective programs are planned and executed (Thomas and Ely, 1996). There is an important approach introduced by Nussbaum and Amartya Sen in 1999

described (Nussbaum, 2006; Saiganaran et al., 2015) as the Capabilities approach where three important parameters are used i.e. Capabilities, instrumental freedom, and agency and rights as diversity management. Capabilities concerns about person's well-being (physical economic, social, and self-actualizing). Agency and Rights can be Individual or Collective. Capabilities, instrumental freedoms, and individual and collective agency where addressed fully with mutual support, understanding and awareness in the organization is similar and equality in opportunity is observed, are more likely to feel fair and the result is perceived and actual equality and in the vice versa condition the result is feeling unfair and inequality (Saiganaran et al., 2015).

As per the globalization era, the most concern area is manpower or human capital. Due to demographic shifts, new changes in the legal aspects, and technological adoption, workforce diversity is introduced in business organizations (Maina, 2013; Vohra, 2015). Earlier there are only the issues of equal employment opportunities and affirmative actions were considered, but now there are inclusions of various challenges are added like cases of women, minorities, socially disadvantaged, and disabled employees (Woodford et al., 2015; Vohra, 2015; Arora and Patro, 2021). Diversity generally includes several dimensions such as gender, age, ethnicity, race, culture, religion, language, sexual orientation, gender identity, physical ability, personality, marital status, education, skill sets, knowledge, etc (Royall et al., 2022; Abibi and Mezher, 2023). Inclusivity is creating a healthier environment in which all of the employees will participate in the given job equally and comfortably irrespective of gender, age, differentially abled, etc. (Lincoln, 2023; Dorpenyo et al., 2024). This paper is an attempt to understand the concepts of diversity and inclusivity and also review the present issues and challenges faced by banks. There are complexities in diversified workforce culture or cross-cultural organization as people are influenced by (Luthans, 2010; Crouch, 2015): Multiple cultures: National/ Regional/ Organizational/ Functional/ Professional, Beliefs/ Values and behaviours, Personal Experiences/ Situations, and Individual complexities of cultures (Luthans, 2010; Meena, 2015; Royall et al., 2022; Abibi and Mezher, 2023; Dorpenyo et al., 2024). Diversity and Inclusivity are understanding, accepting, and valuing people including those of different races, ethnicities, genders, ages, religions, disabilities, and sexual orientations with differences in education, personalities, skill sets, experiences, and knowledge bases, and leads to innovation regardless the demography and represents fairness among the employees. It is the company's mission and strategic practices to support a diverse workplace and leverage the effects of diversity to achieve a competitive business advantage (Follick, 2019). There is an input-output model described by several authors (Joubert, 2016; Luthans, 2010; Meena, 2015; Royall et al., 2022; Abibi and Mezher, 2023; Dorpenyo et al., 2024) in the early 2000s, as it includes effective diversity management initiatives, variables related to personal and organizational dimensions, and also shows the outcomes. Here the mediating variables may be stereotyping, Racism, prejudice, history of the diversity management firm and labor pool etc. (Royall et al., 2022; Abibi and Mezher, 2023; Dorpenyo et al., 2024).

Organizations are excelled in productivity, creativity, and achievement of goals due to effective diversity management it also helps in better client sources and personally employees will learn more about one another, communicate better with each other, increase trust and respect, and be able to work as good team members. Overall, it will create healthier and motivated employees in banks, build a good relationship and it has been a proper corporate social investment (Saiganaran et al., 2015; Joubert, 2016; Arora and Patro, 2021; Dorpenyo et al., 2024).

Diversity focuses on demographic shifts or socioeconomic background whereas inclusion refers to employee participation in a diversified workforce (Cornelius, 2006; Hammer, 2012; Bauer and Erdogan, 2015; Kundu, 2018; Gallego and Pucheta, 2020; Doke and Herbert, 2022; Dorpenyo et al., 2024). Inclusivity requires highly motivational factors, good leadership, teamwork, proper guidance, and cooperation, etc. (Nair and Vohra, 2015; Jetha et al., 2021; Royall et al., 2022; Dorpenyo et al., 2024). Inclusion is the extent to which diverse individuals are allowed to participate and are enabled to contribute fully. Inclusion is the degree to which an employee is accepted and treated as an insider by others in a work system. Inclusion is the removal of obstacles to the full participation and contribution of employees in the organization. Inclusion is the degree to which an employee perceives that he or she is an esteemed member of the work group through experiencing treatment that satisfies his or her needs for belongingness and uniqueness (Shore et. al., 2011; Wirawan and Willim, 2023; Dorpenyo et al., 2024). The feeling of inclusion is driven by perceptions of fairness and respect, values and belongingness with appreciation (Nair and Vohra, 2015; Oser et al., 2019; Lincoln, 2023; Dorpenyo et al., 2024).

Identification Of Different Dimensions of Diversity and Inclusivity Training Need Assessment in Private Banks

Diversity training research emphasizes the importance of inclusive workplaces (Ely & Thomas, 1996; Gilbert, 2000; Nishii and Mayer, 2009; Kumar, 2012; Luthans, 2014; Meena, 2015; Bhardwaj, 2016). Lloyd, S., & Hartel, C. E. (2003) have written titled "The Intercultural Competencies Required for Inclusive and Effective Culturally Diverse Work Teams". It describes how culturally diverse teams can enhance innovation, creativity, and problem-solving abilities due to increased cross-cultural interactions. However, these teams also face challenges such as miscommunication and misunderstanding, which can hinder their effectiveness.

Essential intercultural competencies identified in the literature include understanding cultural differences, effective communication, and the ability to integrate diverse perspectives is important in the banking sector. It also suggested that both organizational support and individual team members must develop intercultural competence to realize the synergies from cultural diversity (Banks et al., 2019; Arora and Patro, 2021; Doke and Herbert, 2022; Castelino and Shunde, 2022). This literature survey highlights the importance of intercultural competencies in fostering effective collaboration within culturally diverse teams, as well as the need for practical strategies to enhance these skills among team members.

Establishing a workplace where staff members feel free to express their gender identity and sexual orientation without worrying about harassment or discrimination is one of the main objectives of LGBTQ+ inclusivity training. This entails making certain that employment procedures, benefits (such as parental leave and healthcare), and regulations are welcoming and inclusive of LGBTQ+ people (Banerji et al., 2012; Fullerton, 2013; Bailinson et al., 2020; Opall, 2021; Kaplan, 2022). The significance of gender-neutral restrooms, inclusive dress standards, and transitioning staff policies, for instance, may be covered in training in private banks (Alger and Lorenz,2022; Abiib and Mezher, 2023). It may also discuss how subtle forms of bias, such deadnaming or misgendering, and microaggressions can compromise inclusivity. Setting the example for LGBTQ+ inclusivity is a major responsibility of leaders, particularly in organizations with a diverse workforce (Fullerton, 2013; Bailinson et al., 2020; Opall, 2021; Kaplan, 2022). Building a truly inclusive workplace where all employees regardless of their sexual orientation, gender identity, or cultural background feel secure, respected, and appreciated requires training on cultural differences in the context of LGBTQ+ inclusivity (Banerji et al., 2012; Fullerton, 2013; Badgett, 2014; Vohra et al., 2015; Sengar et al., 2020; Tang et al.; Kaplan, 2022; Tamer et al., 2023). Establishing cultural sensitivity and awareness regarding LGBTQ+ issues can help organizations dismantle obstacles, dispel myths, and establish a work atmosphere where each person feels free to be who they are. This type of training enhances staff engagement, retention, and overall organizational performance in addition to fostering a pleasant, encouraging culture.

Kryscynski et al. (2018) found that interactive training methods outperform lecture-based approaches. The findings underscore the importance of organizational support, trainer expertise, and participant engagement. Research indicates that a significant number of individuals experience microaggressions regularly. For example, 78% of participants reported experiencing at least one microaggression over two weeks (Kundu, 2028; Jetha et al., 2021). The literature highlights the importance of bystanders in addressing microaggressions. The workplace serves as a microcosm of society, where individuals often lack autonomy over their interactions. This can lead to situations where employees from minoritized backgrounds must engage with colleagues or supervisors who may harbour biases (Banks et al., 2019; Basumallick, 2019; Cardillo et al., 2021; Galetta et al., 2022). The consequences of microaggressions in the workplace can be significant, affecting employee well-being and organizational culture (Elisa, 2022; Kaplan, 2022).

Diversity and inclusion are essential for success in a globalized business environment. Companies recognize that a diverse talent pool enhances creativity, innovation, and adaptability to changing market demands. Racial microaggressions are common in workplaces and negatively impact the targeted individuals' work satisfaction, psychological safety, and self-esteem (Nair and Vohra, 2015; Woodford et al., 2015) While much research has focused on the direct targets of microaggressions, this paper integrates findings from workplace incivility literature, suggesting that witnessing racial microaggressions also harms bystanders. This expands the understanding of microaggressions beyond the immediate victim to include the psychological impact on witnesses (Banerji et al., 2012; Fullerton, 2013; Badgett, 2014; Vohra et al., 2015; Sengar et al., 2020; Tang et al.; Kaplan, 2022; Tamer et al., 2023). The findings emphasize the importance of fostering a racially inclusive climate in workplaces. The paper suggests that racial incivility particularly diminishes the willingness to voice concerns among racial minoritized participants, highlighting the need for leaders to address these issues to harness the innovative potential of diverse groups. Particularly when collaborating with coworkers from diverse cultural backgrounds, employees should receive training on how to respectfully and sensitively address discussions about LGBTQ+ topics (Fullerton, 2013; Vohra et al., 2015; Sengar et al., 2020; Kaplan, 2022). This includes being aware of how various cultural contexts may influence how LGBTQ+ rights are expressed. Cultural awareness is essential to prevent inclusivity from unintentionally alienating or excluding workers who may come from backgrounds where LGBTQ+ issues are taboo or not frequently discussed (Badgett, 2014; Vohra et al., 2015; Tang et al., 2021; Maji et al., 2014). According to a study, it is concluded that the training and skill development programs as beneficial chances for career advancement and improved job performance, and they generally had favourable experiences with them. The training programs' range and relevance, as well as the encouraging learning atmosphere, were commended by the participants. The study emphasizes how important it is to put newly acquired abilities into practice and keep them reinforced in order to maintain beneficial effects on job performance in Private Banks in Bangladesh (Emon and Choudhary, 2023).

The diversity in India includes variations in cultures, languages, and faiths, necessitating effective management strategies to foster inclusivity. It emphasizes the need for organizations to create a welcoming environment that values individual differences. This is crucial for enhancing

interpersonal communication and organization productivity. There is a study (Purohit et al., 2023) which discusses the development of methods, procedures, and policies that respect cultural differences. It is suggested that organizations should implement cultural awareness training and celebrate various cultural occasions to promote inclusivity. By implementing cultural awareness training, promoting cultural sensitivity, and fostering effective communication, organizations can create inclusive workplaces that leverage diversity and drive success (Mouboua, P. D et.al., 2024). Key topics include age diversity, generational value differences, and the impact of 'wokeness' on workplace dynamics, issues related to sexual orientation, the inclusiveness of (LGBTQ+) and gender equity etc (Fullerton, 2013; Bailinson et al., 2020; Tanhg et al. 2021; Opall, 2021; Kaplan, 2022). It emphasizes that effectively managing diversity can lead to more committed, satisfied, and high-performing employees, which may enhance an organization's financial performance. This survey highlights the multifaceted nature of diversity and inclusion in the workplace, underscoring the need for organizations to value all perspectives to achieve true inclusivity (Hemavathi and Arpitha, 2024).

3. RESEARCH GAP IDENTIFICATION

Large corporations now operate internationally as multinational firms as a result of globalization. These businesses have to operate in different, culturally diverse environments, which makes it difficult to implement HRM practices. For example, they must decide whether to localize or standardize their processes across national boundaries. It is needed to research this diversity and inclusiveness training in organizations (Banks et al., 2018).

There is a study that proposes gender-specific evaluation standards for developing and assessing policies and initiatives aimed at bridging the gendered digital divide among entrepreneurs. It suggests that there should be more research done regarding the inclusiveness and diversified culture in organizations (Orser et al., 2019). The workplace is undergoing fast change. The influence of future job transformations on employees and workplaces has been the subject of a growing body of research. In order to gain a deeper understanding of these concerns, Studies should be done to explore more and more on these matters.
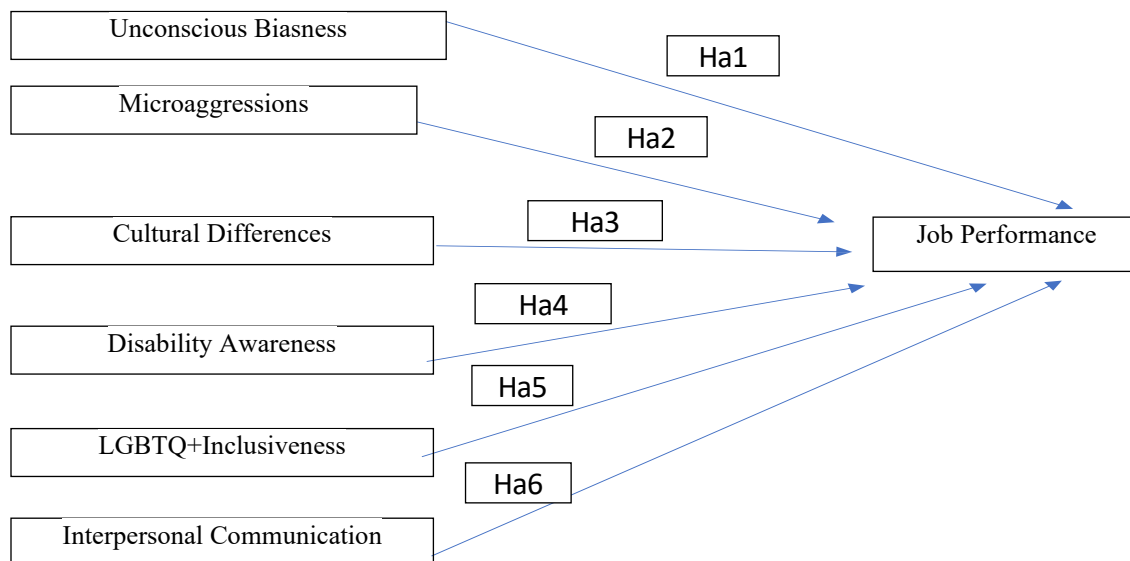
As the working world evolves, insight into prospective possibilities and problems for particular worker groups can be uncovered through the synthesis of the literature about diversified workforce and its various aspects (Jatha et al., 2021). Diversity, Equity, and Inclusion (DEI) considerations have been largely absent from cross-cultural performance literature, leading to a fragmented understanding. A new definition of Cross-Cultural Performance (CCP) integrates multiple cultural perspectives to enable diverse, inclusive, and equitable work environments. This study offers a novel perspective on cross-cultural performance, highlighting DEI's critical role in achieving inclusive and equitable work environments. By integrating CCP with DEI, organizations can foster culturally competent and high-performing teams (Jennifer et.al, 2022).

Objectives of the study

1.   To study the concept of the need for diversity and inclusivity training in business organization

2.   To explore different training need areas related to diversity and inclusivity in private banks

3.   To analyze the impact of identified training need areas on the job performance of the employees of banks 18

4. STRUCTURAL FRAMEWORK

Figure No 1: Structural Framework and Hypotheses formulations   *(Source: Author)*

Ha1: There is a need for training on Unconscious biasness as a part of diversity and Inclusivity training in private banks.

Ha2: There is a need for training on Microaggression as a part of diversity and Inclusivity training in private banks.

Ha3: There is a need for training on Cultural Differences as a part of diversity and Inclusivity training in private banks.

Ha4: There is a need for training on Disability Awareness as a part of diversity and Inclusivity training in private banks.

Ha5: There is a need for training on LGBTQ+ inclusiveness as a part of diversity and Inclusivity training in private banks.

Ha6: There is a need for training on Interpersonal communication as a part of diversity and Inclusivity training in private banks.

5. RESEARCH METHODOLOGY

A mixed-methods approach is employed, combining quantitative and qualitative research to provide a comprehensive understanding of the training need and effectiveness of diversity and inclusivity training in the private banks in India. Stratified Random Sampling is used to collect approximately 600 data, including data from diverse backgrounds across various private banks. Techniques such as EFA and ANOVA are utilized to determine significant differences by using SPSS S/W.

6. PARTICIPANT AND DESIGN

To achieve a comprehensive knowledge of the impact across multiple positions, the study on diversity and inclusiveness training in private banks involved a cross-section of employees at different levels within the organization, from entry-level staff to senior management. Around 700 questionnaires are distributed but 600 data is collected successfully. Some data are collected online and some are offline from the private banks of India.

7. DATA COLLECTION INSTRUMENT

Data is collected from the standard questionnaire having 60 questions; designed and modified from various literature. Questionnaire sources for data collection are Hammer (2012); Woodford et al., (2015); Thompson and Inkson (2017); Project Implicit (Harvard University), "The Diversity and Inclusion Handbook" by Sondra Thiederman, Algner and Lorenz (2022); Doke and Herbert (2022); Tamer et al., (2023); Disabilities Awareness and Sensitivities Training; Disability Awareness and Sensitivity Training: A Guide to

Implementation" by Julie E. Tesch; LGBTQ+ Inclusion in the Workplace: A Guide for Employers" by the National LGBT Chamber of Commerce (NGLCC); Dhal and Mohapatra (2022).

8. ETHICAL CONSIDERATION

Before data collection, consent was obtained from the participant about maintaining confidentiality about the data and report. For some of the interviews, approval is taken from the higher authorities of the bank.

9. DATA ANALYSIS

TABLE 2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.937	.940	60

TABLE 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.841
Bartlett's Test of Sphericity	Approx. Chi-Square	48407.856
	Df	1770
	Sig.	.000

From the Table No 2 and 3, it can be deducted that data is reliable as Cronbach's Alpha is 0.940. Data is adequate as the KMO vale is 0.841 and significant as p < 0.5. 14

TABLE 4: Demographic Characteristics

Variables	Subcategories	Frequency	Percent	Valid Percentage	Cumulative percentage
Age	20-29 yrs	185	30.8	30.8	30.8
	30-39 yrs	334	55.7	55.7	86.5
	40-49 yrs	35	5.8	5.8	92.3
	50-59 yrs	46	7.7	7.7	100.0
Gender	Female	272	45.3	45.3	45.3
	Male	327	53.8	53.8	98.2
	Trans Gender	1	0.8	0.8	100.0
Religion	Christian	66	11.0	11.0	11.0
	Hindu	397	66.2	66.2	77.2
	Muslim	116	19.3	19.3	96.5

	Others	21	3.5	3.5	100.0
Educational Qualificatio n	12th	13	2.2	2.2	2.2
	Graduation	226	37.7	37.7	39.8
	Others	52	8.7	8.7	48.5
	Post Graduation	309	51.5	51.5	100.0
Experiences in Current Bank	4-7 yrs	308	51.3	51.3	51.3
	7-10 yrs	150	25.0	25.0	76.3
	Less than equal to 3 yrs	94	15.7	15.7	92.0
	More than 10 yrs	48	8.0	8.0	100.0
Total Experiences in the Banking Sector	10-15 yrs	241	40.2	40.2	40.2
	5-10 yrs	292	48.7	48.7	88.8
	Less than equal to 5 yrs	44	7.3	7.3	96.2
	More than 15 yrs	23	3.8	3.8	100.0

Are You differently Abled?	No	549	91.5	91.5	91.5
	Yes	51	8.5	8.5	100.0
How would you rate the diversity policy in your organizatio n?	1.0	11	1.8	1.8	1.8
	2.0	40	6.7	6.7	8.5
	3.0	66	11.0	11.0	19.5
	4.0	426	71.0	71.0	90.5
	5.0	57	9.5	9.5	100.0
Have you ever witnessed experienced discriminati on or biasness?	1.0	480	80.0	80.0	80.0
	2.0	69	11.5	11.5	91.5
	3.0	29	4.8	4.8	96.3
	4.0	16	2.7	2.7	99.0
	5.0	6	1.0	1.0	100.0
Do you		44	7.3	7.3	7.3

agree that diversity and inclusivity training is necessary?	No				
	Yes	556	92.7	92.7	100.0

TABLE 5 Exploratory Factor Analysis

Total Variance Explained

Com pon ent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Tota l	% of Vari ance	Cum ulati ve %	Tot al	% of Vari ance	Cum ulati ve %	Tot al	% of Vari ance	Cum ulati ve %
1	14.0 47	23.4 11	23.4 11	14.0 47	23.4 11	23.4 11	9.9 52	16.5 87	16.58 7
2	9.74 7	16.2 45	39.6 56	9.74 7	16.2 45	39.6 56	9.1 53	15.2 56	31.84 2
3	5.28 5	8.80 9	48.4 65	5.28 5	8.80 9	48.4 65	6.2 82	10.4 70	42.31 2
4	4.84 6	8.07 6	56.5 41	4.84 6	8.07 6	56.5 41	4.7 07	7.84 5	50.15 7
5	3.48 6	5.81 0	62.3 50	3.48 6	5.81 0	62.3 50	4.2 96	7.16 0	57.31 7
6	2.13 6	3.56 0	65.9 11	2.13 6	3.56 0	65.9 11	3.9 96	6.66 0	63.97 7
7	1.93 5	3.22 4	69.1 35	1.93 5	3.22 4	69.1 35	3.0 95	5.15 8	69.13 5

TABLE 6: Factor Analysis

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
X8	.973						
X11	.969						
X3	.964						
X6	.940						
X7	.930						
X31	.928						

Item						
X35	.890					
X38	.888					
X49	.847					
X54	.835					
X59	.812					
X19	.800					
X24						
X2		.950				
X37		.927				
X53		.920				
X10		.919				
X18		.917				
X51		.862				
X23		.857				
X58		.843				
x60		.832				
X25		.795				
X45		.769				
X12			.918			
X15			.912			
X16			.895			
X39			.880			
X28			.848			
X55			.845			
X57			.799			
X20			.643			
X4						
X5				.860		
X29				.820		
X13				.783		
X40				.771		
X21				.709		
X56				.703		
X26				.571		
X46					.798	
X32					.745	
X48					.721	

Item						
X47				.685		
X34				.648		
X33				.626		
X42						
X43						
X1					.818	
X9					.772	
X36					.731	
X50					.691	
X52					.577	
X17					.573	
X44					.502	
X14						.785
X27						.709
X30						.706
X22						.627
X41						.511

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

TABLE No:7

Regression Analysis to check the significance of hypotheses Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	1.098	.354		3.105	.002	.403	1.792
Unconscious Biasness (UB)	.058	.039	.051	1.492	.136	-.018	.135
Microaggressions (MA)	.060	.033	.071	5.843	.003	-.004	.124
Cultural	.068	.04	.058	4.59	.001	-.016	.151

Compete nce (CC)		3		6			
Disability Awarenes s (DA)	.237	.04 8	.188	4.94 6	.000	.143	.331
LGBTQ + Inclusive ness (LI)	.268	.04 4	.248	6.10 0	.000	.181	.354
Interperso nal communi cation (IC)	.138	.05 1	.112	2.70 7	.007	.038	.237

a. Dependent Variable: Job Performance (JP)

10. DATA FINDINGS AND DISCUSSION

From Table No. 4, it is statistically observed that among 600 samples taken in this study were 327 male, 272 female, and one trans-gender respondent, which shows the diversity of the organization based on gender. It refers not only to biological differences between males and females but also to the social, cultural, and personal roles that individuals assume based on their gender identity. Age can influence how individuals are perceived, and treated, and how they navigate their professional and social environments. Here the above Table No 5 demonstrates the diversity level of employees based on age, which shows the maximum percentage of employees that is 55.7 percent belongs to the age group 30-39 years and the minimum percentage that is 7.7 belongs to the age group 50-59 years. Understanding the importance of religion as a demographic factor here the study takes into consideration all types of religious people working in baking sectors, which includes 11% Christians, 66% Hindu, 19% Muslim, and 3.5% other religious employees. Based on the importance of qualification, the study segregated a range of qualification demographic factors into 12th pass, graduation, postgraduate, and others which include the percentages 2.2%, 37.7%, 51.5%, and 8.7% respectively. In this study from among the 600 samples, 16% of employees have less than 3 yrs of experience, 51% of employees have 4-7 yrs of experience, 25% of employees have 7-10 yrs of experience, and 8% of employees have more than 10 yrs of experience. Banks that embrace diversity and foster an inclusive work environment are likely to see not only improved employee satisfaction and retention but also enhanced innovation, customer engagement, and long-term business performance. The study segregates the experience category in the banking sector into less than 5 years, 5-10 years, 10-15 years, and more than 15 years which includes 7%, 48%, 40%, and 4% of employees respectively. It is also observed from the study that 8.5% of employees are differently abled from among the 600 sample. Organizations

that actively seek and respond to this feedback are more likely to create a work environment where all employees feel respected, valued, and empowered to contribute their full potential. In light of this perspective, 71% of employees among the stated sample rated the diversity policy of their organization as excellent. Here the study result shows that among the 600 samples, only 1% of employees experienced a very high level of discrimination and bias where whereas 80% of employees experienced a very low level of discrimination at the workplace. The result of the study can be interpreted as more than 92% of employees of the organization showed their interest in the necessity of diversity and inclusivity training in the banking sector.

From the Table No.5, it is empirically proved that there are six important training need areas i.e. Unconscious Biasness (16.58%), Microaggressions (31.84%), Cultural Competence (42.31%), Disability Awareness (50.15%), LGBTQ+ inclusion (57.31%) and interpersonal communication (69.13%) respectively, in which employees are agreed with to look forward to getting training in future. After training, the feedback is collected and analyzed where it is observed that Microaggregation, Cultural Competence, Disability awareness, and LGBTQ+ inclusiveness is having a significant impact on job performance (Table No.7). It is observed that (Table No 5), 16.58% of the cumulative variance explained that one of the important training needs is the training on unconscious biasness. By assisting people in identifying and addressing automatic, frequently unintentional prejudices that influence choices and actions, unconscious bias training is essential for advancing diversity and inclusivity in the workplace. These unconscious biases can result in unfair treatment and a lack of diversity in important domains such as hiring, performance reviews, and interpersonal relationships.

It is observed that (Table No 5), 31.84% of the cumulative variance explained that one of the important training needs is the training on microaggregation. In Diversity and Inclusion (D&I) training, microaggregation refers to recognizing and resolving microaggressions, which are small, frequently inadvertent behaviours or remarks that have the potential to marginalize members of under-represented or marginalized groups. Whether verbal, behavioural, or environmental, these microaggressions build up over time and have a substantial negative influence on a person's well-being, sense of belonging, and employment prospects. Raising awareness of how unconscious biases, such as confirmation or affinity bias, fuel microaggressions is the main goal of effective diversity and inclusion training. It also gives staff members the skills they need to identify, address, and stop these behaviours.

It is observed that (Table No 5), 42.31% of the cumulative variance explained that one of the important training needs is training on cultural competencies. Diversity and Inclusion (D&I) programs must include training on cultural

competencies because it enables staff members to appreciate and comprehend the many backgrounds, values, and viewpoints that people from various cultures bring to the workplace. As the world grows more interconnected, workplaces are becoming more culturally varied. Fostering an inclusive and cooperative atmosphere requires an awareness of these cultural distinctions. Social standards, communication techniques, decision-making procedures, and work ethics are just a few examples of how cultural variations might show up.

It is observed that (Table No 5), 50.15% of the cumulative variance explained that one of the important training needs is training on disability awareness. As per the statistical analysis, it is observed that training on disability awareness is important for the employees. For several reasons, including maintaining compliance and promoting an inclusive, accessible, and customer-satisfying environment, disability awareness training is especially crucial in banks.

It is observed that (Table No 5), 57.31% of the cumulative variance explained that one of the important training needs is the training on LGBTQ+ inclusiveness. In addition to emphasizing how cultural norms and values may affect how LGBTQ+ people are treated, accepted, and integrated in various geographical or cultural contexts, LGBTQ+ inclusiveness training assists staff members in understanding the variety of sexual orientations, gender identities, and expressions that make up the LGBTQ+ community. LGBTQ+ identities, Lesbian, gay, bisexual, transgender, queer, intersex, and asexual people are just a few of the LGBTQ+ identities that employees should learn about in training. This entails providing inclusive vocabulary and terminology that demonstrates respect and sensitivity, as well as comprehending the subtleties of sexual orientation and gender identity (e.g., transgender, non-binary).

It is observed that (Table No 5), 63.97% of the cumulative variance explained that one of the important training needs is training on interpersonal communication. Good communication is essential to creating a courteous, welcoming, and cooperative workplace, interpersonal communication training is an essential part of Diversity and Inclusion (D&I) initiatives. It assists staff members in realizing the significance of identifying and adjusting to a variety of verbal and nonverbal communication styles that result from variations in background, gender, or culture.

From the Table No 7, it is analyzed and statistically proves that there is a direct and significant impact of the training on Microaggregation, Cultural Competence, Disability awareness, and LGBTQ+ inclusiveness on job performance having the p-value.003,.001,.000,.000 respectively. Training in Disability Awareness, Microaggregation, Cultural Competence, and LGBTQ+ Inclusiveness creates a more welcoming, courteous, and encouraging workplace, which improves employee engagement, teamwork, and job performance in general. Every team member can achieve at their highest level thanks to various kinds of training, which eliminate prejudices, enhance communication, cultivate empathy, and provide equal opportunity for all workers. These activities ultimately lead to increased levels of innovation, productivity, work happiness, and retention all of which are vital for the success of an organization.

Employees who receive microaggregation training are better able to identify and deal with little, frequently inadvertent behaviours or microaggressions that can create an uncomfortable or excluded atmosphere. Employees can enhance interpersonal relationships, lower stress levels, and promote a more courteous and harmonious workplace by recognizing and addressing these problems. People are more likely to be motivated, interested, and give their best work when they feel valued and included. In addition to lowering the risk of stress and burnout, reducing microaggressions improves concentration, creativity, and job satisfaction. Employees who receive cultural competence training are better equipped to function in a multicultural workplace by having a deeper grasp of various cultural conventions, communication styles, and values. Understanding other points of view can help varied teams come up with more creative solutions, collaborate more easily, and avoid misunderstandings. Culturally competent workers can handle cross-cultural situations more easily, making various team members feel appreciated and respected. By fostering an inclusive environment where each person makes a significant contribution, this, in turn, enhances team dynamics, reduces conflict, and increases overall performance. Training on disability awareness encourages a more accessible and inclusive workplace by bringing attention to the difficulties faced by workers with impairments. Employees can collaborate more successfully with coworkers who might need different kinds of support when they are taught to identify and accommodate disabilities, whether they be physical, sensory, or neurodivergent. Employees with disabilities can perform to the best of their ability when workplace procedures, tools, and settings are made accessible. At the same time, encouraging a supportive and empathetic work atmosphere among all employees boosts morale and lowers turnover, which increases output and job satisfaction. Training on LGBTQ+ inclusivity contributes to the development of a courteous and encouraging work environment for staff members with a range of sexual orientations and gender identities. A more pleasant and psychologically safe work environment is produced when staff members are aware of the difficulties LGBTQ+ coworkers encounter and are given the resources to act inclusively. Supported LGBTQ+ workers are more likely to be involved, self-assured, and effective in addition to offering original ideas and viewpoints. Furthermore, inclusive policies lower turnover, increase retention rates, and eliminate discrimination all of which can directly improve organizational performance.

11. IMPLICATIONS

Managerial Implication

The research can serve as a benchmark for banks to evaluate their current diversity and inclusivity training efforts, identifying areas for improvement and promoting best practices across the sector. Banks can use their commitment to diversity and inclusivity as a foundation for community outreach initiatives, building stronger relationships with diverse client bases and enhancing their brand reputation. The study highlights the need for ongoing training and development in diversity and inclusivity. Banks can implement continuous learning programs to ensure employees remain engaged and informed about best practices.

12. SOCIAL IMPLICATION

Organizations that commit to diversity and inclusivity demonstrate social responsibility, enhancing their reputation and strengthening their relationships with stakeholders and the community. By enhancing employees' understanding of diverse cultures and perspectives, the training fosters a more inclusive society where differences are celebrated, leading to greater social cohesion. Banks that prioritize inclusivity can influence societal norms, encouraging other organizations to adopt similar practices and promoting a culture of acceptance and respect.

13. LIMITATION OF THE STUDY

The reliance on self-reported surveys and interviews may introduce bias, as participants might overestimate their performance or the impact of the training due to social desirability or personal perceptions.

14. FUTURE RESEARCH AGENDA

The study is set in India, where cultural dynamics may influence perceptions of diversity and inclusivity differently than in other contexts, potentially limiting applicability to international settings. Future scope may include the study of the impact of mediating and moderating variables like change in attitude, organizational culture, or employee engagement on the association between variables used in the study. Future research should investigate longitudinal effects and explore diversity training's impact on business outcomes.

15. CONCLUSION

In summary, training on diversity and inclusivity in private banks is not just a matter of corporate duty but also a competitive advantage that boosts customer satisfaction and employee engagement. By embracing diversity and cultivating an inclusive culture, banks may access a multitude of viewpoints that result in improved innovation, problem-solving, and more individualized services for a wide range of customers. By lowering biases and fostering a more collaborative work atmosphere, this training helps employees feel appreciated, which improves job performance overall. Additionally, private banks that place a high priority on

diversity and inclusivity stand a better chance of attracting and keeping top talent, boosting employee morale, and showcasing their commitment to social responsibility in a fiercely competitive and increasingly varied global market.

REFERENCE

[1.] Aaberg, L. (2024). Corporate India after Section 377: haphazardness and strategy in LGBTQ diversity and inclusion advocacy. *Gender, Place & Culture*, 31(9), 1235-1252.

[2.] Abiib, I., & Mezher, R. (2023). Diversity and Team Performance in Banks: A qualitative analysis of how workplace diversity and team performance are related: A study of Swedish banks.

[3.] Algner, M., & Lorenz, T. (2022). You're prettier when you smile: Construction and validation of a questionnaire to assess microaggressions against women in the workplace. *Frontiers in Psychology*, 13, 809862.

[4.] AlSaffar, G. J., Al-Aali, E. A., & Masmoudi, M. (2023). Impacts of Gender Inclusivity on the Banking Sector in Bahrain: Culture Perspective. In *Corporate Psychology and Its Impact on Diversity, Equity, and Inclusion* (pp. 14-31). IGI Global.

[5.] Arora, S., & Patro, A. (2021). Inclusivity and empowerment—Grow and let grow. *Global Business and Organizational Excellence, 41(1), 21-30.*

[6.] Aydemir-Döke, D., & Herbert, J. T. (2022). Development and validation of the ableist microaggression impact questionnaire. *Rehabilitation Counseling Bulletin*, 66(1), 36-45.

[7.] Badgett, M. V. (2014). The economic cost of stigma and the exclusion of LGBT people: A case study of India.

[8.] Bailinson, P., Decherd, W., & Ellsworth, D. (2020). LGBTQ+ voices.

[9.] Banerji, A., Burns, K., & Vernon, K. (2012). Creating inclusive workplaces for LGBT employees in India. Hong Kong: Community Business, 12.

[10.] Banks, G. C., Woznyj, H. M., Wesslen, R. S., Frear, K. A., Berka, G., Heggestad, E. D., & Gordon, H. L. (2019). Strategic Recruitment Across Borders: An Investigation of Multinational Enterprises. *Journal of Management,* 45(2), 476-509. https://doi.org/10.1177/0149206318764295

[11.] Basumallick, C. (2019). Retrieved from ww.hrtecnologist.com.

[12.] Bătae, O. M., Dragomir, V. D., & Feleagă, L. (2021). The relationship between environmental, social, and financial performance in the banking sector: A European study. *Journal of cleaner production*, 290, 125791.

[13.] Bauer, B. E. (2015, Dec). Leader-member exchange Theory.

[14.] Bauer, T. N., & Erdogan, B. (2015). Leader-member exchange (LMX) theory: An introduction and overview. *Oxford handbook of leader-member exchange*, 3-9.

[15.] Bezrukova, K., Jehn, K. A., & Spell, C. S. (2012). Reviewing diversity training: Where we have been and where we should go. *Academy of Management Learning & Education, 11(2), 207-227.*

[16.] Birindelli, G., Iannuzzi, A. P., & Savioli, M. (2019). The impact of women leaders on environmental performance: Evidence on gender diversity in banks. *Corporate Social Responsibility and Environmental Management,* 26(6), 1485-1499.

[17.] Brewer. (1991*). Optimal Distinctive Theory.*

[18.] Cardillo, G., Onali, E., & Torluccio, G. (2021). Does gender diversity on banks' boards matter? Evidence from public bailouts. *Journal of Corporate Finance*, 71, 101560.

[19.] Carlisle, C. (2020). Banks' Pride Activities Build Customer Loyalty and Attract Talent. *American Bankers Association. ABA Banking Journal*, 112(3), 52-53.

[20.] Castelino, L. M., & Shinde, R. (2022). Excellence through diversity- inclusiveness: a focus on IT Industry. *International Journal of Case Studies in Business, IT and Education (IJCSBE),* 6(2), 496-511.

[21.] Cornellius, S. g. (2006). Re-examining workplace equality: The capabilities approach. *Human resource management journal.*

[22.] Crouch, R. T. (2015). A study of the perceptions of diversity and Inclusion initiaives in producing improved productive work culture. Gardenerr web university.

[23.] Dhal, S., Mohapatra, S. (2022). Training Need Identification of Nursing Professional's Competencies During Pandemic and Scale Development. In: Rajagopal, Behl, R. (eds) Managing Disruptions in Business. *Palgrave Studies in Democracy, Innovation, and Entrepreneurship for Growth. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-79709-6_19*

[24.] Dorpenyo, I., Das, M., Dayley, C., Kendall Roundtree, A., & Williams, M. (2024). Are You Committed to Diversity? Evaluating Immigrants' Perceptions of US Banks' Diversity and Inclusion Claims/Initiatives. *Technical Communication, 71(1),* 65-89.

[25.] Dulebohn, J. H., Bommer, W. H., Liden, R. C., Brouer, R. L., & Ferris, G. R. (2012). A meta-analysis of antecedents and consequences of leader-member exchange: Integrating the past with an eye toward the future. Journal of management, 38(6), 1715-1759.

[26.] Emon, M. M. H., & Chowdhury, S. A. (2023). Assessing The Influence of Training and Skill Development Initiatives on Employee Performance: A Case Study of Private Banks in Dhaka, Bangladesh. *Bangladesh (August 17, 2023).*

[27.] Follick, O. (2019, February 24). Retrieved from www.ideal.com.

[28.] Fullerton, M. (2013). Diversity and inclusion–LGBT inclusion means business. *Strategic HR Review, 12(*3), 121-125

[29.] Gallego-Álvarez, I., & Pucheta-Martínez, M. C. (2020). Environmental strategy in the global banking industry within the varieties of capitalism approach: The moderating role of gender diversity and board members with specific skills. *Business Strategy and the Environment, 29(2), 347-360.*

[30.] Galletta, S., Mazzù, S., Naciti, V., & Vermiglio, C. (2022). Gender diversity and sustainability performance in the banking industry. *Corporate Social Responsibility and Environmental Management, 29(1), 161-174.*

[31.] Gilbert, D. J. (2000). Diversity management: Time for a new approach. *Sage journal of publication, 29(1), 75-92.*

[32.] Hammer, M. R. (2012). The Intercultural Development Inventory: A new frontier in assessment and development of intercultural competence. In *Student learning abroad* (pp. 115-136). Routledge.

[33.] Haralayya, B., & Aithal, P. S. (2021). Performance affecting factors of Indian banking sector: an empirical analysis. George Washington International Law Review, 7(1), 607-621.

[34.] Hornsey, M. J. (2008). Social identity theory and self-categorization theory: A historical review. *Social and personality psychology compass, 2(1), 204-222.*

[35.] Huddy, L. (2001). From social to political identity: A critical examination of social identity theory. *Political Psychology, 22(1), 127-156.*

[36.] Issa, A., Zaid, M. A., Hanaysha, J. R., & Gull, A. A. (2022). An examination of board diversity and corporate social responsibility disclosure: evidence from the banking sector in the Arabian Gulf countries. *International Journal of Accounting & Information Management, 30(1), 22-46.*

[37.] Jetha, A., Shamaee, A., Bonaccio, S., Gignac, M. A., Tucker, L. B., Tompa, E., ... & Smith, P. M. (2021). Fragmentation in the future of work: A horizon scan examining the impact of the changing nature of work on workers experiencing vulnerability. *American journal of industrial medicine, 64*(8), 649-666.

[38.] Joubert, Y. T. (2016). Diversity management content model based on organizational team sport intervention. *African journal of hospitality, tourism and leisure, 5(2).*

[39.] Kaplan, S. (2022). "Bringing Your Full Self to Work": Fashioning LGBTQ Bankers on Wall Street. *Anthropology of Work Review, 43(1), 5-15.*

[40.] Kryscynski, D., Reeves, C., Stice-Lusvardi, R., Ulrich, M., & Russell, G. (2018). Analytical abilities and the performance of HR professionals. *Human Resource Management, 57(3), 715-738.*

[41.] Kumar, H. A. (2012). Managing workplace Diversity: Issues and Challenge. *Sage publication, 1-15.*

[42.] Leonardelle, G. J. (2010). Optimal Distinctiveness Theory.

[43.] Lincoln, A. (2023). Board Diversity and Inclusivity. In *Encyclopedia of Sustainable Management* (pp. 341-346). Cham: Springer International Publishing.

[44.] Lloyd, S., & Härtel, C. E. (2003). The Intercultural Competencies Required for Inclusive and Effective Culturally Diverse Work Teams. Monash University *Faculty of Business and Fullerton, M. (2013).*

[45.] Luthans, F. (2014). Organizational Behaviour: An evidence-based approach. *McGraw-Hill International Edition.*

[46.] Lynn M. shore, a. E. (2011). Inclusion and Diversity in a workgroup: A review and model for future research. Journal of Management, 37(4).

[47.] Maina, E. H. (2013). Employee attitude towards organizational diversity in business performance: perspectives from the small and medium enterprises employees in Kisii town. *Review of contemporary business research, 2(2), 30- 40.*

[48.] Maji, S., Yadav, N., & Gupta, P. (2024). LGBTQ+ in the workplace: a systematic review and reconsideration. *Equality, Diversity, and Inclusion: An International Journal, 43(2), 313-360.*

[49.] Meena, K. (2015). Diversity dimensions of India and their organizational implication: An analysis. *International Journal of economics and management science.*

[50.] Nair, N., & Vohra, N. (2015). Diversity and inclusion at the workplace: a review of research and perspectives.

[51.] Naraharisetti, R., Castro, M.C. Factors associated with persons with disability employment in India: a cross-sectional study. *BMC Public Health 16, 1063 (2016). https://doi.org/10.1186/s12889-016-3713-6*

[52.] Nishii, L. H., & Mayer, D. M. (2009). Do inclusive leaders help to reduce turnover in diverse groups? The moderating role of leader-member exchange in the diversity to turnover relationship. *Journal of Applied Psychology, 94(6), 1412.*

[53.] Nussbaum, M. C. (2007). Capabilities as fundamental entitlements: *Sen and social justice. In Capabilities equality (pp. 54-80). Routledge.*

[54.] Opall, B. S. (2021). Motives in creating an LGBTQ inclusive work environment: A case study. *Qualitative Research in Organizations and Management: An International Journal, 16(1), 237-260.*

[55.] Orser, B., Riding, A., & Li, Y. (2019). Technology adoption and gender- inclusive entrepreneurship education and training. *International Journal of Gender and Entrepreneurship*, *11*(3), 273-298.

[56.] Pardise, B. T. (2012). Organizational Assessment: An Overlook Approach to managing diversity and addressing racism in the Workplace. Journal of diversity management, 7(1).

[57.] Pasztor, S. K. (2016). Exploring the framing of diversity rhetoric in top-rated in diversity organizations. *International journal of business communication*, 1-21.

[58.] Rajiv Bharadwaj. (2016). Workplace diversity.

[59.] Royall, S., McCarthy, V., & Miller, G. J. (2022). Creating an inclusive workplace: The effectiveness of diversity training. *J. Glob. Econ. Trade Int. Bus*, *3*, 39-55.

[60.] Ryan, C. (2016). Managing diversity: a study of staff awareness of cultural workforce diversity within an organization: A case study.

[61.] Saigaran, N. G., Karupiah, P., & Gopal, P. S. (2015). The Capability Approach: Comparing Amartya Sen and Martha Nussbaum. *Proceedings of Universiti Sains Malaysia,*

[62.] Sengar, R., Chaudhary, N. S., Bhushan, B., & Rangnekar, S. (2020). Engaging an LGBT workforce: Inclusion through workplace culture. *In Management Practices for Engaging a Diverse Workforce (pp. 1-31). Apple Academic Press*.

[63.] Singha, S. (2022). Social inclusion, equality, leadership, and diversity to attain sustainable development goal 5 in the Indian banking industry. *Journal of International Women's Studies, 23(5), 135-141.*

[64.] Srivastava, P., & Kumar, P. (2015). Disability, its issues, and challenges: Psychosocial and legal aspects in Indian scenario. *Delhi Psychiatry Journal, 18(1), 195-205.*

[65.] Subhash C. Kundu, j. B. (2018). Workforce diversity status in Indian public sector: A study of employee's reactions. *Journal of Organization and Human Behaviour, 7(2 and 3), 34-46.*

[66.] Swarup, A. (2021). Hiring of Persons with Disabilities in the Indian Private Sector: *An Overview. NHRD Network Journal, 14(3), 325-328. https://doi.org/10.1177/26314541211030574*

[67.] Tamer, D., Liu, Y., & Santee, J. (2023). Considering the intercultural development inventory (IDI) to assess intercultural competence at US pharmacy schools. *Pharmacy*, *11*(1), 39.

[68.] Tan, S. K. (2013). Herzberg's two-factor theory on work motivation. *Global journal of commerce and management perspective.*

[69.] Tang, D. T. S., Teng, S., Tan, C., Lam, B., & YUAN, C. (2021). Building inclusive workplaces for lesbians and bisexual women in Hong Kong's financial services industry.

[70.] Thomas, D. A., & Ely, R. J. (1996). Making differences matter. *Harvard Business Review, 74(5), 79-90.*

[71.] Thomas, D. A., & Ely, R. J. (1996). What will it take for organizations to reap the rea and full benefits of a diverse workforce? A radically new understanding of the term, for starters. *Harvard Business Review.*

[72.] Thomas, D. C., & Inkson, K. C. (2017). *Cultural intelligence: Surviving and thriving in the global village*. Berrett-Koehler Publishers.

[73.] Varkkey, G. D. (2010). Human resource management. Pearson.

[74.] Vohra, N. N. (2015). Diversity and Inclusion at the workplace: *A review of research and perspectives. working paper of IIMA.*

[75.] Vohra, N., Chari, V., Mathur, P., Sudarshan, P., Verma, N., Mathur, N.,... & Gandhi, H. K. (2015). *Inclusive workplaces: Lessons from theory and practice. Vikalpa, 40(3), 324-362.*

[76.] Wirawan, J., & Willim, A. P. (2023). The Effect of Board Diversity and Financial Stability on Financial Performance of Banking Sector in Indonesian Stock Exchange. *Journal of Asian Multicultural Research for Economy and Management Study, 4(4), 8-18.*

[77.] Woodford, M. R., Chonody, J. M., Kulick, A., Brennan, D. J., & Renn, K. (2015). The LGBQ microaggressions on campus scale: A scale development and validation study. *Journal of Homosexuality, 62(12), 1660-1687.*

[78.] Mouboua, P. D., Atobatele, F. A., & Akintayo, O. T. (2024). Cross-cultural competence in global HRD: Strategies for developing an inclusive and diverse workforce.

[79.] Priyanka Purohit, Dinesh Chandra Pandey, Najeeb Razul A. Sali (2023). *Managing Cultural Diversity at Workplace: An Exploratory Study.* 26

Green HRM and Associated Sustainable Practices: A Case Study from India's Steel Sector

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ABSTRACT

At the United Nations Framework Convention on Climate Change's 26th Conference of the Parties (COP26) in Glasgow, UK, in November 2021, Prime Minister Narendra Modi affirmed India's aspiration to reach net zero emissions by 2070. In the direction of achieving the goal of carbon neutrality, the current study intends to examine how green human resource management (GHRM) practices affect environmental impact for a leading steel company in a public sector set up. Thus, the current study attempts to measure the direct effect of employees' perceptions of GHRM practices on environmental impact (ENVI) as well as the indirect effect by means of work engagement (WENG). The moderating effect of customized HR policy (CHRP) between WE and EI was also investigated. The study's theoretical underpinning was based on Ability-Motivation-Opportunity (AMO) theory. Convenience random sampling technique via a questionnaire was employed to gather data from 500 employees' working in one of the key manufacturing units operating in India. Smart PLS (Partial Least Square) based structural equation modeling was utilized to test the measurement and structural model. SEM results affirmed that employees' perspective of GHRM practices was significant and had positive effect on WENG. The results also showed that WENG have significant and had positive impact on ENVI when CHRP was used as a moderator. The study provides practical guidance for HR professionals on developing policies that support and aligns environmental goals with organizational objectives, particularly within the steel manufacturing sector.

Keywords: India; Steel Sector; Environmental Impact; Green HRM; AMO theory

1. INTRODUCTION

In response to global concerns about climate change and resource depletion, organizations are increasingly adopting sustainable practices, with GHRM emerging as a key approach. GHRM integrates environmental sustainability into traditional HR functions such as recruitment, training, and employee engagement, fostering a culture of ecological responsibility. This is especially relevant in resource-intensive industries like steel, which contribute 7-9% of global CO_2 emissions (World Steel Association, 2023). Being a world's second largest steel producer, India faces the dual challenge of driving economic growth while addressing environmental issues.

The Government of India's Viksit Bharat 2047 vision aims for a developed, sustainable nation by 2047, with net-zero carbon emissions by 2070 (Ministry of Environment, 2022). The steel sector, which is a significant economic contributor, has a crucial role to play in achieving these goals. By adopting GHRM practices, Indian steel companies can align with national sustainability goals, reduce their environmental impact, and contribute to long-term sustainable development. This paper examines the implementation of Green HRM in India's steel industry through a case study, assessing its role in advancing national environmental and economic goals, ensuring the sector's long-term competitiveness.

1.1 Importance of Green HRM in Organizational Sustainability

Green HRM integrates environmental sustainability into HR practices, creating an eco- conscious workforce. This approach embeds sustainability in recruitment, training, performance management, and daily work life, helping organizations reduce their environmental impact (Jabbour & Santos, 2020). Green HRM is particularly vital for resource-intensive industries like steel, which face high emissions and regulatory pressure. By engaging employees in green practices, organizations can foster a culture of sustainability while maintaining a competitive edge.

In India, the steel sector's challenges include regulatory compliance, reducing its carbon footprint, and balancing economic growth with sustainable development. Green HRM plays a crucial role in this transformation by aligning with Viksit Bharat 2047, India's vision for a sustainable and developed nation.

1.2 The Role of Green HRM Practices in the Steel Sector

Green HRM plays a strategic role in aligning HR practices with environmental goals, especially in resource-intensive industries like steel, which face significant ecological challenges such as carbon emissions and high energy consumption. Despite growing interest in Green HRM, there

is limited research on its application in high-impact sectors like steel, particularly in emerging economies like India. Green HRM addresses sustainability challenges by integrating eco-friendly practices across HR functions. It begins with green recruitment, prioritizing candidates committed to sustainability. Training programs enhance employees' understanding of environmental issues, promoting energy efficiency and waste reduction. Performance management systems incorporate sustainability metrics, incentivizing eco-friendly behaviors. Additionally, engaging employees through initiatives like green teams fosters ownership of sustainability efforts, crucial in the steel sector for reducing environmental impact (Sharma & Gupta, 2020; Renwick et al., 2019; Jackson et al., 2021; Ahmad, 2022)

1.3 The Steel Industry and Sustainable Challenges in India

India's steel industry, the second largest globally, plays a vital role in the nation's economic growth but is also highly energy-intensive and environmentally impactful. In 2022, production reached 118 million tonnes, contributing to significant resource consumption and waste, including hazardous materials and greenhouse gases (World Steel Association, 2023). To address these challenges, the Indian government has implemented policies like the National Steel Policy (2017) and the Energy Conservation Act (2020), focusing on resource- efficient, sustainable steel production. Additionally, environmental regulations under the Companies Act (2013) mandate Corporate Social Responsibility (CSR) initiatives for sustainability. Despite regulatory efforts, many companies face difficulties in adopting sustainable practices due to high costs and infrastructure challenges. However, those that implement sustainability, particularly through Green HRM practices, benefit from regulatory compliance, cost savings, and improved brand reputation (Joshi & Sharma, 2020).

1.4 The Case for Green HRM in India's Steel Sector

In recent years, the integration of GHRM policies with work engagement (WE) and environmental performance (EI) has gained attention, especially in energy-intensive sectors like steel manufacturing. GHRM policies aim to foster sustainability by aligning HR practices with environmental goals (Renwick et al., 2013). These policies focus on recruitment, training, performance management, and employee motivation to support environmental sustainability. However, limited research has explored how specific GHRM practices, such as green training programs or eco-friendly reward systems, impact work engagement in the context of the steel industry. Steel manufacturing is known for its energy- intensive operations, and addressing its environmental footprint is crucial for achieving sustainability (Jabbour et al., 2020). Despite the growing interest in GHRM, research gaps persist, particularly concerning the contextual role of energy-intensive industries in developing

customized green HRM policies. Private sector companies like Tata Steel have begun implementing Green HRM initiatives, including green recruitment, energy-efficient training programs, and employee-driven sustainability projects, contributing to their carbon reduction efforts and alignment with global standards (Tata Steel, 2022). However, the present study is restricted to one of the major public sector undertaking in India.

This study aims to address these research gaps by examining the implementation and impact of green HRM practices in a leading Indian steel company in a public sector set up. By employing a case study approach, the research will provide empirical insights into how green HRM contributes to sustainability goals, considering the unique challenges faced by the Indian steel industry. This exploration will help inform best practices and frameworks for integrating green HRM into corporate strategies, ultimately contributing to the broader discourse on sustainable industrial development.

By focusing on the Indian context, this research will highlight the specific socio-economic and regulatory factors influencing the adoption of green HRM in the steel sector, providing valuable insights for policymakers and practitioners alike.

Ultimately, transitioning toward sustainability in the steel sector is essential for meeting the national goals outlined in **Viksit Bharat 2047** and promoting responsible industrial development. The next section will provide review of literature highlighting the research gaps and theoretical framework. It will be followed by methodology, analysis of data and findings. The concluding part of the paper includes discussion, implications, limitations, future research directions and conclusion.

2. LITERATURE REVIEW

GHRM and WENG

Green HRM has emerged as a critical field in organizations striving for environmental sustainability. In energy-intensive sectors like steel manufacturing, green HRM practices can play a pivotal role in promoting eco-friendly practices among employees, influencing work engagement and overall organizational performance. Recent studies emphasize that green HRM, encompassing practices such as eco-friendly recruitment, training, and performance management, can enhance employees' commitment to sustainability (Jabbour & Santos, 2020; Mandal & Gupta, 2022). In steel manufacturing units, where energy consumption and environmental impact are significant, green HRM practices has potential to align employee engagement with organizational sustainability goals, driving both eco-efficiency and work motivation (Kumar & Kappor, 2021).

Work engagement in this context refers to the emotional, cognitive, and physical commitment employees' exhibit towards their tasks, fostering a positive and productive work

environment. It is important to differentiate between promoting green values and developing green skills. A study by Sharma & Gupta (2023) highlighted that green HRM practices positively influence work engagement by aligning personal values with organizational sustainability objectives, thus enhancing employee well-being and performance. Despite the promising implications, a gap remains in understanding the intersection of green HRM, work engagement, and the specific dynamics of energy-intensive industries like steel. Few studies address the unique challenges and practices in such industries, and there is limited empirical research on how green HRM can effectively enhance work engagement specifically in the steel sector (Meyer et al., 2022). To bridge this gap, we propose the following hypothesis:

H_1: GHRM perception is significantly and positively related to WENG.

WENG and EI

Work engagement and environmental performance are increasingly interconnected in energy- intensive manufacturing industries, such as the steel sector. Work engagement, characterized by vigor, dedication, and absorption, can significantly impact environmental performance by fostering a proactive culture toward sustainability (Rich et al., 2020). In the steel industry, where energy consumption and emissions are high, engaged employees are more likely to adopt energy-saving practices and contribute to green initiatives (Sharma & Gupta, 2023). Recent studies indicate that engaged workers are more committed to organizational goals, including environmental sustainability, thus improving operational efficiency and reducing environmental footprints (Saks, 2022).

Environmental performance in energy-intensive sectors depends heavily on employee behaviours, as they are crucial in implementing and maintaining sustainable practices such as waste reduction, energy efficiency, and pollution control. A significant research gap exists in understanding the specific mechanisms linking work engagement to environmental performance in the steel sector. Further empirical research is needed to examine how specific work engagement dimensions, such as dedication and vigour, influence environmental outcomes in this energy-intensive industry (Meyer et al., 2022). A study by Zhang et al. (2021) found that in manufacturing contexts, including steel, employees' engagement in sustainability policies directly influences the reduction of carbon emissions and energy usage. However, the relationship between work engagement and environmental performance remains underexplored in the context of the steel industry. Based on past studies, we propose the following hypothesis:

H_2: WENG perception is positively but not significantly related to ENVI.

H_3: WENG perception is significantly related to ENVI in presence of CHRP as a moderator.

GHRM and ENVI

Green HRM is gaining traction in energy-intensive manufacturing industries, such as steel, where environmental performance is a critical concern. Green HRM integrates sustainable policies into HR practices, including green recruitment, training, and performance management et al, aiming to align employee behaviour with organizational environmental goals (Jabbour & Santos, 2020). In the steel sector, which is notorious for its high energy consumption and carbon emissions, Green HRM practices are crucial for improving environmental performance by encouraging eco-friendly behaviours, enhancing energy efficiency, and reducing environmental impacts (Mandal & Gupta, 2022). Recent literature highlights that green HRM can significantly contribute to environmental performance by fostering employee engagement in sustainability practices and promoting green organizational culture (Kumar & Kapoor, 2021). Studies have shown that organizations with strong green HRM practices report better environmental outcomes, including reduced waste, energy consumption, and emissions (Gholami et al., 2023).

However, the specific impact of green HRM on environmental performance within the steel sector remains under-explored. Most studies focus on broader manufacturing contexts, and empirical evidence is sparse regarding the unique challenges and dynamics of energy-intensive industries like steel (Sharma & Gupta, 2023). Future studies should explore how work engagement mediates the relationship between GHRM and ENVI in such settings, and examine how industry-specific challenges (e.g., high carbon emissions) affect the implementation of green practices (López-Rodríguez et al., 2023). Therefore, there is a pressing research gap to explore how green HRM policies can be tailored using customized policies to enhance environmental performance in energy-intensive manufacturing environments like the steel sector. This paper attempts to fill the above-mentioned research gap by proposing the following hypothesis:

H_4: GHRM perception is positively but not significantly related to ENVI.

H_5: GHRM perception is significantly related to ENVI in presence of CHRP as a moderator.

The suggested research model as shown below illustrates the postulated associations between the variables.

Figure1: Proposed Research Model
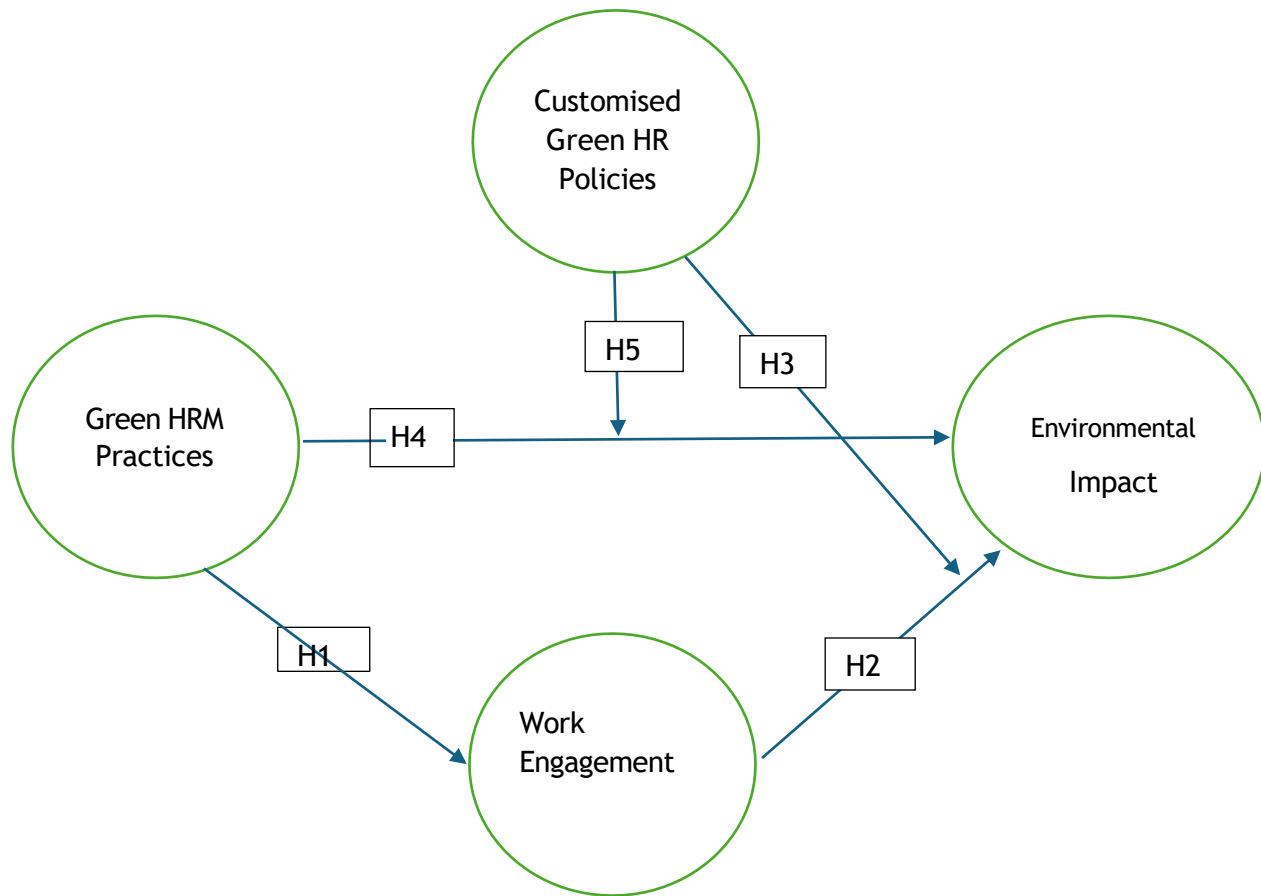
3. METHODOLOGY

Research Design

This study employs a quantitative analysis to explore GHRM and sustainable practices within the Indian steel sector. The design is expected to enable a comprehensive understanding of the relationship between GHRM practices and sustainability outcomes. The case study provides context and in-depth analysis of GHRM practices at one of the flagship units of a 'Maharatna' steel enterprise in India, while the quantitative survey assesses employee perceptions and engagement with these practices.

Case Study Selection

The case study organization for this research is XYZ Ltd. *(name changed),* one of India's largest and most influential steel producers. XYZ Ltd was selected for its well-documented sustainability initiatives and significant market presence with one of the largest employees on roll in a steel sector. The company has made considerable commitments to reducing carbon emissions, improving energy efficiency, and

implementing environmentally friendly practices (XYZ Ltd., 2023).

XYZ Ltd. sustainability efforts encompass innovative practices in waste management and energy utilization, making it an ideal candidate for exploring the integration of GHRM into its operational framework. The organization's comprehensive approach to sustainability, coupled with its market influence, provides a rich context for understanding how HR practices can facilitate environmental goals. Additionally, XYZ Ltd. history of transparency in reporting and stakeholder engagement enhances the reliability of the data collected for this study.

Data Collection and Measurement

Data for this study were collected using a combination of structured surveys and qualitative interviews, ensuring a comprehensive understanding of GHRM practices at XYZ Ltd.

1. **Surveys**: A structured questionnaire (attached in appendix) was administered to a sample of 500

employees by applying the convenience random sampling method. Data was collected in phases from Sep'23 to Sep'24 at one of the key units of XYZ Ltd. The paper survey consisted of closed-ended and seven-point Likert-scale (where 1 stand for strongly disagree and 7 stand for strongly agree) questions designed to quantify employee perceptions regarding GHRM practices, their level of engagement in sustainability initiatives, and their views on the company's commitment to environmental responsibility. The scale for the measurement was adapted from existing published literature. A total of 14 items for the study was sub divided into three parts viz GHRM, WENG and ENVI. We measured green HRM practices through five items adapted from Dumont et al, (2017). A sample item is 'My Company provides employees with green training to promote green values'. WENG is measured by questions adapted from Utrecht Work Engagement Scale-9 in English given by Schaufeli et al. (2006). A sample item is 'I am proud on the work that I do'. ENVI is measured using the questions from Thomson Reuters EIKON data (2018). A sample item is 'My Company considers minimizing CO2 reduction'. Out of 600 questionnaires, 363 responses were received back from the participants who include 23 incomplete responses. Hence, 340 responses were taken up for the analysis with the response rate of 68%. This quantitative data will enable statistical analysis to identify trends and correlations within the workforce.

2. **Case Study Documentation**: In addition to survey data, secondary data sources such as XYZ Ltd. annual reports, sustainability reports, and HR policy documents were analysed. This data provided contextual information on the organization's sustainability strategies and GHRM practices, facilitating a more comprehensive understanding of the quantitative findings. The following table compares XYZ Ltd Green HRM practices and sustainability outcomes with other Indian and international steel manufacturers:

TABLE 1. Comparison with Other Global and Indian Companies

Company	Country	Green HRM Practices	Energy Efficiency Improvements (%)	CO₂ Emission Reductions (%)	Waste Recycling (%)
XYZ Ltd	India	Strong focus on employee engagement, green training, CSR alignment	12%	10%	75%
Tata Steel	India	Advanced green recruitment, high-tech solutions in energy management	15%	12%	85%
JSW Steel	India	Comprehensive green compensation, sustainability awards	14%	11%	80%
ArcelorM ittal	Luxembou rg	Cutting-edge green technologies, international green HR policies	20%	25%	90%
POSCO	South Korea	Highly integrated green HRM, leadership in green steel production	22%	30%	95%

As seen from the table, XYZ Ltd performs relatively well in terms of energy efficiency and waste recycling compared to other Indian companies like JSW Steel and Tata Steel. However, international steel giants such as Arcelor Mittal and POSCO have achieved more significant reductions in carbon emissions and energy consumption, largely due to their investment in advanced green technologies and integrated HRM systems.

4. DATA ANALYSIS

Data analysis in this study involved a multi-faceted approach to interpret both the quantitative and qualitative data collected.

1. **Quantitative Analysis:** Survey data were analysed using partial least square (PLS) method with the statistical software (Smart PLS version 4.1.0.9) to conduct descriptive statistics, which summarize

employee demographics and trends in responses regarding GHRM practices and sustainability awareness. Inferential statistics, including correlation and regression analyses, were performed to explore relationships between the implementation of GHRM practices and employees' perceptions of sustainability efforts (Field, 2018). This statistical approach enables the identification of significant patterns within the data.

2. **Qualitative Analysis:** The follow-up interviews were analyzed using thematic analysis, as described by Braun and Clarke (2020). The qualitative data were transcribed and coded to identify recurring themes and insights related to employee experiences with GHRM practices. This method allows for a detailed exploration of how GHRM initiatives are perceived and experienced by employees, offering depth to the quantitative findings.

3. **Integration of Findings:** The results from the quantitative analyses were integrated with qualitative insights to provide a holistic understanding of the role of GHRM in promoting sustainability within target company. By combining the statistical analysis with thematic insights, this study aims to present a well-rounded perspective on how GHRM practices contribute to sustainable organizational outcomes.

PLS-based structural equation modeling (PLS-SEM) was used to evaluate the measurement and structural model. While the structural model focused on the potential relationship between latent variables, the measurement model validated the association between the items and the unobserved latent variables. The PLS-SEM approach is appropriate for determining outcomes for both the measurement and the structural models because the study used a second-order reflective-reflective model. Furthermore, a two-stage method as proposed by Anderson and Gerbing (1988) in consideration of the hierarchical order model was used. Reliability, discriminant validity, and hypothesis testing were used in the first step to evaluate the measurement model's first-order reflective construct and determine whether the structural link was significant (Hair et al., 2014).

5. MEASUREMENT MODEL

To determine how well the construct was explained by the study's indicators, the measurement model was essential (Figure 2). Therefore, Cronbach's alpha, factor loadings, composite reliability (CR), and average variance extracted (AVE) were used to examine the validity and reliability of measurement models. Details of the measures and descriptive analysis is shown in table 2 and 3 respectively. Heterotrait-monotrait (HTMT) criteria was computed to test the discriminant validity (Table 3). Cronbach's alpha, CR, and

AVE of the specified construct, which indicate the model's internal consistency and dependability. As suggested by *Hair et al. (1998), the factor loading scores of the construct for each item are displayed in* Tables 5 and 6.

TABLE 2: Details of the Measures

S.No	Dimensions	Total Items	Source	Cronbach's alpha
1	GHRM	5	Dumont et al, (2017)	0.749
2	WENG	4	Schaufeli et al. (2006)	0.730
3	ENVI	4	Thomson Reuters EIKON data (2018)	0.781

TABLE 3. Descriptive Analysis

Construct	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
GHRM	0.657	0.521	1.303	0.193
WENG	0.989	0.002	637.100	0.000
ENVI	-0.646	0.551	1.217	0.224

Figure 2. Measurement Model
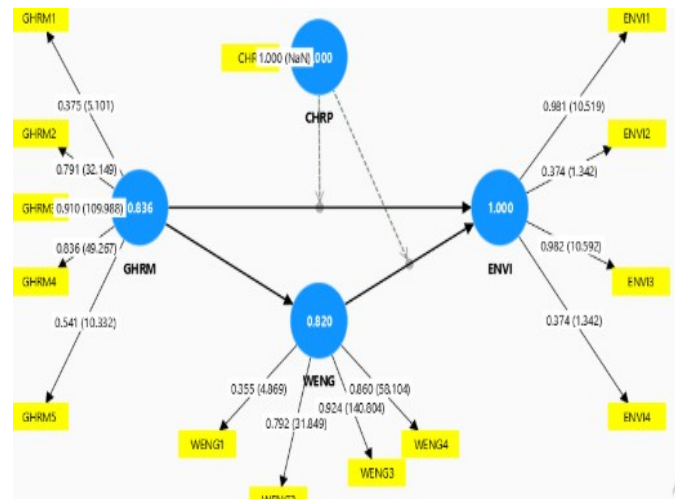
TABLE 4. Assessment of discriminant validity by HTMT criteria

Variables	CHRP	GHRM	WENG	ENVI
GHRM	0.161			
WENG	0.139	0.806		
ENVI	0.318	0.232	0.204	

TABLE 5. Results for the Reflective Measurement

Constructs	Items	Loading	AVE	CR	rhoA	R-sq.	R-sq. adjusted
GHRM			0.517	0.832	0.836	-	-
	GHRM1	0.375					
	GHRM2	0.791					
	GHRM3	0.910					
	GHRM4	0.836					
	GHRM5	0.541					
WENG			0.587	0.839	0.820	0.978	0.978
	WENG1	0.355					
	WENG2	0.792					
	WENG3	0.924					
	WENG4	0.860					
ENVI			0.552	0.804	1.000	0.171	0.159
	ENVI1	0.981					
	ENVI2	0.374					
	ENVI3	0.982					
	ENVI4	0.374					

TABLE 6. Results of Effect magnitude (F^2)

	Original sample (O)
CHRP -> ENVI	0.101
GHRM -> ENVI	0.005
GHRM -> WENG	44.855
WENG -> ENVI	0.004
CHRP x GHRM -> ENVI	0.054
CHRP x WENG -> ENVI	0.056

Hoffmann and Birnbrich (2012) calculated the internal consistency of the latent construct, which is indicated by CR. The recommended threshold value of 0.7 on lower side should not be breached by the CRs score (Nunnally, 1978). The AVE result for each construct also ranged from 0.517 to 0.587. As can be seen from Tables 2 and 3, the Cronbach's alpha values are likewise acceptable. HTMT was used to evaluate the discriminant validity of the measurement models, and results are displayed in Table 3.

Additionally, Table 5 shows the results of establishing discriminant validity using the HTMT criterion, which was endorsed by Henseler et al. (2015). According to this criterion, the recommended HTMT threshold value is 0.90, and the true correlation between the construct is closely estimated. Any number higher than the cutoff point (0.90)

would indicate that the model lacks discriminant validity. The HTMT fulfillment criteria are shown in Table 5, which guarantees the discriminant validity of the model.

Structural Model

The second step involved testing the structural model to determine the path model's statistical significance after the measurement model was accepted. We evaluated the structural model using effect magnitude (F^2) and coefficient of determination (R^2). Additionally, according to Sarstedt et al. (2017), the R^2 guiding principle for dependent variables designates 0.25, 0.50 and 0.75 as weak, moderate and strong respectively. The appropriate R^2 values for WENG and ENVI are shown in Table 6 as 0.978 and 0.159 respectively.

F^2 is also used to calculate the latent factors' effect size on the dependent construct. Furthermore, according to Cohen (1988), the ideal F^2 value is 0.02 for small effect sizes, 0.15 for medium effect sizes, and 0.35 for high effect sizes. Hair et al. (2017) suggested using standardized root mean square (SRMR) for model fitness. Hu and Bentler (1998) suggested that the SRMR threshold value for model fitness in CB-SEM can be set at 0.08. The results show that the SRMR value is 0.07, which corresponds to a satisfactory fit metric.

Figure 3. Structural Model
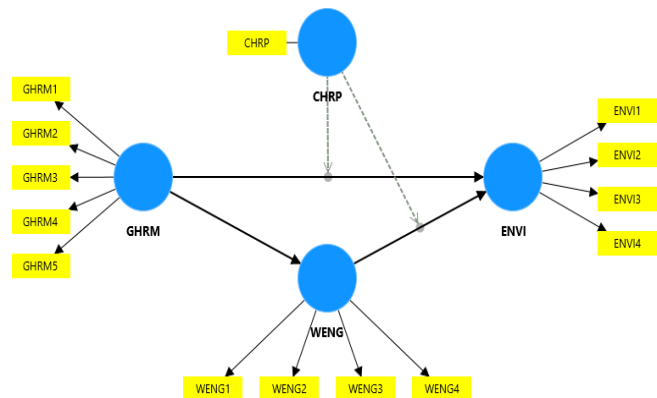
Bootstrapping

To test the statistical significance of hypotheses, a 5,000 resample technique was used in the second step of the bootstrapping process (Hair et al., 2017). With WENG and ENVI as dependent variables and GHRM as an independent variable, hypothesis testing was carried out. The results of the structural model were taken into consideration, and it accounted for positive and significant values that support the suggested hypotheses, as indicated below.

TABLE 7. Results of the Structural Model

Structural path	Original sample (O)	Sample mean (M)	Standard deviation (STDE	T values	P values	Remarks

			V)			
GHRM -> WENG	0.989	0.989	0.002	652.767	0.000	H1 accepted
WENG -> ENVI	-0.671	-0.646	0.551	0.840	0.401	H2 accepted
CHRP x WENG -> ENVI	1.693	1.590	0.499	2.853	0.004	H3 accepted
GHRM -> ENVI	0.679	0.657	0.521	0.978	0.328	H4 accepted
CHRP x GHRM -> ENVI	-1.637	-1.528	0.502	2.737	0.006	H5 accepted
CHRP -> ENVI	0.272	0.273	0.065	4.189	0.000	H6 accepted

GHRM and WENG have a significant and positive association (b = 0.989, p = 0, t-value = 6.527). H1 is therefore supported. With values b = 0.41 p = 0.4 and t-value = 0.8, the second hypothesis which suggested positive but not significant association between WENG and ENVI hold true, H2 is therefore also supported. Similarly, the relationship between WENG and ENVI has a significant and positive association in the presence of CHRP as a moderator (b = 1.511, p = 0.004, t-value = 2.853). H3 is therefore supported. The fourth hypothesis is also acceptable with values b = 0.452 p = 0.328 and t-value = 0.978, showing the positive but not significant association between GHRM and ENVI. H4 is therefore supported. Similarly, the relationship between GHRM and ENVI has a significant and positive association in the presence of CHRP as a moderator (b = 1.452, p = 0.006, t-value = 2.737). H5 is therefore supported.

6. DISCUSSION

The present study examined how employees' perceptions of GHRM and WENG affected ENVI in India's energy-intensive steel manufacturing industry. In line with earlier research investigations, empirical data indicate a positive relationship between GHRM and WENG (Tran, Nguyen. (2023).

Research by Renwick et al. (2013) suggests that green HRM should incorporate sustainable recruitment, training in environmental management, and rewards for eco-friendly behaviour. Additionally, commitment to green training programs, such as those focused on energy conservation and pollution control, aligns with the findings of Jabbour and Santos (2008), who emphasized in their studies the need for continuous green skill development.

Employees are trained in energy management techniques and are incentivized to suggest improvements. According to the studied company's sustainability report, these efforts helped them to reduce energy consumption by 12% between 2018 and 2023. This reduction aligns with academic research that highlights the importance of employee engagement in achieving energy savings (Renwick et al., 2013).

Similarly, while newer plants have adopted advanced energy-saving technologies, older facilities/ units continue to operate at lower efficiency levels, highlighting the need for modernization. This gap in implementation mirrors challenges as noted in academic studies, such as those by Singh and Kumar (2023), emphasizes the difficulty large industries face in balancing environmental goals with financial constraints in retrofitting older plants.

The company's focus on creating a culture of sustainability reflects academic suggestion that emphasizes employee-driven initiatives as key to successful environmental outcomes (Mishra & Sharma, 2022). Training programs focused on energy efficiency, waste management, and carbon reduction have had a notable impact on XYZ Ltd. sustainability performance, aligns with academic recommendations for continuous employee education (Jabbour et al., 2021).

Through employee-driven initiatives, the company has improved its waste recycling rate, with 75% of its slag being reused in road construction and other applications. This achievement supports findings from Sarkar and Banerjee (2022), who argued that waste management improvements are closely tied to employee involvement in green practices.

The studied company reported a 10% reduction in CO_2 emissions per tonne of steel produced over the last five years. While this is a positive trend, XYZ Ltd. emissions remain higher than global benchmarks. This discrepancy highlights the challenges Indian steel companies face in balancing production efficiency with stringent global emission standards (Bhattacharya & Mukherjee, 2022).

Findings suggested that when a company chooses to develop its employees' skills, provide opportunities and simultaneously inspires them, the employee's performance increases, supporting the AMO theory. An organization's interests are best served by a system that emphasizes these three aspects of employee qualities, according to the AMO hypothesis. Employers can use this idea to make and guide the selection of HR policies and procedures that influence employees' potential, motivation, and skills. For instance, a company can shape opportunities through teamwork or suggestion systems, performance-related compensation to shape motivation, and hiring, training, and selection to shape abilities.

Linking sustainability outcomes to performance reviews and rewards for all employees can increase engagement. Departments through customizing HR policies should develop reward mechanisms for its employees to engage, following global best practices where environmental impact is incentivized across the organization. This is in line with the results of earlier research by Renwick et al., (2013).

The findings demonstrate how WENG influences ENVI in the presence of CHRP as a moderator there by filling the research gap from earlier research by Cem Tanova & Steven W. Bayighomog (2022).

The implementation of Green Human Resource Management (Green HRM) in India's steel industry is a strategic response to environmental and economic challenges, ensuring sector competitiveness and alignment with national sustainability goals. A case study of a leading public-sector steel company highlights the integration of green practices across recruitment, training, and performance management to enhance sustainability.

Key initiatives include green recruitment processes focusing on eco-conscious candidates, training programs promoting energy efficiency, and performance metrics tied to environmental objectives. These measures have not only reduced operational emissions but have also fostered a culture of environmental accountability among employees, aligning with India's carbon neutrality targets under its Nationally Determined Contributions (NDCs)

Furthermore, by adopting renewable energy sources and efficient waste management practices, the sector contributes to economic resilience, reducing reliance on non-renewable inputs and enhancing global competitiveness. These actions reflect the industry's alignment with national goals, such as the "Viksit Bharat 2047" vision, which prioritizes sustainable industrial growth

This integration of Green HRM practices underscores the steel sector's role as a driver of both environmental stewardship and economic advancement, providing a replicable model for other industries

7. IMPLICATIONS

The current study has management and theoretical ramifications. The study tends to advocate for additional micro-level research in the field of green HR by examining how a company's green HRM strategies affect environmental performance through employee engagement. Companies should move beyond periodic training programs to create a continuous learning culture that engages employees at all levels in sustainability education. For example, energy-saving practices and waste management strategies should be part of ongoing professional development (Sarkis, 2022). However, a critical challenge is integrating these practices across all levels of the organization. Academic literature highlights the need for top-down and bottom-up approaches to green HRM (Zibarras & Coan, 2015).

Most discussions about green HR have taken place in Western contexts and in service industry like hospitality sector (Cem Tanova & Steven W. Bayighomog, 2022). Therefore, by providing empirical support for green HR from the viewpoint of employees from a major developing economy, the study adds to the body of knowledge in the existing literature.

PLS-SEM is used to evaluate the suggested conceptual model's more reliable outcomes. Employers must be aware of how employees' behave in response to green HR initiatives. With reference to environmental performance, all corporations worldwide are moving from voluntary to statutory disclosures to meet the increased stringent requirements. In India too, companies engage in green HR initiatives to enhance their public perception rather than as a business tactic. To create and preserve positive public relations, they engage in green HR initiatives by concentrating on all stakeholders. According to our research, companies should prioritize the work engagement of employee to improve their environmental performance by customizing HR policies.

8. LIMITATION AND FUTURE RESEARCH DIRECTIONS

The results of this study should help managers and organizations bring back focus on the work engagement in the workplace to enhance their environmental performance through the customization of HR policies.

Additionally, there are several limitations to other empirical investigations in this study. First, this study used cross-sectional data; longitudinal data should be used more in future research. Second, the study does not include the boundary condition moderator variable, which could either strengthen or diminish the link between CHRP, GHRM, and ENVI. Similarly, the mediating affect between the variables may also be studied in the future research. Depending on the personalities, demography, and other factors, employees' perceptions of GHRM may differ. Future research may be moderated by these variables. Third, our study's use of the Western scale to gauge ENVI is another drawback (Thomson Reuters EIKON data, 2018).

Future studies should examine other dynamics of environmental performances in the Indian setting for private players of the steel industry. Fourth, we only examined how employees felt about green HRM practices (GHRM) in a public sector set up at one location; opinions from employees of other private players with different geographical locations can also be examined. Fifth, the present study measures employees' perceptions of GHRM using a widely accepted AMO theory; future research may choose from another two dozen and more theories, such as RBV, SIT, SET etc (Cem Tanova & Steven W. Bayighomog, 2022), to test the proposed model. Future research can also examine the impact of different leadership styles and other factors on employees' perceptions of green HRM.

9. CONCLUSION

It is believed that good citizenship behaviour is a key sign of high organizational success and achievement. The current

study looks at how green HRM initiatives affect ENVI in the Indian setting by using CHRP as a moderator. The study uses PLS-SEM as a statistical tool to produce more reliable findings. AMO theory is applied to demonstrate how green HRM affects ENVI both directly and indirectly in the selected company from India's steel manufacturing industries in a public sector set up. The findings validated each of the hypotheses that were put forth. The company's green HRM practices benefits the community, environment, and next generation. It is also valued by the employees (Mishra & Sharma, 2022).

Employee behaviour and performance, however, are influenced by their workplace culture and how they are regarded by others outside the company and how they are productively engaged inside the company. Green HRM practices have become a strategic need for firms to minimize its environmental impact. The results indicate that companies who are successful in carrying out socially responsible actions toward the public, consumers, government, and workers gain a great deal of trust from their workforce. These organizations are also known for their good environmental performance.

REFERENCES

[1.] Ahmad, S. (2022). Green Human Resource Management: A Conceptual Review and Future Research Agenda. Journal of Cleaner Production, 315, 128120.

[2.] Appelbaum, E., Bailey, T., Berg, P., & Kalleberg, A. L. (2000). *Manufacturing Advantage: Why High-Performance Work Systems Pay Off.* Cornell University Press.

[3.] Arora, R., & De, S. (2020). "Corporate Social Responsibility and Environmental Sustainability: Legal Perspectives." Journal of Corporate Governance, 18(1), 89-103.

[4.] Barney, J. B. (1991). Firm resources and sustained competitive advantage. Journal of Management.

[5.] Bhattacharya, S., & Mukherjee, P. (2022). "Energy Efficiency Initiatives in the Indian Steel Industry." International Journal of Energy and Environment, 13(4), 245-258.

[6.] Braun, V., & Clarke, V. (2020). Reflecting on reflexive thematic analysis. Qualitative Research in Psychology, 1-21.

[7.] Cem Tanova & Steven W. Bayighomog (2022): Green human resource management in service industries: the construct, antecedents, consequences, and outlook, The Service Industries Journal, https://doi.org/10.1080/02642069.2022.2045279

[8.] Centre for Responsible Business (CRB). (2024). Roadmap for a Sustainable and Viksit Bharat by 2047. Insights from the 11th India and Sustainability Standards Conference, emphasizing multi-stakeholder collaborations and sustainability goals

[9.] Creswell, J. W., & Plano Clark, V. L. (2017). Designing and Conducting Mixed Methods Research. Sage Publications.

[10.] da Rocha, A.B.T., Espuny, M., Kandsamy, J. et al. Advancing sustainability in the steel industry: the key role of the triple helix sectors. Environ Sci Pollut Res 31, 43591–43615 (2024). https://doi.org/10.1007/s11356-024-33983-7

[11.] Field, A. (2018). Discovering Statistics Using IBM SPSS Statistics. Sage Publications.

[12.] Gupta, A. (2023). Sustainable Practices in Heavy Industries: The Role of HRM. Sustainability, 15(3), 2214-2232.

[13.] International Journal of Creative Research Thoughts (IJCRT). (2024). Implementation strategies for Viksit Bharat 2047, including Green HRM integration as a mechanism to achieve environmental and economic goals

[14.] Jabbour, C. J. C., Santos, F. C. A., & Nagano, M. S. (2020). Environmental management and corporate performance: The role of green HRM in the steel industry. Resources, Conservation and Recycling, 158, 104817.

[15.] Jabbour, C. J. C., & Santos, F. C. A. (2008). "The Central Role of Human Resource Management in the Search for Sustainable Organizations." The International Journal of Human Resource Management, 19(12), 2133-2154.

[16.] Jabbour, C. J. C., & Santos, F. C. A. (2020). Green Human Resource Management and Green Supply Chain Management: Linking Two Emerging Agendas. Journal of Cleaner Production, 283, 125-142.

[17.] Jabbour, C. J. C., et al. (2021). "Green human resource management and environmental sustainability." Journal of Cleaner Production, 140, 1-10.

[18.] Jabbour, C. J. C., Sarkis, J., Jabbour, A. B. L. D. S., & Renwick, D. W. S. (2019). Green human resource management and the enablers of green organizational culture: A systematic review. Journal of Cleaner Production.

[19.] Jackson, S. E., Renwick, D. W. S., & Jabbour, C. J. C. (2021). Green Human Resource Management and Sustainable Performance. Human Resource Management Journal, 31(2), 189-205.

[20.] Jackson, S. E., Renwick, D. W. S., Jabbour, C. J. C., & Muller-Camen, M. (2011). State- of-the-art and future directions for Green HRM. German Journal of Human Resource Management.

[21.] Jain, R., & Singhal, P. (2022). "The Role of Green HRM in Driving Sustainability: A Case of the Indian Steel Sector." Journal of Human Resource and Sustainability Studies, 10(3), 123-136.

[22.] Jamal T, Zahid M, Martins JM, Mata MN, Rahman HU, Mata PN. Perceived Green Human Resource Management Practices and Corporate Sustainability: Multigroup Analysis and Major Industries Perspectives. Sustainability. 2021; 13(6):3045. https://doi.org/10.3390/su13063045

[23.] Joshi, R., & Sharma, V. (2020). Sustainable Practices in India's Steel Sector: The Role of Green HRM. Journal of Environmental Management, 267, 110595.

[24.] Kaur, R., & Kaur, R. (2021). Green HRM practices in Indian industries. International Journal of Human Resource Studies.

[25.] Mahvish K. K. et al., (2022). Understanding the Impact of Green Human Resource Management Practices and Dynamic Sustainable Capabilities on Corporate Sustainable Performance: Evidence From the Manufacturing Sector, Frontiers in Psychology,

[26.] Ministry of Environment, Forest, and Climate Change. (2022). India's Updated Nationally Determined Contributions Under the Paris Agreement.

[27.] Ministry of Steel (2017). National Steel Policy 2017.

[28.] Ministry of Steel. (2023). Annual Report 2022-23. Government of India. https://steel.gov.in/annual-reports

[29.] Mishra, P., & Sharma, P. (2022). "Green HRM Practices in Indian Manufacturing: Employee Engagement and Sustainability Outcomes." Journal of Environmental Management and Sustainability, 5(2), 97-109.

[30.] Mishra, P., & Sharma, P. (2023). "Sustainability Practices in the Indian Steel Sector: Challenges and Opportunities." Journal

of Environmental Management and Sustainability, 5(2), 97-109.

[31.] NITI Aayog. (2023). Industrial Decarbonization and Energy Transition: A Strategy for Net-Zero Emissions.

[32.] Rani, R., Singh, M., & Kumar, A. (2021). Employee Engagement and Green HRM: A Case Study of India's Steel Sector. Sustainability, 13(5), 2624.

[33.] Renwick, D. W. S., et al. (2013). "Green HRM: A review and research agenda." International Journal of Management Reviews, 15(1), 1-14.

[34.] Renwick, D. W. S., Redman, T., & Maguire, S. (2019). Green HRM: A review and research agenda. International Journal of Management Reviews, 17(1), 1-14.

[35.] Renwick, D. W. S., Redman, T., & Maguire, S. (2022). Green HRM: A review, process model, and research agenda. Human Resource Management Review.

[36.] SAIL. (2023). Sustainability Reports. Retrieved from SAIL Sustainability Reports.

[37.] Sarkar, R., & Banerjee, S. (2022). "Waste Management Practices in the Steel Industry: A Focus on Indian Companies." Indian Journal of Industrial Ecology, 9(2), 34-45.

[38.] Sarkis, J. (2022). "Sustainable performance in the steel industry." Sustainability, 14(5), 678-690.

[39.] Saxena, R., & Jain, P. (2021). The Impact of Green HRM on Employee Motivation in Indian Manufacturing. International Journal of HRM, 32(5), 1104-1123.

[40.] Sharma, P., & Gupta, V. (2020). Integrating Green HRM Practices for Organizational Sustainability: Insights from the Indian Steel Industry. Journal of Business Ethics, 165(1), 203-220.

[41.] Singh, N., & Kumar, A. (2023). "Carbon Reduction Strategies in Indian Steel Manufacturing." Environmental Science and Policy Review, 14(1), 56-73.

[42.] Tata Steel. (2022). Sustainability Report 2022: Reducing Our Environmental Footprint.

[43.] Tata Steel. (2023). Sustainability Reports. Retrieved from Tata Steel Sustainability Reports.

[44.] World Steel Association. (2023). World Steel in Figures 2023. https://worldsteel.org/media-centre/press-releases/2023/

[45.] Yadav, V., Singh, A., & Kumar, P. (2023). Sustainability and green practices in Indian manufacturing industries. Sustainable Production and Consumption.

[46.] Yin, R. K. (2018). Case Study Research and Applications: Design and Methods. Sage Publications.

[47.] Yong, J. Y., Yusliza, M.-Y., & Ramayah, T. (2020). Green human resource management and environmental sustainability. Journal of Environmental Management.

[48.] Renwick, D. W., Redman, T., & Maguire, S. (2013). Green HRM: A review, process model, and research agenda. International Journal of Management Reviews, 15(1), 1-14.

[49.] Tran, Nguyen. (2023). An empirical investigation on the impact of green human resources management and green leadership on green work engagement. Heliyon. 9. e21018. 10.1016/j.heliyon.2023.e21018.

[50.] Zhao, X., Li, N., & Kuo, H. (2020). Work engagement and environmental performance: The moderating role of green HRM. Journal of Cleaner Production, 276, 123234.

[51.] López-Rodríguez, M. D., Navarro-Galera, A., & García-Gutiérrez, A. (2023). Green HRM and sustainable performance: Empirical evidence from energy-intensive industries. Sustainability, 15(7), 2382.

Appendix: Questionnaire based on seven points Likert Scale

Strongly Disagree	Likely disagree	Disagree	Neutral	Agree	Likely Agree	Strongly Agree
1	2	3	4	5	6	7
A	B	C	D	E	F	G

1	GHRM1	My company sets green goals for its employees.
2	GHRM2	My company provides employees with green training to promote green values.
3	GHRM3	My company provides employees with green training to develop employees' knowledge and skills required for green management.
4	GHRM4	My company considers employees' workplace green behavior in performance appraisals.
5	GHRM5	My company relates employees' workplace green behaviors to rewards and compensation.
6	WE1	My job inspires me.
7	WE2	I am proud on the work that I do.
8	WE3	I feel happy when I am working intensely
9	WE4	At my job, I feel strong, vigorous and bursting with energy.
10	EI1	My company considers minimizing CO2 reduction.
11	EI2	My company considers emphasis on waste management.
12	EI3	My company considers optimum utilization of natural resources like land, water etc.
13	EI4	My company stresses policy on energy efficiency and optimum utilization of energy.
14	CHRP	My company considers customization of HR policies to get most of green practices.

Assessing the Factors Influencing Intellectual Capital Management in Educational Institutions- A study in Sambalpur University

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ABSTRACT

Intellectual Capital Management (ICM) plays a pivotal role in enhancing the competitive advantage and sustainable growth of educational institutions. The purpose of this study is to evaluate the major variables affecting the management of intellectual capital at Sambalpur University, an esteemed university in Sambalpur, Odisha, India. Using an analysis of the interactions among Human Capital, Structural Capital, and Relational Capital, the study determines the ways in which these elements support the university's overall effectiveness and capacity for knowledge development. A mixed-method approach is used in this study, including quantitative surveys aimed at students and staff and qualitative interviews with faculty members and administrators at the university. The results underscore the significance of faculty competence, administrative effectiveness institutional culture, and external collaborations in cultivating an atmosphere favorable to the advancement of intellectual capital using Factor Analysis Technique. In addition to providing useful suggestions for improving intellectual capital management practices in universities, especially in developing nations like India, this study adds to the expanding body of research on ICM in the context of higher education.

Keywords: Intellectual capital management, human capital, structural capital, relational capital, competitive advantage and sustainable growth.

1. INTRODUCTION

Background of the study:

In the contemporary knowledge economy, the shift to innovative, competitive, and sustainable development (SD) is marked by intellectual capital (IC). The company's most valuable resource is its "people," whose knowledge serves as the growth engine (Nikolaichuk et al., 2019). This is what is meant by "IC" (Parthenope et al., 2019). For modern educational institutions, the value of knowledge has greatly increased.

For different educational institutions to continue adding value and retaining their competitive advantage, knowledge-related resources must be strategically managed (Garcia-perez et al., 2020). Nations' and firms' competitive advantage is influenced by tangible resources such as land and labour, as well as other economic assets (Secundo, Passiante, et al., 2015). According to that resource-based viewpoint, resources (particularly intangible assets) improve the institution's performance and sustainability. Organizations and educational institutions have recognized intellectual capital (IC) as a crucial intangible asset that influences its success for 20 years (Hoang et al., 2020).

In the latter half of the 20th century, a "knowledge-based economy" emerged or "post-capitalist society" shifted the emphasis to knowledge and intellectual capital as major part of the society (Secundo, Passiante, et al., 2015). In this sense, IC management has developed into a crucial managerial task (Castro et al., 2019).

IC primarily comprises of three important components: human capital, structural capital and relational capital (Teimouri et al., 2017).

Human capital:

As the name suggests, the term "human capital" refers to the human resources—more precisely, the knowledge—each of these people brings to the firm. Usually, what is meant by tacit knowledge is the knowledge that each employee and manager of an organization has (Samaibekova et al., 2019). It includes each employee's unique knowledge, skills, expertise, experience, know-how, and capacity. An organization might lose human capital when employees or managers leave because it is inherent in people and cannot be owned by organizations (Kehle et al., 2018). However, human capital may be transformed into structural capital by codifying the implicit knowledge that exists in people into explicit knowledge and archiving it in a repository (Danvila-del-Valle et al., 2019).

Structural capital:

Structural capital, also known as organizational capital, includes all of an organization's processes, procedures, and other codified knowledge. the items that remain in the company's ownership after the employees have left the building (Svistunov et al., 2019).

In other words, it contains customer lists, technological infrastructure, business plans, strategies, manuals, control systems, information systems, innovations, patents,

intellectual properties, etc (Nevado-Peña et al., 2015). It can be altered, copied, and shared indefinitely (Kramin et al., 2015). It can also be utilized for the purpose of value creation by a variety of staff members at various times. In the context of structural capital, culture is a collection of values, norms, and practices (Huang et al., 2021).

Relational capital:

Relational capital describes the exterior networks and connections of an organization with the outside world (Kasztler & Leitner, 2002). It includes dealing with customers, shareholders, governments, partners, distributors, and suppliers as well as managing a company's brand, corporate image, and reputation. Because it is more externally focused than structural and human capital, it is more challenging to manage (Stachová et al., 2019).

Importance of Intellectual capital:

The importance of intellectual capital in the growth of the higher education system in Sambalpur University is examined in this paper. Intellectual capital's importance for an institution's establishment in the education market is demonstrated by the explanation of its economic and marketing values (Iacuzzi et al., 2020). Intellectual capital import and export are realities of globalization processes and are regarded as being crucial to the economy of a knowledge society. Aspects like human capital, structural capital, and relational capital are crucial components of the entire intellectual capital management programme, which is a part of higher education institutions' knowledge management programmes (Stauf & Horeth, 2020). The university's customer capital and stakeholders' expertise in the field of tertiary education are becoming increasingly crucial (Kohnová & Papula, 2020). However, this research provides us with the opportunity to learn more about the trends in the importation of intellectual capital, and the elements of changes in sustainable development (de Matos Pedro et al., 2020).

Justification of Research:

An essential resource and major factor in an educational institution's economic performance and value generation is its intellectual capital (Costa & Santos, 2020). Future advantages are produced through an institution's intangible value driver known as intellectual capital. Additionally, because of how dynamic the modern environment is, education systems are always changing (Salazar-Elena et al., 2020). The educational institution's ability to quickly adjust to the changes and maintain its competitiveness in the marketplaces is a result of its intellectual capital. Intellectual capital is one of the most important components in today's competitive climate for fostering institutional growth and competitiveness (Svistunov et al., 2019). Intellectual capital is frequently defined and described in terms of adding value, boosting competitive advantage, and ensuring an organization's success (Khakimov et al., 2019). An

institution's ability to innovate and its wealth of ideas make up its intellectual capital, which has a significant impact on the educational institution's future (Sallos et al., 2019).

Intellectual capital today serves as the actual and functional capital of institutions due to its capacity to convert knowledge into value and, ultimately, a competitive advantage (Hariyati et al., 2019). As a result, focusing on ways to raise intellectual capital is one of the requirements of the modern educational institutions enhancing its intellectual capital to perform better than its competitors in areas like performance quality and flexibility in responding fast to any unexpected occurrences (Mahardhika et al., 2019).

Problem Statement:

To advance in the university's career in order to keep up with contemporary trends in higher education, the institution must make use of its existing intellectual resources in order to stay up with this progress and to meet the pressing issues since teaching over the Internet is not a novel way at Sambalpur University (Levina et al., 2019). This is due to the fact that advancing in the university's career will enable it to meet these obstacles and keep up with current trends in higher education (Minică, 2020). As a result, it distinguishes itself from its competitors from other universities. Sambalpur University needs to play a significant role in developing contemporary, multifaceted and committed quality systems and management practices higher education system (Posada-Arias et al., 2018). Additionally, Sambalpur University must create rehabilitation plans that consider alterations in the environment and rely on their own internal assets, or so-called "intellectual capital," in order to improve and strengthen their capacities and competitive advantages (Zaķe & Eiriņa, 2018).

Research Gap:

To establish a proper link between Intellectual capital management practices such as management of human capital, structural and relational capital, Education and continuing education system also the research and development leads to sustainable intellectual capital management in educational institutions. Further to show the collaboration patterns among the major three components of intellectual capital (human, structural, and relational capital) that enable various innovation processes in Sambalpur University.

Research Objectives:

1) To understand the concept and the applications of Intellectual Capital Management (ICM) in Sambalpur University.
2) To identify the key contributing factors responsible for intellectual capital management in Sambalpur University.
3) To measure the effectiveness of intellectual capital management in Sambalpur University.

Overview of Sambalpur University, Odisha

To realise a long-held desire of the people of Western Odisha for the formation of a university, the Odisha Legislature passed the Sambalpur University Act on December 10, 1966. With Prof. Parsuram Mishra serving as the first Vice-Chancellor, the university officially began operations on January 1st, 1967. The University began operations in 1967 in a rented private structure at Dhanupali, Sambalpur, and then from 1968 to 1972 it was housed in a government structure in Ainthapali, Sambalpur. The University moved to its current Burla location in 1973, where it is now known as Jyoti Vihar. Twenty Post-Graduate Departments at the University at Jyoti Vihar offer post-graduate instruction in 27 different subjects. The University Post-Graduate Departments offer a one-year study programme for the M.Phil degree, a two-year study programme for the M.A., M.Sc., LL.M., Business Administration, M.Lib. & Inf.Science degrees, a one-year P.G. diploma course in computer science & application, a diploma course in Sambalpuri Studies, a three-year course for the M.C.A., and an executive M.B.A.

The University use a semester system that is based on on-going assessment. They create their own study plans. On the university campus, there are ten post-graduate hostels, six of which are for men and four of which are for women. Numerous amenities, including a common room with a TV, a reading room with newspapers and magazines, a guest room, first aid, an STD telephone booth, etc. are provided by the university to the boarders in the hostels.

Brief introduction about various Departments in S.U:

TABLE 1

Sl. No	Name of the Departments	Year of Establishment
1	Departments Anthropology	1976
2	Biotechnology and Bioinformatics	2016
3	Business Administration	1989
4	Centre For Food Science & Technology (FST & FS)	2010
5	Chemistry	1969
6	Computer Science & Application	1988
7	Earth Science	1984
8	Economics	1971
9	Education	2017
10	English	1969
11	Environmental Science	1989
12	Hindi	2010
13	History	1969
14	Home Science	1976
15	Law	1986

Sl. No	Name of the Departments	Year of Establishment
16	Library & Information Science	1976
17	Life Science	1971
18	Mathematics	1969
19	Odia	1968
20	Physics	1969
21	Poltical Science	1967
22	Sociology	1991
23	Statistics	1976

Courses offered in Sambalpur University in Its Campus at Jyotivihar, Sambalpur, Odisha:

TABLE 2

Sl. No.	Programme	Department/Schools/Institute
1	M.A. (Anthropology)	P.G. Department of Anthropology
2	M.Sc. (Anthropology)	
3	M.Phil. (Anthropology)	
4	Ph.D. (Anthropology)	
5	M.Sc. (Biotechnology)	P.G. Department of Biotechnology And Bioinformatics
6	M.Sc. (Bioinformatics)	
7	M.Phil. (Biotechnology)	
8	Ph.D. (Biotechnology)	
9	M.B.A. (Executive)	
10	M.B.A.	
11	M.Phil. (Business Administration)	P.G. Department of Business Administration
12	Ph.D. (Business Administratio)	
13	M.Sc. (Computer Science)	P.G. Department Of Computer Science
14	M.Phil. (Computer Science)	
15	Ph.D. (Computer Science)	
16	M.Sc. (Applied Geology)	P.G. Department Of Earth Sciences
17	M.Phil. (Applied Geology)	
18	Ph.D. (Geology)	
19	M.A. (Economics)	P.G. Department Of Economics
20	M.A. (Economics)	
21	M.Phil. (Economics)	
22	Ph.D. (Economics)	
23	Integrated (P.G.) (B.Ed.-M.Ed.)	Department Of Education
24	M.A. (English)	P.G. Department Of English

Sl. No.	Programme	Department/Schools/Institute	Sl. No.	Programme	Department/Schools/Institute
25	M.Phil. (English)		59	M.Phil. (Physics)	
26	Ph.D. (English)		60	Ph.D. (Physics)	
27	M.Sc. (Environmental Science)	P.G. Department Of Environmental Sciences	61	M.A. (Political Science)	P.G. Department Of Political Science And Public Administration
28	M. Tech. (Environmental Science and Engineering)		62	M.Phil. (Political Science)	
29	M.Phil. (Environmental Science)		63	Ph.D. (Political Science)	
30	Ph.D. (Environmental Science)		64	M.P.A. (Dance)	Department Of Performing Arts
31	Ph.D. (Environmental Science and Engineering)		65	M.P.A. (Drama)	
32	M.Sc. (Food Science)	Department Of Food Science and Technology	66	Ph.D. (Education)	Dr P. M. Institute Of Advanced Study In Education Sambalpur
33	M.Tech. (Food Science and Technology)		67	M.S.W.	P.G. Department Of Social Work
34	M.A. (Hindi)	P.G. Department Of Hindi	68	M.A. (Sociology)	P.G. Department Of Sociology
35	Ph.D. (Hindi)		69	M.Phil. (Sociology)	
36	M.A. (History)		70	Ph.D. (Sociology)	
37	M.Phil. (History)	P.G. Department Of History	71	M.A. (Statistics)	P.G. Department Of Statistics
38	Ph.D. (History)		72	M.Sc. (Statistics)	
39	M.A. (Home Science)	P.G. Department Of Home Science	73	M.Phil. (Statistics)	
40	M.Sc. (Home Science)		74	Ph.D. (Statistics)	
41	M.Phil. (Home Science)		75	M.Sc. (Chemistry)	School Of Chemistry
42	Ph.D. (Home Science)		76	M.Sc. (Applied Chemistry)	
43	Ph.D. (Food Science)		77	M.Phil. (Chemistry)	
44	L.L.M.	P.G. Department Of Law	78	Ph.D. (Chemistry)	
45	M.Phil. (Law)		79	M.Sc. (Life Science)	School Of Life Science
46	Ph.D. (Law)		80	M.Sc. (Microbiology)	
47	M.Lib. & Info. Sci.	P.G. Department Of Library And Information Science	81	M.Phil. (Life Science)	
48	M.Phil. (Library Science)		82	Ph.D. (Life Science)	
49	Ph.D. (Library Science)		83	Ph.D. (Microbiology)	
50	M.A. (Mathematics)	P.G. Department Of Mathematics	84	Ph.D. (Botany)	
51	M.Sc. (Mathematics)		85	Ph.D. (Zoology)	
52	M.Phil. (Mathematics)		86	B.Tech. (Computer Science and Engineering ICS)	
53	Ph.D. (Mathematics)		87	B.Tech. (Computer Science and Engineering & AI and ML)	
54	M.A. (Odia)	P.G. Department Of Odia	88	B.Tech. (Electrical and Electronics Engineering)	
55	M.Phil. (Odia)		89	B.Tech. (Electronics and Communication Engineering)	
56	Ph.D. (Odia)		90	B.Tech. (Computer Science and Engineering)	Sambalpur University Institute Of Information
57	Ph.D. (Santali)				
58	M.Sc. (Physics)	P.G. Department Of Physics			

Sl. No.	Programme	Department/Schools/Institute
91	M.C.A.	Technology
92	M.Sc. (Computer Science)	
93	M. Tech. (Computer Science and Engineering)	
94	Ph.D. (Computer Science and Engineering)	
95	Ph.D. (Electronics)	
96	Ph.D. (Electronics Engineering)	
97	Ph.D. (Electrical and Electronics Engineering)	
98	D.Litt. (Humanities Social Science Education and Management)	Sambalpur University
99	L.L.D. (Law)	
100	D.Sc. (Science and Engineering)	

2. REVIEW OF LITERATURE:

Intellectual Capital with Human Capital:

Bontis & Serenko, 2007 stated the purpose, to propose and empirically test a model for explaining employee capacities from a knowledge-based standpoint. The findings back up the proposed model, Human capital management methods are used as a moderator variable in this model demonstrating that an employee's capabilities are influenced by his or her training and growth as well as job happiness. When employee opinions of human capital management methods are likewise strong, the model has the best predictive potential. Dzinkowski, n.d.2000 stated the objective, to conduct a value chain analysis in order to identify the parts of organizational processes and activities that contribute to the creation of value by businesses. To assist in the management of the firm's human, organizational, and customer capital, a wide range of precedent principles are currently available, such as 'Market-to-book values,' 'Tobin's 'q,' and 'Calculated intangible value,' which draw upon a broad range of disciplines and management perspectives. Endovitsky et al., 2021 stated the purpose, with the traditional educational system, to move the emphasis from learning simply the academic component to a personality-oriented, growing cognitive activity. In order to stay competitive, a person will need to choose a new application and promptly finish his or her professional competence profile. Human capital will become the primary economic resource of businesses in the age of innovation and rapid development of IT technology. New kinds of teacher-student engagement, based on the ideas of cooperation, teamwork, and expert advice, are required. It is the sensible application

of each person's potential, as well as the establishment of situations conducive to harmonious development.

Intellectual Capital with Structural Capital:

Isaac et al., 2009 The purpose of this paper is, to claim that certain structural, cultural, and climate factors will contribute to better IC management. The finding of the study was, the model developed will aid researchers in identifying and investigating aspects such as organic environmental structures, creative renewal processes, participatory decision-making systems, trust, and others that are linked to effective IC management within the organizations. J. A. Kok, n.d.2005 The goal of the research was, to look into explicit management and measurement models of intellectual capital in order to better understand how value is created and extracted. The findings show that, the management of the interaction between three components, namely Human Capital, Structural Capital, and Customer Capital, can be viewed as the management of an organization's intellectual assets, which consists of two phases. 1. Value Creation and 2. Value Extraction. A measurement model was established as the vehicle for measuring performance, which included * Marketing capitalization methods * Return on Assets methods* Scorecard methods and * Direct Intellectual Capital methods. Masoulas, 1998 Stated the purpose, to provide a foundation for the systematic management process that is necessary for the creation of future value, to have a balanced overview of a function or a business unit and to have an organizational structure that fosters a culture of trust and participation while also facilitating the process of defining individual and organizational requirements. Certain parts of participatory design must be facilitated in order to accomplish this approach, including interdisciplinary communication, requirements specification, scenario production and evaluation, systems design, and collective experience registration and management.

Intellectual Capital with Relational Capital:

Hamzah & Nazari Ismail, 2008 stated the purpose, to present empirical and theoretical evidence for the relationship between company strategy and intellectual capital management. The finding of this study was, some organizations followed their own plans, while the majority drew knowledge from other sources. They also placed a greater emphasis on building individual knowledge in order to improve the quality of their products and services. Lim & Dallimore, 2004 stated the objective, to determine whether there is a link between the importance of measuring intellectual capital indicators and the level of knowledge of these indicators. The finding of this study was, in terms of innovation, productivity, growth, enterprise competitiveness, and economic performance, intellectual capital is becoming increasingly important. Matos et al., 2017 stated the purpose, to investigate a theoretical framework that emphasizes the importance of structural capital in smart city strategic and operational planning. This study emphasizes the synergistic

ability to improve both a smart city's competitiveness and sustainability, demonstrating the advantages of merging both ideas in a common theoretical framework.

Intellectual Capital and Education, Research & development:

Córcoles, 2013 stated the purpose, to learn how important it is to university stakeholders to supplement information from financial statements with information about these institutions' intellectual capital of Spanish public universities. The findings of our empirical study enable us to criticize the existing accounting information model used by Spanish higher education institutions and to urge that the yearly accounts of universities be expanded to include information on intellectual capital as desired by various stakeholders. Finally, this empirical study determines which of the three types of intellectual capital (human, structural, and relational) is most important for publishing. Elena-Pérez et al., 2011 stated the purpose, to investigate the possibility of merging foresight techniques and intellectual capital management in higher education institutions as two approaches to participatory strategic management.. The findings show that, Universities could benefit from an integrated use of foresight and intellectual capital management, according to the idea. The case study shows how foresight is an excellent way to address the question of how to develop a shared vision of the future and jointly define a strategy to best adapt an organization to the new context, and how intellectual capital management models can help with strategic management, resource allocation, and monitoring of goals and performance.

Intellectual Capital with Sustainability:

Alvino et al., 2021 stated the purpose, to discuss whether IC can influence entrepreneurial orientation (EO) toward the creation of sustainable business models (SBMs) through the implementation of knowledge management (KM) processes, as outlined in the Sustainable Development Goals (SDGs) 2030 agenda and adopted by all UN member states in 2015. The finding of this study was, in terms of increased business performance, published research on IC in the context of sustainability focuses mostly on the measurement of results, and the IC is linked to the concept of long-term value. Huang & Kung, 2011 stated the objective, to talk about how environmental awareness and green intellectual capital influenced competitive advantage. According to the findings of the study, investing in green intellectual capital had an indirect impact on competitive advantage. As a result, it was discovered that green intellectual capital acts as a link between environmental awareness and competitive advantage. Lönnqvist et al., 2009 stated the objective, to get significant empirical data and a better understanding of the role of IC in the change process of the organization. The finding of this study was, An IC model can be a beneficial tool for change management as it ensures that the change content is aligned with the organization's strategic goals.

3. RESEARCH METHODOLOGY:

The research approach that will be applied in this study is detailed in this chapter. Both the population and the study's design are discussed. The tools to be utilized for data collection and the techniques to be applied for data analysis are also discussed.

4. RESEARCH DESIGN:

To achieve the project's goals, this research is being done to gather both primary and secondary data. The research is both exploratory and descriptive in nature. When gathering data on people's views, opinions, behaviours, or any other range of educational or societal difficulties, etc., this methodology is ideal. The study was conducted at Sambalpur University in Odisha using this approach of information gathering, which involves interviewing or giving a questionnaire to a sample of people in order to make conclusions and obtain complete knowledge and to meet the stated objectives.

5. SCOPE:

The current study's focus is solely on Sambalpur University's assessment of intellectual capital management using a multi-criteria approach.

6. DATA SOURCE:

The information for the study has been gathered from both primary and secondary sources. The primary data were acquired through structured questionnaires, and secondary data came from official websites, journals, publications, etc.

7. METHOD OF DATA COLLECTION:

Sambalpur University's teaching faculty and research scholars were given standardized questionnaires to complete in order to collect the data. A total of 130 questionnaires were distributed to the respondents, and 113 were deemed complete enough to be used in the study.

8. SAMPLING AND DATA COLLECTION:

To gather the information for the study, a questionnaire was created. Five people from Sambalpur University took the survey as a trial project. It was altered prior to administration as a result of the pilot test.

9. SAMPLE SIZE:

Out of a total of 130 questionnaires that were disseminated due to time and accessibility restrictions, 120 questionnaires were actually received from various Sambalpur University departments. The investigation was carried out using 113 genuine questionnaires that were selected from this population.

10. RESEARCH INSTRUMENTS:

The main tool for this study is questionnaire. The questionnaire aims to gather information about respondent's demographic background, perception regarding the ICM in Sambalpur University, Odisha.

11. METHOD OF DATA ANALYSIS:

The information gathered from the questionnaire responses is examined. Descriptive statistics like Mean, Standard Deviation, and Factor Analysis are the primary statistical techniques used in this study (In SPSS-26 Version).

Sample Size and proportionate representation of population:

Population on the basis of gender

TABLE No-3

Male	Female	N (Population size)
61	52	113

Data Analysis and Interpretation:

In addition to the analysis against demographic variables, the collected data was examined against five broad parameters, including Intellectual Property - Human Capital, Structural Capital, Relational Capital, Core Processes - Education and Continuing Education, Research and Development, Output and Impact of Core Processes - Research and Development, as discussed below.

Reliability Test:

TABLE 4

Reliability Statistics	
Cronbach's Alpha	N of Items
0.916	23

Interpretation:

According to reliability statistics, the Cronbach's Alpha value is (0.916), which is recognized as a good value. We can therefore assume that the study's Intellectual Capital is reliable for further research.

Factors determining effective Intellectual Capital Management in Sambalpur University:

Numerous statistical techniques, including factor analysis, Kaiser-Meyer-Olkin, and Bartlett's tests, have been used to pinpoint the elements that contribute to successful ICM practises at Sambalpur University. Following a thorough literature search to identify the factors that influence effective ICM Practices, a list of 23 variables has been chosen. These 23 variables have been given codes, as shown in Table-5.

TABLE-5: List of variables and the assigned codes:

Statement No.	Statements	Variable Codes
1	The recruitment and selection	Human_Capital
	process is transparent and fair in the University	-1
2	Every faculty member and every student is given the assistance and direction they need for their professional development	HC-2
3	New employees and scholars receive necessary guidance and support on regular basis	HC-3
4	Employees/Scholars are highly qualified and competent candidates	HC-4
5	Funding for initiatives in your department that advance gender equality and affirmative action for Women	Structural_Capital-1
6	Funding for the advancement of gender-specific	SC-2
	education, research /development, and faculty promotion in the Department	
7	Any cost associated with the department's accessible online research databases	SC-3
8	Cost associated with the accessibility of any journals by the Department	SC-4
9	Funding for large equipment for research and development in the Department	SC-5
10	There is sufficient cooperation between Faculties & Research Scholars who work for various projects and research works	Relational_Capital-1
11	There is good team spirit among the partner institutions /enterprises incorporated in cooperation agreements in the university	RC-2
12	Good achievers are openly acknowledged, and they receive appropriate awards	RC-3
13	The staffs & students are satisfied with the support receive from	RC-4

Statement No.	Statements	Variable Codes
	Library activities	
14	Total number of academic programs offered by the department are sufficient for the university	Education_And _Contin uing_Education -1
15	Sufficient number of students enroll in the department each year	ECE-2
16	Success rate of master's, M. Phil., Ph. D., and other degree programs in the department is satisfactory	ECE-3
17	Sufficient number of students from Odisha & from outside Odisha/Abroad take part in different programs conducted by your Department per year (incoming/Outgoing)	ECE-4
18	Sufficient number of researchers (Ph.D. Scholars) funded by R&D projects	Research And Development-1
19	The ongoing projects for research and development are supported by third-party funds	RD-2
20	There is open recognition for good performers and respective rewards	RD-3
21	The department gets sufficient number of awarded doctoral degrees each year	Output_Educati on-1
22	Good number of publications are done by the faculties and the research scholars every year	OECE-2
23	Sambalpur University is a good choice for career growth	OECE-3

In order to identify the key determinants of successful ICM practices at Sambalpur University, a factor utilizing the Principal Component Analysis with Varimax rotation was performed on the 23 variables that were so selected and detailed above.

Table-5 provides a summary of the Factor Analysis's findings. But first, the sample adequacy was examined using the test procedures developed by KMO and Bartlett, which are presented in Table-6. Before doing the factor analysis,

additional prerequisites such as commonalities, total variance, and rotated component matrix were also examined using the data shown in Tables-7 and 8 respectively.

Test of sample adequacy:

KMO and Bartlett's test has been used to analyze the sample suitability of the data gathered. The sample adequacy result is displayed in Table 6.

TABLE 6

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.852
Bartlett's Test of Sphericity	Approx. Chi-Square	1509.988
	df	253
	Sig.	.000

According to Table 6, KMO and Bartlett's test, the sample adequacy value of 0.852 and the Chi-Square value of 1509.988 are both statistically significant at a 95% confidence level.

This suggests that the concept can be adequately explained by the 23 variables of ICM. To explain the distinctive qualities of ICM's component parts, the sample distribution is also normal.

Test of communalities:

The test of communalities has been carried out to analyze the variances. The differences in the ICM components are explained in Table-7 under the heading "Communalities."

TABLE 7: Communalities

Communalities		
	Initial	Extraction
The recruitment and selection process is transparent and fair in the University	1.000	.572
Every faculty member and every student is given the assistance and direction they need for their professional development	1.000	.712
New employees and scholars receive necessary guidance and support on regular basis	1.000	.673
Employees/Scholars are highly qualified and competent	1.000	.639

candidates		
Funding for initiatives in your department that advance gender equality and affirmative action for women	1.000	.660
Funding for the advancement of gender-specific education, research /development, and faculty promotion in the Department	1.000	.715
Any cost associated with the department's accessible online research databases	1.000	.652
Cost associated with the accessibility of any journals by the Department	1.000	.667
Funding for large equipment for research and development in the Department	1.000	.785
There is sufficient cooperation between Faculties & Research Scholars who work for various projects and research works	1.000	.722
There is good team spirit among the partner institutions/ enterprises incorporated in cooperation agreements in theuniversity	1.000	.668
Good achievers are openly acknowledged, and they receive appropriate awards	1.000	.617
The staffs & students are satisfied with the support receive from Library activities	1.000	.738
Total number of academic programs offered by the department are sufficient for the university	1.000	.608
Sufficient number of students enroll in the department each year	1.000	.735
Success rate of master's, M. Phil., Ph. D., and other degree programs in the department is satisfactory	1.000	.656
Sufficient number of students from Odisha & from outside	1.000	.627

Odisha/Abroad take part in different programs conducted by your Department per year (incoming/Outgoing)		
Sufficient number of researchers (Ph.D. Scholars) funded by R&D projects	1.000	.647
The ongoing projects for research and development are supported by third-party funds	1.000	.682
There is open recognition for good performers and respective rewards	1.000	.736
The department gets sufficient number of awarded doctoral degrees each year	1.000	.547
Good number of publications are done by the faculties and the research scholars every year	1.000	.753
Sambalpur University is a good choice for career growth	1.000	.701
Extraction Method: Principal Component Analysis.		

According to the above table, the variance of 23 variables that are beneficial to ICM varies from 0.547 to 785.

TABLE-8: Total Variance Explained

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.328	36.210	36.210	4.526	19.679	19.679
2	2.725	11.850	48.060	4.156	18.069	37.748
3	2.117	9.205	57.265	3.387	14.725	52.473
4	1.209	5.257	62.521	2.221	9.656	62.129
5	1.133	4.927	67.449	1.223	5.319	67.449
6	1.398	6.991	60.334	1.433	7.163	60.334
Extraction Method: Principal Component Analysis.						

The study's factor analysis was extracted using a fixed number of factors i.e. 6. The total frequency of the five-factor extracted sum of squared loadings is 67.449. The aforementioned table reveals that the 23 variables and five major factors each have significant individual values of 19.679, 37.748, 52.473, 62.129, 67.449 and 60.334. This

demonstrates unequivocally that all five primary elements exist, each with its own varying loadings.

Further, Table-9 shows the Rotated Component Matrix for factorisation of variables.

Rotated component matrix:

As shown in Table-9, the Rotated Component Matrix has been used to factorise the 23 variables.

TABLE 9: Rotated Component Matrix:

Component Matrix^a						
	Component					
	1	2	3	4	5	6
The recruitment and selection process is transparent and fair in the University	.733	-.285	-.155	.374	-.208	.072
Every faculty member and every student is given the assistance and direction they need for their professional development	.822	.176	.059	.584	.483	.105
New employees and scholars receive necessary guidance and support on regular basis	.682	.119	-.359	.247	-.062	.116
Employees/Scho lars are highly qualified and competent candidates	.667	.037	-.362	.168	-.184	-.559
Funding for initiatives in your department that advance gender equality and affirmative action for women	.069	.651	-.417	.249	.004	.067
Funding for the advancement of gender-specific education, research /development, and faculty promotion in the Department	.055	.670	-.476	-.058	.014	.234
Any cost associated with the department's accessible online research databases	.027	.644	-.434	-.123	-.150	-.052
Cost associated with the accessibility of any journals by the Department	-.056	.650	-.321	-.349	-.068	-.042
Funding for large equipment for research and development in the Department	.063	.740	-.042	-.371	.087	.000
There is sufficient cooperation between Faculties & Research Scholars who work for various projects and research works	.017	-.282	.717	-.336	.030	.031
There is good team spirit among the partner institutions /enterprises incorporated in cooperation agreements in the university	-.378	-.428	.655	.055	.159	.400
Good achievers are openly acknowledged, and they receive appropriate awards	.214	-.288	.577	.060	.182	.232
The staffs & students are satisfied with the support receive from Library activities	.120	-.369	.621	.002	.296	-.641
Total number of academic programs offered by the department are sufficient for the university	-.035	-.271	.256	.667	.150	.152
Sufficient number of students enroll in the department each year	-.013	-.057	.394	.688	-.312	.351
Success rate of master's, M. Phil., Ph. D., and other degree programs in the department is satisfactory	.067	.019	.441	.642	-.206	-.135

Sufficient number of students from Odisha & from outside Odisha/Abroad take part in different programs conducted by your Department per year (incoming/Outgoing)	-.330	.341	.426	**.552**	-.135	-.174
Sufficient number of researchers (Ph.D. Scholars) funded by R&D projects	-.373	.389	.321	-.066	**.624**	.063
The ongoing projects for research and development are supported by third-party funds	.142	.504	.224	.177	**.548**	.142
There is open recognition for good performers and respective rewards	-.075	.542	.055	.236	**.578**	-.012
The department gets sufficient number of awarded doctoral degrees each year	.379	.580	-.084	-.040	.243	**.916**
Good number of publications are done by the faculties and the research scholars every year	.500	.637	-.129	-.072	.276	**.898**
Sambalpur University is a good choice for career growth	.250	.574	-.155	-.246	.475	**.873**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table-9 indicates that variables coded as Human Capital-1, HC-2, HC-3 and HC-4 have been clubbed together as the first major factor of ICM. Similarly, the variables coded as Structural Capital-1, SC-2, SC-3, SC-4 and SC-5 have been merged as the second component of ICM. Furthermore, the variables coded as Relational Capital-1, RC-2, RC-3 and RC-4 have been group together as the third essential factor of ICM. Likewise, the variables coded as Education and Continuing Education-1, ECE-2, ECE-3 and ECE-4 have been clubbed together as the fourth prime factor of ICM.

Similarly, the variables coded as Research and Development-1, RD-2 and RD-3 have been clubbed together as the fifth prime factor of ICM. Finally, the variables coded as Output Education-1, OECE-2 and OECE-3 have been merged as the fifth factor of ICM.

Identification of attributes:

The factors extracted through Rotated Component Matrix have been rearranged in the Table-10 with their attributes.

TABLE 10: Principal factors along with attributes:

Sl. No.	Principal factors	Variable No.	Factor score					
1.	**Human Capital**	Human_Capital-1	.733					
		HC-2	**.822**					
		HC-3	**.682**					
		HC-4	**.667**					
		Structural_Capital-1		.651				
		SC-2		.670				
2.	**Structural Capital**	SC-3		.644				
		SC-4		.650				
		SC-5		.740				
3.	**Relational Capital**	Relational_Capital-1			.717			
		RC-2			.655			
		RC-3			.577			
		RC-4			.621			
4.	**Core Processes as Education and Continuing Education**	Education_And_Continuing_Education-1				.667		
		ECE-2				.688		
		ECE-3				.642		
		ECE-4				.552		
5.	**Research and Development**	Research And Development-1					.624	
		RD-2					.548	
		RD-3					.578	
6.	**Output and**	Output_Education-1						.916

Impact of Core Processes as Research and Development	OECE-2						.898
	OECE-3						.873

Source: Extracted from Table-9

According to the aforementioned data, Sambalpur University's ICM practices are influenced by six key elements. These include **(i) Human Capital as Intellectual Property, (ii) Structural Capital, (iii) Relational Capital, (iv) Core Processes as Education and Continuing Education, (v) Research and Development, and (vi) Output and Impact of Core Processes as Research and Development.**

12. FINDINGS:

The outcome of the present study is as follows:

- Effective intellectual capital management practices are necessary for the individual and the institutional growth, which was evidenced from the **Review of Literature**.

- The contributions of ICM practices are essential for the smooth flow of the work in Sambalpur University, which was evidenced from **Rotated Component Matrix of Factor Analysis,** where the values for each component are found to be **more than 0.5.**

- Effective training and development programs, satisfying the demands of employees, providing authority on their work, and organizational culture are found to be the most important factors which influence intellectual capital management practices in Sambalpur University, which was evidenced from the test of **principal component factor analysis, where the KMO Value is 0.852.**

13. CONCLUSION

In the actual stage of knowledge era, educational institutions need to gain and maintain their competitive advantage and one of the feasible ways is through their Intellectual Capital Management, which is the root of all institutional activities (Lapygin & Makarov, 2019). As Intellectual capital is one of the most crucial management functions, Sambalpur University needs to take action to close its gaps, such as timely recruitment and selection, task assignment for the right people in the right jobs, adoption of new technology for easy and timely work to be done, etc., and ensure that the processes involved are properly followed (Wudhikarn, 2018). The success of institutions strongly depends on the way they manage all facets of knowledge and skills that creates value and give the sustainable competitive advantage (Matos et al., 2018). Therefore, to cope up with innovation and competitiveness, identifying, measuring, and managing intellectual capital is essential for Sambalpur University.

The ability to find, keep, and develop the most talented workers on the educational institutions especially in Sambalpur University is a key component of effective intellectual capital management (Wang, 2022). Again, the study's findings imply that Sambalpur University staff members and the research scholars who understood the necessity for a mind-set shift and desired formal education in order to keep up with contemporary technology advancements financed themselves to learn these abilities (Wudhikarn & Pongpatcharatorntep, 2022).

14. RESEARCH LIMITATIONS:

The survey was conducted in a single university, namely Sambalpur University, and it was limited to this region alone. Collecting data from the faculty members and research researchers was challenging due to their busy schedules. The study was completed within a constrained time period. Additionally, the study's sample size was too small to permit the use of any complex statistical analysis; hence, additional research is needed to understand more about the relationships between HRM and ICM in different other educational institutions and universities.

Possibilities for future research:

1. Further research of similar kind may be conducted by taking different other Universities (Government, Private and Deemed Universities etc.) present in Odisha and India will aid value to the kind of study which may be tried in future research.

2. Future research should compare each aspect of green IC—green human, green structural, and green relational capital—with the six aspects of green HRM (green recruitment, selection, training, performance management, pay & reward, and involvement) in order to take sustainability, performance, and competitive advantage into account.

REFERENCES

[1.] Abeysekera, I. (2007). Intellectual capital reporting between a developing and developed nation. *Journal of Intellectual Capital*, *8*(2), 329–345. https://doi.org/10.1108/14691930710742871

[2.] Authors, F. (2012). *The performance of intellectual capital Mobilising relationships between intellectual.* https://doi.org/10.1108/09513571111139120

[3.] Authors, F. (2014). *Creating value from intellectual assets.* https://doi.org/10.1108/14691930810870319

[4.] Bamel, U., & Giudice, M. Del. (2020). *The extent and impact of intellectual capital research : a two decade analysis.* https://doi.org/10.1108/JIC-05-2020-0142

[5.] Bamel, U., Pereira, V., Del Giudice, M., & Temouri, Y. (2022). The extent and impact of intellectual capital research: a two decade analysis. *Journal of Intellectual Capital*, *23*(2),

375–400. https://doi.org/10.1108/JIC-05-2020-0142

[6.] Bellucci, M., Marzi, G., Orlando, B., & Ciampi, F. (2021). Journal of Intellectual Capital: a review of emerging themes and future trends. *Journal of Intellectual Capital*, *22*(4), 744–767. https://doi.org/10.1108/JIC-10-2019-0239

[7.] Benevene, P., Buonomo, I., Kong, E., Pansini, M., & Farnese, M. L. (2021a). *Management of Green Intellectual Capital : Evidence-Based Literature Review and Future Directions*. 1–22.

[8.] Benevene, P., Buonomo, I., Kong, E., Pansini, M., & Farnese, M. L. (2021b). Management of green intellectual capital: Evidence-based literature review and future directions. *Sustainability (Switzerland)*, *13*(15). https://doi.org/10.3390/su13158349

[9.] Bornemann, M., Alwert, K., & Will, M. (2021). Lessons learned in intellectual capital management in Germany between 2000 and 2020 – History, applications, outlook. *Journal of Intellectual Capital*, *22*(3), 560–586. https://doi.org/10.1108/JIC-03-2020- 0085

[10.] Castro, G. M., Díez-vial, I., & Delgado-verde, M. (2019). *Intellectual capital and the firm : evolution and research trends*. *20*(4), 555–580. https://doi.org/10.1108/JIC-12-2018-0221

[11.] Chaminade, C., & Johanson, U. (2003). Can guidelines for intellectual capital management and reporting be considered without addressing cultural differences? *Journal of Intellectual Capital*, *4*(4), 528–542. https://doi.org/10.1108/14691930310504545

[12.] Costa, R. V, Fernández-jardon, C., & Dorrego, F. (2014). *Critical elements for product innovation at Portuguese innovative SMEs : an intellectual capital perspective. April*, 322–338. https://doi.org/10.1057/kmrp.2014.15

[13.] Costa, R. V, & Santos, A. (2020). Describing the process of creating an intellectual capital management framework: An interventionist case study. *Knowledge and Process Management*, *27*(1), 43–52. https://doi.org/10.1002/kpm.1619

[14.] Crupi, A., Cesaroni, F., & Di Minin, A. (2020). Understanding the impact of intellectual capital on entrepreneurship: a literature review. *Journal of Intellectual Capital*, *22*(3), 528–559. https://doi.org/10.1108/JIC-02-2020-0054

[15.] Danvila-del-Valle, I., Estévez-Mendoza, C., & Lara, F. J. (2019). Human resources training: A bibliometric analysis. *Journal of Business Research*, *101*, 627–636. https://doi.org/10.1016/j.jbusres.2019.02.026

[16.] De Matos Pedro, E., Alves, H., & Leitão, J. (2022). In search of intangible connections: intellectual capital, performance and quality of life in higher education institutions. *Higher Education*, *83*(2), 243–260. https://doi.org/10.1007/s10734-020-00653-9

[17.] De Matos Pedro, E., Leitão, J., & Alves, H. (2020). Bridging intellectual capital, sustainable development and quality of life in higher education institutions. *Sustainability (Switzerland)*, *12*(2). https://doi.org/10.3390/su12020479

[18.] Dzinkowski, R. (n.d.). *The Measurement and Management of Intellectual Capital: An Introduction*. https://www.researchgate.net/publication/247931350

[19.] Elena-Pérez, S., Saritas, O., Pook, K., & Warden, C. (2011). Ready for the future? Universities' capabilities to strategically manage their intellectual capital. *Foresight*, *13*(2), 31–48. https://doi.org/10.1108/14636681111126238

[20.] Faraji, O., Asiaei, K., Rezaee, Z., Bontis, N., & Dolatzarei, E. (2022). Mapping the conceptual structure of intellectual capital research: A co-word analysis. *Journal of Innovation and Knowledge*, *7*(3). https://doi.org/10.1016/j.jik.2022.100202

[21.] Fedorova, A., & Ponomareva, O. (2017). *Developing university hr potential as the basis for its intellectual capital* (L. I.T., S. R., & S. R. (Eds.); Vols. 2017-April, pp. 97–105). Academic Conferences Limited.

[22.] Galeitzke, M., Steinhöfel, E., Orth, R., & Kohl, H. (2015). Strategic intellectual capital management as a driver of organisational innovation Strategic intellectual capital management. In *Int. J. Knowledge and Learning* (Vol. 10, Issue 2).

[23.] Gogan, L. M., Artene, A., Sarca, I., & Draghici, A. (2016). The Impact of Intellectual Capital on Organizational Performance. *Procedia - Social and Behavioral Sciences*, *221*, 194–202. https://doi.org/10.1016/j.sbspro.2016.05.106

[24.] Gogan, L.-M., Rennung, F., Fistis, G., & Draghici, A. (2014). A Proposed Tool for Managing Intellectual Capital in Small and Medium Size Enterprises. *Procedia Technology*, *16*, 728–736. https://doi.org/10.1016/j.protcy.2014.10.022

[25.] Habib, M., Abbas, J., & Noman, R. (2019). Are human capital, intellectual property rights, and research and development expenditures really important for total factor productivity? An empirical analysis. *International Journal of Social Economics*, *46*(6), 756–774. https://doi.org/10.1108/IJSE-09-2018-0472

[26.] Hamzah, N., & Nazari Ismail, M. (2008). *The Importance of Intellectual Capital Management in the Knowledge-based Economy* (Vol. 4, Issue 3).

[27.] Huang, C. L., & Kung, F. H. (2011). Environmental consciousness and intellectual capital management: Evidence from Taiwan's manufacturing industry. *Management Decision*, *49*(9), 1405–1425. https://doi.org/10.1108/00251741111173916

[28.] Hurtado, M., & Viedma, J. M. (2017). *Healthcare analytics in oncology: A framework to improve competitive advantage on healthcare* (B.-M. J., M.-M. M., B. R., B. R., M. F., & B.-M. J. (Eds.); Vol. 2, pp. 1107–1116). Academic Conferences Limited.

[29.] Isaac, R. G., Herremans, I. M., & Kline, T. J. B. (2009). Intellectual capital management: Pathways to wealth creation. *Journal of Intellectual Capital*, *10*(1), 81–92. https://doi.org/10.1108/14691930910922914

[30.] Kasztler, A., & Leitner, K.-H. (2002). Bibliometric analysis and visualisation of intellectual capital. *Journal of Universal Computer Science*, *8*(5), 516–525.

[31.] Khan, S. Z., Qing, Y., & Khan, N. U. (2019). *Impact of intellectual capital management on sustainable competitive advantage via business model innovation*. 212–216. https://doi.org/10.1145/3312662.3312688

[32.] Kong, E. (2007). *The strategic importance of intellectual capital in the non-profit sector*.

[33.] *8*(4), 721–731. https://doi.org/10.1108/14691930710830864

[34.] Kramin, T. V, Fatkhiev, A. M., Timiryasova, A. V, & Kochetkova, N. V. (2015). Model of intellectual capital management at universities, based on transactional approach. *Asian Social Science*, *11*(11), 148–154. https://doi.org/10.5539/ass.v11n11p148

[35.] Lee, S. H. (2010). Using fuzzy AHP to develop intellectual capital evaluation model for assessing their performance contribution in a university. *Expert Systems with Applications*, *37*(7), 4941–4947. https://doi.org/10.1016/j.eswa.2009.12.020

[36.] Lentjušenkova, O., & Lapiņa, I. (2020). An integrated process-based approach to intellectual capital management. *Business Process Management Journal*, *26*(7), 1833– 1850. https://doi.org/10.1108/BPMJ-03-2019-0101

[37.] Lin, C., Wang, C. Y. P., Wang, C. Y., & Jaw, B. S. (2017). The role of human capital management in organizational competitiveness. *Social Behavior and Personality*, *45*(1), 81–92. https://doi.org/10.2224/sbp.5614

[38.] Lin, W. (2011). *Does ownership structure affect firm value ? Intellectual capital across industries perspective*. https://doi.org/10.1108/14691931111181724

[39.] Lönnqvist, A., Kianto, A., & Sillanpää, V. (2009). Using intellectual capital management for facilitating organizational change. *Journal of Intellectual Capital*, *10*(4), 559–572. https://doi.org/10.1108/14691930910996643

[40.] Matos, F., Vairinhos, V. M., Dameri, R. P., & Durst, S. (2017). Increasing smart city competitiveness and sustainability through managing structural capital. *Journal of Intellectual Capital*, *18*(3), 693–707. https://doi.org/10.1108/JIC-12-2016-0141

[41.] Matos, F., Vairinhos, V., & Godina, R. (2020). Reporting of intellectual capital management using a scoring model. *Sustainability (Switzerland)*, *12*(19), 1–19. https://doi.org/10.3390/su12198086

[42.] Matos, F., Vairinhos, V. M., Dameri, R. P., & Durst, S. (2017). Increasing smart city competitiveness and sustainability through managing structural capital. *Journal of Intellectual Capital*, *18*(3), 693–707. https://doi.org/10.1108/JIC-12-2016-0141

[43.] Navas-lo, E., Martı, G., & Alama-salazar, E. (2001). *Organizational capital as competitive advantage of the firm*. https://doi.org/10.1108/14691930610681438

[44.] O, K. J., Schulte Jr Harry F Byrd Jr, W. D., & Schulte Jr, W. (2007). Models for human capital management: human resource management of intellectual capital. In *Int. J. Learning and Intellectual Capital* (Vol. 4, Issue 4).

[45.] Paoloni, P., Modaffari, G., & Mattei, G. (2020). *Knowledge resources in the university context : an overview of the literature context*. https://doi.org/10.1108/JIC-01-2020- 0010

[46.] Parthenope, N., Alvino, F., Vaio, A. Di, & Palladino, R. (2019). *Intellectual capital and sustainable development : a systematic literature review development*. https://doi.org/10.1108/JIC-11-2019-0259

[47.] Pradhan, B. B. (2019). Review on intellectual capital management. *International Journal of Psychosocial Rehabilitation*, *23*(6), 541–546. https://doi.org/10.37200/IJPR/V23I6/PR190806

[48.] Quintero-Quintero, W., Blanco-Ariza, A. B., & Garzón-Castrillón, M. A. (2021). Intellectual capital: A review and bibliometric analysis. *Publications*, *9*(4). https://doi.org/10.3390/publications9040046

[49.] Roos, G., Bainbridge, A., & Jacobsen, K. (n.d.). INTELLECTUAL CAPITAL ANALYSIS AS A STRATEGIC TOOL AUTHORS. In *Strategy and Leadership Journal* (Vol. 29).

[50.] Samaibekova, Z., Zaid, S. S. M., Molchanova, A., & Rybakova, A. (2019). Managing the intellectual potential in the higher education system. *Terra Economicus*, *17*(4), 174–189. https://doi.org/10.23683/2073-6606-2019-17-4-174-189

[51.] Santis, F. De, & Giuliani, M. (2013). *A look on the other side : investigating intellectual liabilities*. https://doi.org/10.1108/14691931311323850

[52.] Ståhle, P., & Bounfour, A. (2008). Understanding dynamics of intellectual capital of nations. *Journal of Intellectual Capital*, *9*(2), 164–177. https://doi.org/10.1108/14691930810870283

[53.] Sucena, A., Matos, F., & Nunes, A. (2022). *Intellectual Capital and Performance: A Case Study of Construction Companies*. *23*(2), 1165–1174. https://doi.org/10.34190/eckm.23.2.703

[54.] Tamošiūnienė, R., & Survilaitė, S. (2016). Assessment of intellectual capital in joint-stock companies. *Business: Theory and Practice*, *17*(1), 56–64. https://doi.org/10.3846/btp.2016.686

[55.] Tan, H. P., Plowman, D., & Hancock, P. (2008). *The evolving research on intellectual capital*. *9*(4), 585–608. https://doi.org/10.1108/14691930810913177

[56.] Volná, J., Kohnová, L., Bohdalová, M., & Holienka, M. (2015). *Innovative mindset and management styles: An intellectual capital approach* (R. V. & W. L. (Eds.); Vols. 2015-January, pp. 316–323). Academic Conferences and Publishing International Limited.

[57.] Wang, P. (2022). A study on the intellectual capital management over cloud computing using analytic hierarchy process and partial least squares. *Kybernetes*, *51*(6), 2089–2108. https://doi.org/10.1108/K-03-2021-0241

[58.] Westnes, P. (2003). *Evaluating intellectual capital in the hotel industry*. *4*(3), 287–303. https://doi.org/10.1108/14691930310487761

[59.] Wiig, K. M. (n.d.). *Integrating Intellectual Capital and Knowledge Management*.

[60.] Wu, A. (2005). *The integration between Balanced Scorecard and intellectual capital*. *6*(2), 267–284. https://doi.org/10.1108/14691930510592843

[61.] Wu, H.-Y., Chen, J.-K., & Chen, I.-S. (2010). Innovation capital indicator assessment of Taiwanese Universities: A hybrid fuzzy model application. *Expert Systems with Applications*, *37*(2), 1635–1642. https://doi.org/10.1016/j.eswa.2009.06.045

[62.] Zaķe, L., & Eiriņa, J. (2018). *Identification and internal evaluation of intellectual capital elements at universities*. 7196–7208. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85063029858&partnerID=40&md5=3b78c9150a658c8aaa19cf472ca2946e

[63.] Zangoueinezhad, A., & Moshabaki, A. (2009). The role of structural capital on competitive intelligence. *Industrial Management and Data Systems*, *109*(2), 262–280. https://doi.org/10.1108/02635570910930136

[64.] Zhou, A. Z., & Fink, D. (2000). *The intellectual capital web capital and knowledge management*. *1997*. https://doi.org/10.1108/14691930310455379

Exploring the Interplay between Green HRM, Organisational Culture and Social Responsibility in Driving Performance Outcome

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ABSTRACT

Purpose - This paper aims to explore the relationship between Green Human Resource Management (GHRM) practices and organisational performance, emphasising the mediating roles of organisational culture and social responsibility.

Design/methodology/approach – To conceptualise the theoretical framework of the study, a Scopus database was utilised to source research papers published in indexed journals. Relevant keywords were identified, and a comprehensive literature search was conducted on topics such as Green HRM practices, organisational performance (OP), organisational culture (OC) and social responsibility (SR). The literature review aimed to explore the connections and potential for developing an integrated model. The primary focus was on elucidating the significance of green HRM practices on organisational performance with the mediating effect of organisational culture and social responsibility.

Findings – Organizational performance can be improved economically and socially by implementing green HRM practices with the integration of organisational culture and social responsibility within the organisation. An individual practising green behaviour can promote environmental sustainability. Green HRM practices are one of the vital conventions for enhancing organisational performance in a greener way.

Practical Implication - Organisations can cultivate a culture that prioritises sustainability and social responsibility by strategically integrating GHRM principles into their policies and procedures, as suggested through this study. Organisations can improve employee commitment, satisfaction, and overall performance by integrating GHRM with more general CSR aims. For the validation of the proposed model, empirical analysis is required.

Originality/value - The study adds to the extant literature of GHRM by proposing a new integrated model that illustrates the relationship between Green human resource management and organisational performance.

Keywords Green HRM, Organisational Culture, Social Responsibility, Organisational performance, Sustainability.

Paper type Conceptual paper

1. INTRODUCTION

Sustainability has emerged as a critical issue for all firms in today's global economic environment. A crucial component of organisational strategy, green human resource management (GHRM) has emerged as a result of the pressing need to address environmental challenges and the growing awareness of their importance (Hameed et al., 2020). As a result of the industrial revolution's damage to the environment, nations are progressively growing and, at the same time, increasingly worried about the impending environmental problems (Ahmed et al., 2021). Thus, motivating organisations to focus on sustainable development is the need of the hour. It is said that because stakeholders and academics have been forcing businesses to plan their operations with the consideration of the environmental, social, and economic outcomes, greening the organisation's management and philosophy has become

imperative (Ni et al., 2023a). The tendency of organisations to get rid of industrial waste and the consequential dangers has drawn attention as environmental concerns have compelled companies to implement ecologically sustainable procedures (Acquah et al., 2021). Also, concentrate on how they perform sustainably to enhance environmental performance. The academic community is now giving green strategies considerable consideration (Aftab et al., 2023a). As a result, experts are now concentrating more on talking about the green business phenomenon as a whole. Green finance, green innovation, green creativity, and, most importantly, green HRM are a few examples (Anwar, 2020). Through various approaches, GHRM aims to incorporate environmental factors into human resource policies and processes. Green hiring, eco-friendly training programs, ecologically sensitive performance reviews, and motivating staff members to take part in green projects are some examples of these approaches (Aukhoon et al., 2024b).

Organisations that implement GHRM practices have the potential to improve their overall performance and make a positive environmental impact. Ghouri et al., (2020) Asserts that an organisation's HR division plays a critical role in accomplishing the goals and objectives of sustainable development. Recent studies that examined the relationship between green HR practices and environmental management are accessible in the green literature (Burlea-Schiopoiu et al., 2022; Correia et al., 2024). For example, it examined the effects of green training, compensation, and hiring. Added gender and age so they could better understand employees' sustainable motivation in the Portuguese setting.

The study aimed to explore the relationship between Green Human Resource Management (GHRM) practices and organisational performance, emphasising the mediating roles of organisational culture and social responsibility (Correia et al., 2024). Financial performance, employee satisfaction, innovation, and operational efficiency are all aspects of organisational performance, an essential metric for success. Traditional Human Resource Management (HRM) strategies have been thoroughly researched for their impact on organisational performance. However, the exact effects of GHRM practices are unknown. There is a rising need to understand how GHRM practices can improve organisational performance and the mechanisms by which they do so. Organisational culture and social responsibility are two significant aspects that can substantially impact the implementation and success of GHRM practices (Eccles et al., 2011). Organisational culture refers to the shared values, attitudes, and standards that influence behaviour inside an organisation. A culture that values sustainability and environmental responsibility can aid in successfully implementing GHRM principles. Conversely, social responsibility demonstrates an organisation's commitment to ethical behaviour and to societal well-being (Dani et al., 2006). Organisations that value social responsibility are more likely to integrate GHRM practices, resulting in improved organisational outcomes successfully (Ziyadeh et al., 2024). These studies stressed the significance of green HRM in promoting organisational performance. This study aims to address existing gaps in the green literature. According to the authors' literature examination, no studies have examined organisational culture and social responsibility factors with Green HR and Environmental Performance. El Baroudi et al., (2023) developed the notion of green intrinsic and extrinsic motivation to assess employees' green creativity. Understanding employee motivation for green HRM practices is crucial for improving organisational performance. Second, the concept of green HRM practices was not explored in conjunction with proactive organisational performance in both the aspects of the financial and social outcome, while it was studied with green human resource management towards sustainable performance with the mediating role of green innovation and risk management (Aukhoon et al., 2024; Correia et al., 2024). It is necessary to assess the effect of green HRM

practices on organisational performance in a greening way to accomplish the main target of green activities to achieve sustainable development goals (Gilal et al., 2019; Jabbour & De Sousa Jabbour, 2016). Consequently, assessing how green HRM practices Cultivate a Sustainable Culture and Enhance Social Responsibility for Improved Organisational Performance is essential. Despite the potential importance of GHRM, organisational culture, and social responsibility, there is a significant gap in the existing research regarding their interrelationships and combined impact on organisational performance. Most studies have focused on the environmental benefits of GHRM, often ignoring its broader implications for organisational success.

In summary, this study examines how organisational culture and social responsibility are affected by green HR practices. It also provides further details on the function of the factors affecting an employee's organisational performance within the organisation. Consequently, this study becomes more significant and adds to the body of green literature. This study aims to fill these gaps by investigating the direct impact of GHRM practices on organisational performance and examining the mediating roles of organisational culture and social responsibility (Jackson et al., 2011; Renwick et al., 2013a). By doing so, the research seeks to provide a comprehensive understanding of how GHRM practices can be leveraged to achieve superior organisational outcomes. It is critical to integrate sustainable HRM practices with organisational culture and social responsibility to improve performance and further larger societal objectives.

2. CONCEPTUAL FRAMEWORK

2.1. Green Human resource management practices

Recently, there has been a lot of interest in the idea of Green Human Resource Management (GHRM), particularly as businesses look to incorporate sustainable practices into their daily operations. GHRM is putting green HR policies and practices into practice with the goal of encouraging sustainability in business (Renwick et al., 2013). This strategy seeks to improve an organisation's environmental performance and organisational performance while encouraging a sustainable and socially conscious work culture among its staff. The broader environmental movement, which gained traction in the latter half of the 20th century, has developed with the idea of GHRM (Hameed et al., 2020). The notion of GHRM evolved alongside the more significant environmental movement, which gained traction in the late twentieth century. Most early environmental management initiatives were reactive in nature, concentrating on following rules and minimising adverse environmental effects. However, corporations started to take more proactive and strategic measures as awareness of global environmental challenges, including pollution, resource depletion, and climate change, increased (Yafi et al., 2021). The introduction of sustainable development principles promoted the incorporation of environmental factors into strategic

planning, especially after the Brundtland Report in 1987. The emergence of corporate social responsibility (CSR) and the realisation that sustainable business practices could result in long-term financial gains and competitive advantage served as additional catalysts for this change (Ghouri et al., 2020).

This assertion finds support in the resource-based view (RBV) of the firm (Barney, 1991), which posits that resources that are special, valuable, and nonreplicable, like a dedicated workforce, can confer a competitive advantage. GHRM practices can be viewed as a tactical instrument for cultivating such resources. The Resource-Based View Theory provides support for the conceptual framework that was built to examine the relationship between variables. This theory was introduced by Barney (1991). It includes the three key competencies—pollution avoidance, product stewardship, and sustainable development—that a business needs to attain environmental sustainability. RBV theory can assist in fostering a sustainable organisational culture in organisations. Many scholars (Aftab et al., 2023b; Ahmed et al., 2021; Ni et al., 2023b) have expanded upon this theory within the framework of GHRM. They propose that green training tries to increase employee's environmental awareness and capabilities, green recruitment, looks for people who care about the environment and green performance management, which integrates environmental goals into performance reviews (Renwick et al., 2013). While green involvement offers many possibilities for employees to engage in environmental management tasks, green performance and green awards concentrate on inspiring green personnel. Zaid et. al (2018) suggested that GHRM practices act in groups to have a significant impact on organizational performance to match environmental objectives with HR policies.

(Aggarwal & Agarwala, 2023; Macduffie, 1995) suggested that unique combinations of HR practices arrangements of complementing individual HR strategies work together to improve organizational performance. Thus, green HR practices work together to provide a synergistic effect that improves organizational performance. According to Tang et. al. (2018), GHRM also incorporates green reward programs that motivate and promote worker's contributions to sustainability objectives. Long-term environmental goals can only be attained by implementing these practices since they contribute to the development of an organizational culture of sustainability.

In order to determine the overall impact of these activities on organizational performance, we would thus additionally take into account a package of five green HR practices. Consequently, the GHRM practices include the following five several eco-friendly HR techniques:

1.   Green Recruitment and Selection. Attracting and employing people who care about the environment and have the abilities required to help the company

achieve its sustainability objectives (Gilal et al., 2019).

2.   Green training and development. This program aims to increase staff members' comprehension of environmental and green concerns and teach them various techniques for cutting waste and energy consumption within the company (Xie & Zhu, 2020).

3.   Green performance management. Incorporating environmental standards into performance reviews and rewarding staff members who help the company achieve its sustainability goals (Abedelrahim et al., 2024).

4.   Green compensation & rewards. It is a system of financial incentives (cash prizes) and nonfinancial incentives (acclaim, awards, and recognition) for those who support environmental management objectives (Fawehinmi et al., 2020).

5.   Employee Involvement. Encouraging employees to participate in environmental management programs and including them in sustainability efforts (Moradeke et al., 2021).
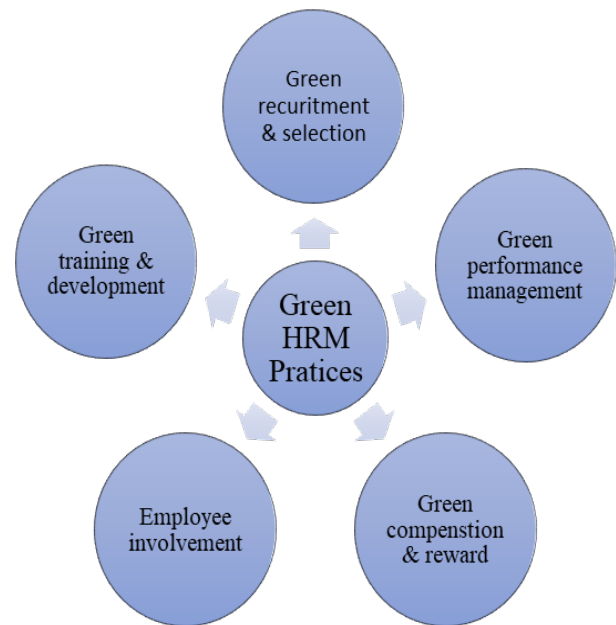
2.2. Green Organizational Culture

In general, OC serves as a catalyst to convert the goals of GHRM activities into observable environmental results. Organizations may use GHRM to dramatically enhance their environmental performance and increase employee engagement by cultivating a culture that values sustainability. Aggarwal & Agarwala, (2023) defined organizational culture encompasses the shared values, beliefs, and practices within an organization that prioritizes

environmental sustainability. The authors define OC as a culture that integrates green values into the organizational framework, influencing how employees think, behave, and engage with environmental initiatives. According to Harris & Crane (2002) organisational culture is described as the degree to which an organization's beliefs, symbols, and artifacts represent its commitment to conducting business in an ecologically sustainable manner. Green culture makes possible the acceptance of any environmental change within the company. Organisational culture helps to achieve the sustainable performance of the organization by adopting and facilitating the eco-friendly activities within the organization to satisfy the stakeholders and customers.

Organisational culture can be (Harris & Crane, 2002) explored in the framework of social identity theory (SIT) proposed by Ashforth & Mael (1989). According to this theory, individuals divide themselves into groups to develop eco-friendly habits. Such as Encouraging the use of energy-efficient lighting, turning off equipment when not in use. Applying this idea to the setting of organizations, OC is produced when people in the organization act and interact in a way that has a beneficial impact on the surroundings (Simpson & Samson, 2010).

Harris & Crane, (2002) created a three-dimensional model of sustainable organisational culture that takes the degree, diffusion and depth of different organisational practices and activities. The degree dimension is the measure of a manager's perception of how important green values are found in the relics of the organization. The adoption of green values by all organizational departments is part of the diffusion dimension of cultural greening. It focuses on how widely green practices have been adopted within the company. The depth component of culture focuses on how widely green practices have been adopted within the company. The individual adoption of green ideals by each member of the organization is the focus of the depth component of cultural greening.

Organizational culture also promotes the idea that it can provide an organization with a competitive edge by relying on the tenets of the resource-based view (RBV) theory (Wang, 2019). In order to show how a company is likely to gain a competitive edge by creating valuable, unique, uncommon, and ordered resources, Barney (1991) first suggested the RBV theory. Green culture also seeks to provide the company with a competitive edge by creating intangible assets that are difficult for competitors to copy.

2.3. Organisational Performance

Georgopoulos & Tannenbaum (1957) was first described as an organizational performance is a firm's combined performance on several aspects such as financial, environmental, social, and ethical grounds. Numerous aspects of organisational performance and GHRM practices have been found to be positively correlated by empirical

research As per Jabbour (2015) Research, companies that adopted all-encompassing GHRM policies witnessed enhancements in their corporate image, employee contentment, and operational efficiency. The improvement in organisational resilience and adaptation, when confronted with environmental difficulties, is a result of the alignment of environmental and commercial goals.

Long-term organisational effectiveness, "Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment," according to the US Environmental Protection Agency (He et al., 2023). OP stands for its long-term ability to satisfy the demands and expectations of its stakeholders and clients (Garske & Ekardt, 2021). Hubbard (2009) suggested combining an organisational sustainability performance indicator with a stakeholder-based sustainable balance scoring card. According to Freeman & Phillips (2023) stakeholder theory of sustainability, an organisation is perceived as having multiple responsibilities for a broader range of groups, including employees, the government, trade associations, the environment, customers, suppliers, and so on. This index streamlines the measurement process and helps compare performance over time. It has become a novel instrument for assessing organisational performance in light of this. It claims that a dynamic business environment is necessary to achieve sustainable performance in the rapidly evolving economies of today (Farao et al., 2023). Businesses must adapt quickly to the market's changing needs and take the initiative to change with it. Accordingly, OP stipulates that the "needs of the future generation should be satisfied without compromising the present needs. Many businesses have come to understand that innovation in services, goods, and procedures may be achieved with the help of sustainability (Islam et al., 2023). The goal of environmental protection can be accomplished when organisations stay loyal to their moral and ecological principle. The organisation established an eco-friendly mindset and methodology in response to a stakeholder's request for greener behaviour to be ingrained through green HRD practices. With clear environmental objectives, green HRD practices can effectively orient employees toward green practices and support the sustainable performance of the firm (Ghouri et al., 2020).

3. RELATIONSHIP BETWEEN GREEN HRM PRACTICES AND ORGANIZATIONAL CULTURE AND ORGANISATIONAL PERFORMANCE

Over the past ten years, organisations have been more interested in environmental preservation (Ahmed et al., 2021). According to Rawashdeh (2018), it has pushed businesses to embrace green practices, which can provide them with a long-term competitive edge (Tang et al., 2018). The Department of Human Resources aids in the development of green culture (Muisyo & Qin, 2021) by

influencing workers' attitudes and behaviours via its policies (Amini et al., 2018). Green HR procedures serve as a spur to track, lessen, and control the negative effects of business establishments in the surrounding area. According to Attaianese (2012), these procedures encourage pro-environmental efforts within the company, which aid in the growth and promotion of OC. Green recruitment is one of the five green HR strategies that aid in attracting workers to the company who are friendly to the environment (Zaid et al., 2018). It backs this by introducing new hires to the organisation's environmental activities and the environmentally conscious culture of the company. These workers receive green training that encourages environmentally conscious ideals.

Green conduct inside the company is encouraged with the use of green performance management. Green rewards encourage this habit. A greener workplace culture is reinforced when we involve staff members and provide them with enough opportunities to contribute to ecological campaigns. Therefore, these procedures complement one another to reduce the organisation's environmental impact and foster a green culture (Muisyo & Qin, 2021). The interplay between GHRM practices, organisational culture, and social responsibility is critical to understanding how these factors contribute to long-term organisational performance. In order to maintain an organisation's commercial operations, it is necessary to adopt a triple-bottom-line approach that considers its environmental, social, and economic performance(Elkington, 1998; Tiwari, 2015). When businesses work to become more environmentally friendly, they can achieve triple-bottom-line performance (Jackson et al., 2011). An organisation's supply chain, production process, waste management, and human resource management are all impacted when it becomes green. Strategic and managerial aspects, and developing a sustainable organisational culture (Benevene & Buonomo, 2020). It is clear to see green human resource management practices have a substantial correlation with organisational performance since they enable businesses to achieve the ideal combination of environmental preservation and economic prosperity (Chen et al., 2020). environmental impact and encourage an eco-friendly culture inside the company (Muisyo & Qin, 2021). Additionally supporting this claim is research by (Roscoe et al., 2019), which demonstrated that when workers collaborate to address environmental issues, it results in the development of the organisation's pro-environmental culture (Porter et al., 2016) proved that. Green organisational development is the result of implementing sustainable practices. The organisation's culture. Suggested that three important factors depth, diffusion, and degree are necessary for the success of green culture. (Harris & Crane, 2002) Green HR practices are deeply ingrained in the three dimensions, contributing significantly to putting the organisation's green culture into practice (Porter et al., 2016). Considering the aforementioned literature, the current investigation attempts to assess the following connections.

Hypothesis 1: GHRM practices have a significant effect on organisational performance.

Hypothesis 2: Organizational culture significantly mediates the relationship between GHRM practices and organisational performance.

4. RELATIONSHIP BETWEEN GREEN HRM PRACTICES AND SOCIAL RESPONSIBILITY AND ORGANISATIONAL PERFORMANCE

Putting GHRM practices into effect improves the organisation's standing as a socially conscious one. It conveys to interested parties that the business is dedicated to lessening its environmental impact and making a constructive contribution to society d(Daily & Huang, 2001). When an organisation places a high priority on social responsibility and environmental sustainability, its employees are likely to feel proud to work there (Jerónimo et al., 2020). Green Human Resource Management is a vital aspect of modern organisational strategy that aligns human resource practices with environmental sustainability goals. Its implementation enhances the organisation's social responsibility and contributes to employee satisfaction, cost savings, and compliance with regulations. As businesses continue to recognise the importance of sustainability, GHRM will play a crucial role in driving positive environmental and social outcomes.

(Mehta & Chugan, 2015; Mishra et al., 2014) acknowledge additional advantages, including enhanced employee understanding of social responsibility and the ability to attract and retain skilled personnel. (Boons et al., 2013; Wang, 2019) asserted, in fact, that there is proof that businesses that made investments in social responsibility saw observable improvements in terms of excellent staff recruitment, customer and employee satisfaction, and innovation factors that are likely to strengthen a firm's social performance. According to Carroll (1991), Corporate social responsibility (CSR) initiatives aid in an organisation's reputation-building and brand-image enhancement. Long-term success depends on greater consumer loyalty and trust, both of which are facilitated by a positive reputation. Companies that engage in corporate social responsibility (CSR) tend to attract customers who favour companies that exhibit social responsibility. This may result in greater sales and client retention rates, which would eventually boost organisational success (Ziyadeh et al., 2024).

A competitive advantage in the market can be obtained through CSR. Businesses that are acknowledged for their social responsibility initiatives may set themselves apart from rivals, resulting in a rise in market share and profitability. Companies that place a high priority on corporate social responsibility typically have happier and more engaged staff members. Workers who support social and environmental concerns are more likely to feel proud of

their employer and stick with them, which can lower attrition and related expenses (Dani et al., 2006, 2006).

By building strong ties with stakeholders, including the community, the government, and investors, SR efforts can support an organisation's long-term viability. Better overall performance and a more stable operating environment may result from this. Several studies indicate that good CSR practices can result in better financial outcomes despite the fact that the relationship between CSR and financial success can be complicated. This entails more shareholder value, lower costs, and better profitability (Maas & Reniers, 2014).

Organisations can reduce their exposure to unfavourable public perception, regulatory scrutiny, and even legal challenges by tackling social and environmental issues. This proactive strategy may result in operations that are more sustainable and stable. As per the existing literature, it is argued that that social responsibility is closely linked to organisational performance through its impact on reputation, customer loyalty, employee engagement, risk management, and overall sustainability (Eccles et al., 2011). Organisations that effectively integrate CSR into their business strategies are likely to experience enhanced performance and competitive advantages in their respective markets. Thus, based on the literature study mentioned above, we suggest the following relationship.

Theoretical Framework
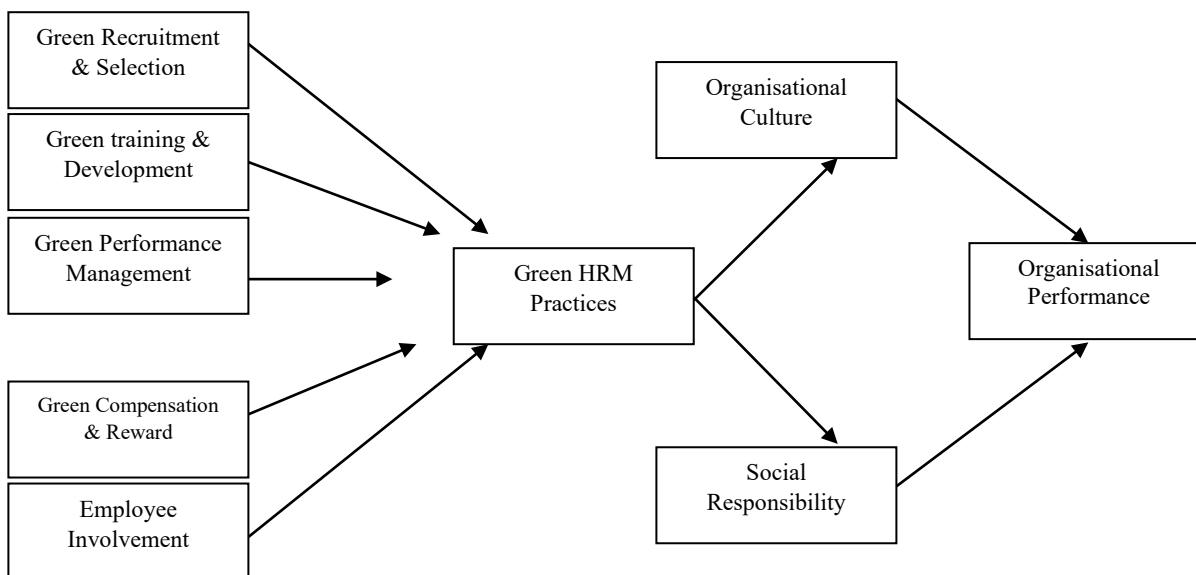
Source: Author's creation

Hypothesis 3: Organizational culture significantly mediates the relationship between GHRM practices and organisational performance.

A conceptual model that illustrates the proposed connections between GHRM practices, corporate culture, social responsibility, and organisational performance will be created based on the literature review. This model will graphically represent the mediating impacts of the cultural and social responsibility components. Based on the literature review, the theoretical framework integrates the Resource-based view (RBV) and stakeholder theory to understand how GHRM practices enhance organisational performance. Evaluation metrics include employee engagement, environmental performance, financial outcome, social identity theory, and how social responsibility enhances organisational reputation among these stakeholders. The proposed model suggests that a strong organisational culture and a commitment to social responsibility amplify the positive effects of GHRM on performance. Expected outcomes indicate that organisations adopting GHRM practices, underpinned by robust cultural and social responsibility frameworks, will experience improved sustainability and competitive advantage.

5. RESEARCH METHODOLOGY

To investigate the relationship between Green Human Resource Management (GHRM) practices and organisational performance, this study takes a conceptual approach, taking organisational culture and social responsibility into account as mediating factors. The study will be grounded in widely recognised theories of HRM, environmental sustainability, and organisational behaviour. According to the resource-based view (RBV) theory, businesses can obtain a competitive edge by utilising resources that are rare, valuable, unique, and non-replaceable (VRIN). By encouraging employee creativity and participation, GHRM

practices can support VRIN resources by promoting environmental sustainability and better performance. GHRM policies can foster an environmental responsibility culture within the firm, improving performance. Natural Resource Dependence theory suggests that organisations that depend on natural resources are more inclined to embrace ecologically sustainable practices. Social Identity theory contends that people get significance by belonging to a specific group. A robust corporate culture that prioritises environmental stewardship has the potential to impact employee conduct and enhance overall performance.

6. DATA COLLECTION

This research is conceptual, and data will be acquired through a detailed evaluation of existing literature. This will involve academic databases such as pertinent peer-reviewed papers and articles on GHRM, organisational culture, social responsibility, and organisational performance. Scholarly databases such as ScienceDirect, Emerald Insight, EBSCO, and JSTOR have been consulted. Also, books and book Chapters are accessed to comprehend the theoretical foundations and current research trends thoroughly.

7. THEORETICAL IMPLICATIONS

This study emphasises how crucial it is to incorporate GHRM into the more extensive Strategic Human Resource Management (SHRM) framework. Competitive advantage and efficiency are frequently highlighted in traditional SHRM theories. GHRM practices, however, highlight the need for a sustainable HRM strategy that synchronises environmental aims with business objectives (Renwick et al., 2013a). Because of this integration, HRM is viewed more holistically, with environmental sustainability emerging as a key strategic element. This work adds to the organisational theory's cultural perspective by highlighting organisational culture as a mediator. GHRM practices are an addition to (Hogan & Coote, 2014).

The model of corporate culture consists of artefacts, stated ideals, and fundamental underlying assumptions. These behaviours have the potential to both impact and be impacted by an organisation's culture, indicating a reciprocal relationship in which environmental activities both shape and are moulded by culture (Dani et al., 2006; Suderman, 2012). Stakeholder theory gains additional meaning when social responsibility is included as a mediator between GHRM and corporate success. Stakeholder theory developed by (Freeman & Phillips., 2023) asserts that companies must consider the interests of all parties involved, not just shareholders. Improved stakeholder interactions and improved organisational performance can result from GHRM strategies that strengthen an organisation's social responsibility (Carroll, 1991). This demonstrates how modern corporate management must balance both moral and financial considerations.

The Environmental, Social, and Governance (ESG) criteria, used more often to assess organisational performance, are placed in a larger context for GHRM in this study. According to the theoretical framework, GHRM practices strengthen the connections between the various ESG components by supporting social responsibility and environmental sustainability (Eccles et al., 2011). This intersectionality thoroughly explains how GHRM practices might promote sustainable performance across various dimensions. This research contributes to the theoretical discourse on the impact of GHRM practices by putting out a multi-level analytical methodology. It implies that these practices affect employee behavior and attitudes at the micro level as well as organisational performance at the macro level (Jackson et al., 2011). Future studies on the cascade impacts of GHRM from individual to organisational outcomes are encouraged by this multi-level perspective. According to Barney (1991), the company's resource-based view (RBV) asserts that precious, uncommon, unique, and non-substitutable resources provide a firm with a durable competitive advantage. By suggesting that GHRM practices might be viewed as strategic resources due to their influence on corporate culture and social responsibility, this research expands on the RBV. They strengthen the company's capacity to address stakeholder and environmental concerns, which helps it maintain a competitive edge(Hart, 1995). This conceptual analysis concludes by emphasising the importance of including GHRM practices in an organisation's fundamental strategic and cultural frameworks. Doing these advances larger societal and environmental objectives and improves business performance.

8. PRACTICAL IMPLICATION

Several practical implications for businesses, HR professionals, and policymakers arise from the conceptual investigation of the relationship between Green Human Resource Management (GHRM) practices and organisational performance, with an emphasis on the mediating roles of organisational culture and social responsibility, first for organisations to improve organisational performance and environmental sustainability, GHRM practices should be incorporated into their overall strategic goals. According to Renwick et al. (2013), this entails incorporating green policies into programs for employee engagement, performance management, training, and recruitment. For example, companies might prefer hiring applicants who firmly commit to sustainability and offer ongoing training on best practices for the environment. Second, building an environmental sustainability-focused business culture is essential to maximising the benefits of GHRM activities. Leaders can model eco-friendly habits, and companies should recognise and honour green milestones and accomplishments (Carroll, 1991). Employee commitment to environmental goals and morale can rise due to this cultural transformation, improving performance. Third, Employing GHRM techniques can help organisations make their CSR

initiatives stronger. Projects aimed at including the community, environmentally friendly supply chain management, and open reporting on the effects on the environment can all be part of this (Aggarwal & Agarwala, 2023; Carroll, 1991). By doing this, businesses can forge closer bonds with stakeholders, enhance their reputation, and draw in more investors and consumers who respect sustainability. By bringing organisational values into line with those of environmentally conscious employees, GHRM practices can increase employee engagement and retention (Suderman, 2012). Fourth, Employers can encourage staff members and recognise their contributions to sustainability initiatives by implementing green rewards and recognition programs. Significant cost reductions and operational efficiencies can result from using GHRM practices. Among the strategies that can reduce operating costs include waste reduction initiatives, energy-efficient practices, and sustainable resource management (Daily & Huang, 2001). A positive feedback loop of ongoing development can be established by reinvesting these savings into other sustainability projects. By implementing GHRM principles, firms can remain ahead of the curve regarding sustainability and environmental regulations. By ensuring adherence to present legislation and preparing businesses for upcoming rules, this proactive strategy lowers the possibility of legal repercussions and improves long-term profitability (Delmas & Toffel, 2008). HR professionals should promote and create policies supporting GHRM practices within their companies. According to (Renwick et al., 2013a), Examples of this include creating green job descriptions, adding sustainability objectives to performance reviews, and providing opportunities for environmental management-focused professional development. Driving the sustainability agenda and making sure it's incorporated into every facet of the company can be significantly aided by HR departments. HR, operations, marketing, finance, and other divisions must work together to execute GHRM practices effectively. To ensure that sustainability goals are in line with more general business objectives, organisations should form cross-functional teams to design and manage green initiatives (Daily & Huang, 2001). This cooperative strategy can result in more creative fixes and a more coordinated push to achieve environmental sustainability.

9. LIMITATION AND FUTURE SCOPE OF RESEARCH

Despite offering a thorough conceptual framework that connects GHRM practices with organisational success, this research needs to present empirical validation. Theoretical presumptions and body of research inform the suggested linkages and mediating roles of social responsibility and organisational culture, which may not adequately represent the subtleties and complexity of actual organisational contexts. There may be context-specific elements that restrict the suggested framework's generalizability. Businesses of different sizes, in various areas, and with other organisational

cultures sometimes have somewhat different social responsibility policies. The generalizability of the results is limited since what is effective in one environment might not be in another. Future studies may examine additional potential mediators and moderators; however, this work concentrates on company culture and social responsibility as mediators. For instance, a more comprehensive knowledge of the relationship between GHRM and performance can be obtained by looking at the roles of leadership styles, employee engagement, and external stakeholder pressures. Future research on GHRM techniques' long-term effects on organisational performance is warranted. Insights into how persistent GHRM initiatives affect organisational results and whether initial gains are retained or increased over time can be gained from longitudinal research, which can monitor changes over time. Studies ought to investigate how GHRM practices affect advocacy on behalf of organisations and public policy. Establishing a supportive environment for sustainable HRM practices will require determining how laws and industry standards might help or impede GHRM projects.

10. CONCLUSION AND DISCUSSION

GHRM stands for a comprehensive strategy that incorporates environmental sustainability into human resource management. Organisations can increase their overall performance and minimise their ecological footprint by promoting a culture of sustainability and social responsibility. Understanding how organisational culture, social responsibility, and GHRM practices interact is essential to determining how these components support long-term organisational performance. The proposed study investigates these connections to show how GHRM practices affect organisational performance and provide helpful advice for managers looking to improve their companies' sustainability initiatives. The study also emphasises how crucial it is to incorporate GHRM practices to promote an environmentally conscious culture inside the organisation, which can positively impact the environment. Previous research has demonstrated that organisational culture is the best indicator of organisational success. On an individual level, social responsibility can lead to a change in behaviour toward the environment and a green attitude, which can be reflected in an employee's work and personal life. Implementing green practices through employees' actions, behaviours, and practices significantly positively influences the environment, employer, and employee and can become standard operating procedures. Green HRM practices help employees feel more connected to the environment, making them more productive and less likely to give up on sustaining the organisation's sustainability.

REFERENCE

[1.] Abedelrahim, S., Qassim, A. A., & Alatawi, F. M. H. (2024). Green Practices in Action: Examining HRM's Role in Fostering Environmental Performance in Egypt's Hospitality

Sector. *Sustainability*, *16*(8), 3314. https://doi.org/10.3390/su16083314

[2.] Acquah, I. S. K., Agyabeng-Mensah, Y., & Afum, E. (2021). Examining the link among green human resource management practices, green supply chain management practices and performance. *Benchmarking: An International Journal*, *28*(1), 267–290. https://doi.org/10.1108/BIJ-05-2020-0205

[3.] Aftab, J., Abid, N., Cucari, N., & Savastano, M. (2023a). Green human resource management and environmental performance: The role of green innovation and environmental strategy in a developing country. *Business Strategy and the Environment*, *32*(4), 1782–1798. Scopus. https://doi.org/10.1002/bse.3219

[4.] Aggarwal, P., & Agarwala, T. (2023). Relationship of green human resource management with environmental performance: Mediating effect of green organizational culture. *Benchmarking*, *30*(7), 2351–2376. Scopus. https://doi.org/10.1108/BIJ-08-2021-0474

[5.] Ahmed, M., Guo, Q., Qureshi, M. A., Raza, S. A., Khan, K. A., & Salam, J. (2021). Do green HR practices enhance green motivation and proactive environmental management maturity in hotel industry? *International Journal of Hospitality Management*, *94*, 102852. https://doi.org/10.1016/j.ijhm.2020.102852

[6.] Amini, M., Bienstock, C. C., & Narcum, J. A. (2018). Status of corporate sustainability: A content analysis of Fortune 500 companies. *Business Strategy and the Environment*, *27*(8), 1450–1461. https://doi.org/10.1002/bse.2195

[7.] Anwar, N. (2020). Green Human Resource Management for organisational citizenship behaviour towards the environment and environmental performance on a university campus. *Journal of Cleaner Production*.

[8.] Ashforth, B. E. & Mael. (n.d.). *Social Identity Theory and the Organization*.

[9.] Attaianese, E. (2012). A broader consideration of human factor to enhance sustainable building design. *Work*, *41*, 2155–2159. https://doi.org/10.3233/WOR-2012-1020-2155

[10.] Aukhoon, M. A., Iqbal, J., & Parray, Z. A. (2024a). Corporate social responsibility supercharged: Greening employee behavior through human resource management practices and green culture. *Evidence-Based HRM: A Global Forum for Empirical Scholarship*. https://doi.org/10.1108/EBHRM-11-2023-0312

[11.] Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

[12.] Benevene, P., & Buonomo, I. (2020). Green Human Resource Management: An Evidence-Based Systematic Literature Review. *Sustainability*, *12*(15), 5974. https://doi.org/10.3390/su12155974

[13.] Boons, F., Montalvo, C., Quist, J., & Wagner, M. (2013). Sustainable innovation, business models and economic performance: An overview. *Journal of Cleaner Production*, *45*, 1–8. https://doi.org/10.1016/j.jclepro.2012.08.013

[14.] Burlea-Schiopoiu, A., Shoukat, M. H., Shah, S. A., Ahmad, M. S., & Mazilu, M. (2022). The Sustainability of the Tobacco Industry in the Framework of Green Human Resources Management. *Sustainability*, *14*(9), 5671. https://doi.org/10.3390/su14095671

[15.] Carroll, A. B. (1991). The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Business Horizons*, *34*(4), 39–48. https://doi.org/10.1016/0007-6813(91)90005-G

[16.] Chen, Y., Lin, S., Lin, C., Hung, S., Chang, C., & Huang, C. (2020). Improving green product development performance from green vision and organizational culture perspectives. *Corporate Social Responsibility and Environmental Management*, *27*(1), 222–231. https://doi.org/10.1002/csr.1794

[17.] Correia, A. B., Farrukh Shahzad, M., Moleiro Martins, J., & Baheer, R. (2024). Impact of green human resource management towards sustainable performance in the healthcare sector: Role of green innovation and risk management. *Cogent Business & Management*, *11*(1), 2374625. https://doi.org/10.1080/23311975.2024.2374625

[18.] Daily, B. F., & Huang, S. (2001). Achieving sustainability through attention to human resource factors in environmental management. *International Journal of Operations & Production Management*, *21*(12), 1539–1552. https://doi.org/10.1108/01443570110410892

[19.] Dani, S. S., Burns, N. D., Backhouse, C. J., & Kochhar, A. K. (2006). The Implications of Organizational Culture and Trust in the Working of Virtual Teams. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, *220*(6), 951–960. https://doi.org/10.1243/09544054JEM415

[20.] Delmas, M. A., & Toffel, M. W. (2008). Organizational responses to environmental demands: Opening the black box. *Strategic Management Journal*, *29*(10), 1027–1055. https://doi.org/10.1002/smj.701

[21.] Eccles, R. G., Ioannou, I., & Serafeim, G. (2011). The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1964011

[22.] El Baroudi, S., Cai, W., Khapova, S. N., & Jiang, Y. (2023). Green human resource management and team performance in hotels: The role of green team behaviors. *International Journal of Hospitality Management*, *110*. Scopus. https://doi.org/10.1016/j.ijhm.2023.103436

[23.] Elkington, J. (1998). Partnerships from *cannibals with forks: The triple bottom line of 21st-century business*. *Environmental Quality Management*, *8*(1), 37–51. https://doi.org/10.1002/tqem.3310080106

[24.] Farao, C., Bernuzzi, C., & Ronchetti, C. (2023). The Crucial Role of Green Soft Skills and Leadership for Sustainability: A Case Study of an Italian Small and Medium Enterprise Operating in the Food Sector. *Sustainability*, *15*(22), 15841. https://doi.org/10.3390/su152215841

[25.] Fawehinmi, O., Yusliza, M. Y., Mohamad, Z., Noor Faezah, J., & Muhammad, Z. (2020). Assessing the green behaviour of academics: The role of green human resource management and environmental knowledge. *International Journal of Manpower*, *41*(7), 879–900. Scopus. https://doi.org/10.1108/IJM-07-2019-0347

[26.] Freeman, R. E., & Phillips, R. A. (2023). Stakeholder Theory: A Libertarian Defense. In S. D. Dmytriyev & R. E. Freeman (Eds.), *R. Edward Freeman's Selected Works on Stakeholder Theory and Business Ethics* (Vol. 53, pp. 157–174). Springer International Publishing. https://doi.org/10.1007/978-3-031-04564-6_7

[27.] Garske, B., & Ekardt, F. (2021). Economic policy instruments for sustainable phosphorus management: Taking into account climate and biodiversity targets. *Environmental Sciences Europe*, *33*(1), 56. https://doi.org/10.1186/s12302-021-00499-7

[28.] Georgopoulos, B. S., & Tannenbaum, A. S. (1957). A Study of Organizational Effectiveness. *American Sociological Review*,

[29.] Ghouri, A. M., Mani, V., Khan, M. R., Khan, N. R., & Srivastava, A. P. (2020). Enhancing business performance through green human resource management practices: An empirical evidence from Malaysian manufacturing industry. *International Journal of Productivity and Performance Management*, *69*(8), 1585–1607. https://doi.org/10.1108/IJPPM-11-2019-0520

[30.] Gilal, F. G., Ashraf, Z., Gilal, N. G., Gilal, R. G., & Channa, N. A. (2019). Promoting environmental performance through green human resource management practices in higher education institutions: A moderated mediation model. *Corporate Social Responsibility and Environmental Management*, *26*(6), 1579–1590. Scopus. https://doi.org/10.1002/csr.1835

[31.] Hameed, Z., Khan, I. U., Islam, T., Sheikh, Z., & Naeem, R. M. (2020). Do green HRM practices influence employees' environmental performance? *International Journal of Manpower*, *41*(7), 1061–1079. https://doi.org/10.1108/IJM-08-2019-0407

[32.] Harris, C., & Crane, A. (2002). The greening of organizational culture: Management views on the depth, degree and diffusion of change. *Journal of Organizational Change Management*, *15*(3), 214–234. https://doi.org/10.1108/09534810210429273

[33.] Hart, S. L. (1995). A Natural-Resource-Based View of the Firm. *The Academy of Management Review*, *20*(4), 986. https://doi.org/10.2307/258963

[34.] He, W., Mushtaq, N., & Jan, L. (2023). Unlocking the dual black box of GHRMP & EGOC for sustainable environmental performance in developing economies: Can green workplace behavior and green passion transmit the real change? *Environment, Development and Sustainability*, *26*(6), 16025–16055. https://doi.org/10.1007/s10668-023-03286-x

[35.] Hogan, S. J., & Coote, L. V. (2014). Organizational culture, innovation, and performance: A test of Schein's model. *Journal of Business Research*, *67*(8), 1609–1621. https://doi.org/10.1016/j.jbusres.2013.09.007

[36.] Hubbard, G. (2009). Measuring organizational performance: Beyond the triple bottom line. *Business Strategy and the Environment*, *18*(3), 177–191. https://doi.org/10.1002/bse.564

[37.] Islam, M. A., Jantan, A. H., Yusoff, Y. M., Chong, C. W., & Hossain, M. S. (2023). Green Human Resource Management (GHRM) Practices and Millennial Employees' Turnover Intentions in Tourism Industry in Malaysia: Moderating Role of Work Environment. *Global Business Review*, *24*(4), 642–662. https://doi.org/10.1177/0972150920907000

[38.] Jabbour, C. J. C. (2015). Environmental training and environmental management maturity of Brazilian companies with ISO14001: Empirical evidence. *Journal of Cleaner Production*, *96*, 331–338. https://doi.org/10.1016/j.jclepro.2013.10.039

[39.] Jabbour, C. J. C., & De Sousa Jabbour, A. B. L. (2016). Green Human Resource Management and Green Supply Chain Management: Linking two emerging agendas. *Journal of Cleaner Production*, *112*, 1824–1833. https://doi.org/10.1016/j.jclepro.2015.01.052

[40.] Jackson, S. E., Renwick, D. W. S., Jabbour, C. J. C., & Muller-Camen, M. (2011). State-of-the-Art and Future Directions for Green Human Resource Management: Introduction to the Special Issue. *German Journal of Human Resource Management: Zeitschrift Für Personalforschung*, *25*(2), 99–116. https://doi.org/10.1177/239700221102500203

[41.] Jerónimo, H. M., Henriques, P. L., Lacerda, T. C. D., Da Silva, F. P., & Vieira, P. R. (2020). Going green and sustainable: The influence of green HR practices on the organizational rationale for sustainability. *Journal of Business Research*, *112*, 413–421. https://doi.org/10.1016/j.jbusres.2019.11.036

[42.] Maas, S., & Reniers, G. (2014). Development of a CSR model for practice: Connecting five inherent areas of sustainable business. *Journal of Cleaner Production*, *64*, 104–114. https://doi.org/10.1016/j.jclepro.2013.07.039

[43.] Macduffie, J. P. (1995). Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry. *ILR Review*, *48*(2), 197–221. https://doi.org/10.1177/001979399504800201

[44.] Mehta, K., & Chugan, P. K. (2015). Green HRM in Pursuit of Environmentally Sustainable Business. *Universal Journal of Industrial and Business Management*, *3*(3), 74–81. https://doi.org/10.13189/ujibm.2015.030302

[45.] Mishra, R. K., Sarkar, S., & Kiranmai, J. (2014). Green HRM: Innovative approach in Indian public enterprises. *World Review of Science, Technology and Sustainable Development*, *11*(1), 26. https://doi.org/10.1504/WRSTSD.2014.062374

[46.] Moradeke, F. T., Ishola, G. K., & Okikiola, O. L. (2021). Green Training and Development Practices on Environmental Sustainability: Evidence from WAMCO PLC. *Journal of Educational Management & Social Sciences*, *1*(2), 1–19. https://doi.org/10.48112/jemss.v1i2.212

[47.] Muisyo, P. K., & Qin, S. (2021). Enhancing the FIRM'S green performance through green HRM: The moderating role of green innovation culture. *Journal of Cleaner Production*, *289*, 125720. https://doi.org/10.1016/j.jclepro.2020.125720

[48.] Ni, L., Ahmad, S. F., Alshammari, T. O., Liang, H., Alsanie, G., Irshad, M., Alyafi-AlZahri, R., BinSaeed, R. H., Al-Abyadh, M. H. A., Abu Bakir, S. M. M., & Ayassrah, A. Y. A. B. A. (2023a). The role of environmental regulation and green human capital towards sustainable development: The mediating role of green innovation and industry upgradation. *Journal of Cleaner Production*, *421*, 138497. https://doi.org/10.1016/j.jclepro.2023.138497

[49.] Porter, T. H., Gallagher, V. C., & Lawong, D. (2016). The greening of organizational culture: Revisited fifteen years later. *American Journal of Business*, *31*(4), 206–226. https://doi.org/10.1108/AJB-04-2016-0011

[50.] Rawashdeh, A. M. (2018). The impact of green human resource management on organizational environmental performance in Jordanian health service organizations. *Management Science Letters*, 1049–1058. https://doi.org/10.5267/j.msl.2018.7.006

[51.] Renwick, D. W., Redman, T., & Maguire, S. (2013a). Green Human Resource Management: A Review and Research Agenda*. *International Journal of Management Reviews*, *15*(1), 1–14. Scopus. https://doi.org/10.1111/j.1468-2370.2011.00328.x

[52.] Roscoe, S., Subramanian, N., Jabbour, C. J. C., & Chong, T. (2019). Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development. *Business Strategy and the Environment*, *28*(5), 737–749. Scopus. https://doi.org/10.1002/bse.2277

[53.] Simpson, D., & Samson, D. (2010). Environmental strategy and low waste operations: Exploring complementarities. *Business Strategy and the Environment*, *19*(2), 104–118. https://doi.org/10.1002/bse.626

[54.] Suderman, J. (2012). *Using the Organizational Cultural*

Assessment (OCAI) as a Tool for New Team Development. 4.

[55.] Tang, G., Chen, Y., Jiang, Y., Paillé, P., & Jia, J. (2018). Green human resource management practices: Scale development and validity. *Asia Pacific Journal of Human Resources*, *56*(1), 31–55. https://doi.org/10.1111/1744-7941.12147

[56.] Tiwari, S. (2015). Framework for adopting sustainability in the supply chain. *International Journal of Automation and Logistics*, *1*(3), 256. https://doi.org/10.1504/IJAL.2015.071724

[57.] Wang, C.-H. (2019). How organizational green culture influences green performance and competitive advantage: The mediating role of green innovation. *Journal of Manufacturing Technology Management*, *30*(4), 666–683. https://doi.org/10.1108/JMTM-09-2018-0314

[58.] Xie, X., & Zhu, Q. (2020). Exploring an innovative pivot: How green training can spur corporate sustainability performance. *Business Strategy and the Environment*, *29*(6), 2432–2449. https://doi.org/10.1002/bse.2512

[59.] Yafi, E., Tehseen, S., & Haider, S. A. (2021). Impact of Green Training on Environmental Performance through Mediating Role of Competencies and Motivation. *Sustainability*, *13*(10), 5624. https://doi.org/10.3390/su13105624

[60.] Zaid, A. A., Jaaron, A. A. M., & Talib Bon, A. (2018). The impact of green human resource management and green supply chain management practices on sustainable performance: An empirical study. *Journal of Cleaner Production*, *204*, 965–979. https://doi.org/10.1016/j.jclepro.2018.09.062

[61.] Ziyadeh, M. W., Othman, M., & Zaid, A. A. (2024). Effects of green human resource management on organisational sustainability: The mediating role of corporate social responsibility and organisational citizenship behaviour. *International Journal of Organizational Analysis*, *32*(2), 357–372. https://doi.org/10.1108/IJOA-11-2022-3506

Spirituality-Driven Workplaces: How Trust Transforms Job Satisfaction and Employee Retention

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ABSTRACT

In the dynamic work environment of the information technology industry, fostering job satisfaction and employee retention are critical challenges for organizations. Employee retention not only leads to the gain of key talent but also improve organizational performance and continuity. To overcome these challenges The IT industry is now adopting workplace spirituality. In this context we conducted a survey involving 400 software engineers from various IT companies in Hyderabad, India. A total of eight hypotheses were developed to test the relationships between the constructs, with primary focus on investigating the mediating effect of Trust on the relationship between workplace spirituality, Job satisfaction, and Employee retention. In addition to, we also want to explore how workplace spirituality, through its key dimensions, meaningful work and a sense of community influences job satisfaction and employee retention. To assess the hypothesized relationships, data was analyzed using a structural equation modeling (SEM) technique. The results showed that the workplace spirituality dimension of meaningful work and a sense of community has a significant positive relationship with trust, and trust also successfully mediates the impact of workplace spirituality dimensions and job satisfaction and employee retention. Along with, it was also found that the managerial level did not have a significant relationship with job satisfaction and employee retention, with path coefficients $\beta=-0.22$ (p = 0.609) and $\beta=0.04$ (p = 0.916), respectively. IT companies should concentrate on developing a meaningful workplace that gives workers a strong sense of belonging. This can be achieved through team-building exercises, recognition initiatives, and purposeful job design.

Keywords: workplace spirituality, job satisfaction, employee retention, trust

1. INTRODUCTION

The 21st century is identified as the era driven by the Information Technology(IT) sector, with India positioned as the focal point of worldwide interest and recognized as a hub of knowledge. The IT sector serves as the foundation for the exponential advancement of our economy and the creation of numerous employment opportunities. Over the past two decades, the substantial growth of India's IT industry has transformed global perceptions regarding the nation's reservoir of knowledge and competencies, consequently fueling economic progress. From 1.2% in 1998 to close to 10% in 2019, the IT industry's contribution to India's GDP has experienced significant growth. A notable aspect of India's IT sector is its ability to not only expand in terms of market size but also progressively enhance its contribution to the country's gross domestic product (GDP), thereby stimulating overall growth and advancement. The digitally adept workforce in India has expanded over time, constituting roughly 75% of the global digital talent pool. The four major IT enterprises in India (TCS, Infosys, Wipro, HCL Tech) collectively employ over a million workers. The technology services sector in India has the potential to achieve annual revenues of $300-350 billion by 2025 through leveraging the increasing opportunities in cloud computing, artificial intelligence (AI), cyber security, and other emerging technologies, as per a joint study by NASSCOM and Mc Kinsey (Jayswal, 2021).

The IT industry is often characterized by high-stress environments and intense workloads that can lead to job dissatisfaction and high employee turnover. However, Workplace Spirituality(WPS) has emerged as a promising approach to address these challenges and foster a more engaged and satisfied workforce. Workplace spirituality, characterized by a sense of purpose, interconnectedness, and alignment with organizational values, has been linked to various positive organizational outcomes, including increased job satisfaction(JS)and higher employee retention(ER) rates (Milliman et al., 2003). Spirituality is a word that came from the Latin word "Spiritus" which means soul. Adopting and exercising spiritual practices in the workplace is nothing but WPS. WPS encompasses the recognition of the inner life of employees, the meaning they find in their work, and the sense of interconnectedness with their colleagues and the organization.

WPS refers to the spiritual experiences of employees in the workplace (Pawar, 2009). In other words, employees practice their spiritual aspects like community, Meaningful work(MW), and inner life in the workplace. In recent years, WPS has become increasingly important because it fosters a positive psychological environment for employees. Many researchers studied different dimensions of WPS like MW, a Sense of community(SOC), alignment of organizational values, inner life, justice, morals, and ethical values. From this, we are using MW and a SOC developed by Ashmos &

Duchon, (2000) for this study, which plays a great role in the enhancement of Job Satisfaction(JS) and Employee Retention(ER). WPS is a relatively unexplored area in the IT industry, with few studies focusing specifically on this aspect within the sector.

Most of the studies on WPS were conducted and focused on outcomes of WPS including Job satisfaction(Van Der Walt & De Klerk, 2014), employee engagement, quality of work life (Gireesan & Rajamannar, 2024), organizational commitment (Rego & Pina E Cunha, 2008), job performance (NWANZU, 2020), work engagement (Adnan et al., 2020), employee well-being (Garg, 2017), counterproductive work behavior (Malhotra & Kathuria, 2017), psychological well-being (Mahipalan & Sheena, 2019), organization sustainability (Rezapouraghdam et al., 2019), employee happiness (Awada et al., 2020), employee turnover intentions (Sreeja et al., 2023), human capital formation (Panigrahy et al., 2014). In this study, we trying to explain our objective to empirically test MW and SOC as independent variables and the mediating effect of Trust on JS and ER among IT employees. While most of the studies concentrate on the outcomes of JS and ER individually, no research has previously been empirically tested combinedly. This study may show that the beneficial effects of workplace spirituality more especially, meaningful work and a sense of community on job satisfaction and employee retention are enhanced when trust is employed as a mediator. Organizations may improve workers' connections to their jobs and coworkers by cultivating trust, which will raise employee happiness and lower turnover. This strategy may result in more devoted and engaged IT workers, assisting businesses in overcoming issues with excessive stress and employee turnover.

Following this introduction, Section 2 outlines the proposed research model and the related hypotheses. Section 3 details the research methodology. Section 4 presents the results, while Section 5 is dedicated to the discussion, emphasizing both the theoretical and practical implications of the study. Finally, Section 6 concludes with the study's conclusions, limitations, and suggestions for future research.

2. LITERATURE REVIEW

Workplace Spirituality

WPS has received significant attention in recent years as organizations acknowledge the importance of cultivating a comprehensive environment where employees can discover meaning and purpose in their work. WPS refers to a sense of connection to something larger than oneself, often involving a SOC, MW, and alignment with organizational values. WPS is defined by (Ashmos & Duchon, 2000) as the recognition of an employee's inner life nourishes and nourished by MW that takes place in the context of community. It is observed that the researcher concentrates on the main dimensions of WPS like inner life, MW, and SOC. In the words of Giacalone and Jurkiewicz, (2023) WPS is defined as a conceptual definition, It is a framework of organizational values evidenced in the culture that promotes employees' experience of transcendence through the work process, facilitating their sense of being connected to others in a way that provides feelings of completeness and Joy. From this, we observed the greatest involvement of WPS dimensions are MW and a SOC. Within these three dimensions, MW and inner life belong to the individual level of WPS, whereas a SOC belongs to the group level of WPS (Milliman et al., 2003). MW means the expression of spirituality in the workplace is based on the belief that everyone has their inner motivations, truths, and aspirations to engage in activities that bring greater significance to their own life and the lives of others (Ashmos & Duchon, 2000). In other words, the process of finding one's life purpose and a way to express oneself. Coming to, a SOC means developing a strong connection or bond with others, which is often described as a SOC (Ashmos & Duchon, 2000). Hence, interconnectedness and inter-relationships of the employees in the context of an organization are depicted as SOC.

Job Satisfaction

Job satisfaction reflects how satisfied people are with their jobs and how much they enjoy them (Ghayas & Hussain, 2023). It is crucial because people spend more time at work than in any other activity. Therefore, its significance for employees is evident, as it represents a substantial part of their lives. Most of the researchers believe that WPS has a significant positive effect on JS in different sectors like the public sector (Oriol & Gomes, 2022), IT industry (Sreeja et al., 2023); Gireesan & Rajamannar, 2024), custom organizations (Golparvar & Abedini, 2014), Pakistan's healthcare sector (Ghayas & Hussain, 2023), the employee correctional institution (Dwiyanti & Khoerunnisa, 2020).

Employee Retention

According to Das & Baruah, (2013) encouraging employees to stay with the organization for an extended period is known as employee retention. Febriani et al., (2023) conducted a study on women employees, he found that meaningfulness at work and cohesiveness increase employee retention rates and reduce work-family conflicts. The study conducted by Arya, (2022) among workers of Patanjali Yogapeeth to determine if spiritually oriented organizations can effectively retain, the results confined to a significant association between spiritually charged organizations and ER.

Trust as a mediator

Spector & Jex, (1998) defined trust as the readiness to be vulnerable, based on positive expectations regarding someone else's intentions or behavior. Past research has demonstrated that trust enhances the relationship between workplace spirituality and job satisfaction (Hassan et al., 2016). Ahmed et al., (2022) conducted a study on staff nurses he found that there is a positive correlation between

trust and intention to stay. Therefore, Trust acts as a successful mediator between WPS and job satisfaction, employee retention.

Managerial level as control variable

Employee commitment to the company and job satisfaction are greatly influenced by decisions made by managers at different levels. Managerial level acts as a control variable in this study on job satisfaction and organizational commitment. From past studies, we can gain a better understanding of how employees' job satisfaction and commitment differ based on the organization's hierarchy and responsibilities by controlling managerial level (Manning, 2002; Rifadha, 2019; van der Voet & Van de Walle, 2018). Manning, (2002), stated that compared to middle managers, top level managers would report greater levels of job satisfaction. (Rifadha, 2019) in his study findings also show that lower levels of job satisfaction experienced by People's Bank managerial level staff. Moon, (2000), demonstrate that, at least conceptually, there are notable sectoral variations in the degree of organizational commitment. It is observed from the above studies found that based on the sectoral differences the impact of managerial level on job satisfaction and organizational commitment will also be changed, also found that some sectors managerial level positively related (Manning, 2002), few studies stated that managerial level negatively related to job satisfaction and organizational commitment.

3. RESEARCH GAP

The comprehensive examination of extant literature elucidates a notable deficiency in research pertaining to the interactions among diverse elements within the Workplace Spirituality (WPS) paradigm, especially within the Information Technology (IT) sector. Although previous investigations predominantly highlight Job Satisfaction (JS) as being influenced by WPS, frequently categorizing JS as either a mediating or dependent construct, the dimension of Trust remains insufficiently scrutinized. Additionally, the synergistic impacts of Meaningful Work (MW), Sense of Community (SOC), Trust, and Employee Retention (ER), in conjunction with JS, have not been rigorously analyzed. The majority of the existing scholarship has predominantly focused on sectors such as higher education, healthcare particularly amongst nursing practitioners and law enforcement. This research endeavour aspires to address this pivotal void by investigating these interconnected relationships within the context of IT.

Hypothesis Formulation

Trust, WPS Dimension MW, JS

When employees find meaning and purpose in their work, their job satisfaction levels increase. In the words of Milliman et al., (2003) employees who feel a higher sense of meaning in their work tend to report increased job satisfaction. Meaningful work affects job satisfaction not only directly but also through trust. When employees trust their organization and its leadership, the positive impacts of meaningful work on job satisfaction are heightened (Dirks, 2002). From this point of view, Tan, (2000), noted that

trust promotes a positive work atmosphere and recovers uncertainties, leading to greater job satisfaction.

Trust, WPS Dimension SOC, and JS

SOC is another dimension of WPS (Ashmos & Duchon, 2000). It means working in an environment where employees feel connected to each other and see themselves as part of a community. Manion & Bartholomew, (2004) emphasize the importance of fostering a SOC in the workplace. In addition, a SOC provides support and coordination among employees. The employee's perception of cooperation and support within organizations are key factors that positively impact stress reduction (Zeffane & McLoughlin, 2006). As a result of this, employees become satisfied and contribute more to an organization. When employees have trust in their organization and its leadership, the benefits of a sense of community significantly enhance job satisfaction (Dirks, 2002).

Trust, WPS Dimension MW, and ER

Spirituality in the workplace involves discovering and articulating the meaning and purpose of one's work, as well as fostering a sense of connection with colleagues (Ashmos & Duchon, 2000). In other words, Spirituality at work is a meaningful connection to the work being done in the workplace. Employees who find their work meaningful are more likely to feel satisfied with their job, as MW meets their internal motivation needs and gives them a sense of purpose (Milliman et al., 2003). In this viewpoint, when an employee finds meaning in their work, they are willing to stay in the organization (Duchon, 2005). Lin, (2023) noted that trust has a significant and positive impact on employees' intentions to remain with the company, which aligns with established theories in organizational behaviour.

Trust, WPS Dimension SOC, and ER

ER is nothing but motivating employees to remain in the organization for a longer period. When the employees maintain interconnectedness in their work, they remain in the organization (Degirmen et al., 2021). According to Duchon, (2005) a lack of SOC would decrease employee turnover intentions. Trust in the organization enhances the influence of workplace spirituality on employees' desire to stay with the organization. In addition, the presence of trust fosters a supportive atmosphere, strengthening employees' emotional connection to the organization (Dirks, 2002). Based on the above extensive literature review following hypothesis has been formulated:

H1: Meaningful work positively influences Job Satisfaction

H2: Trust positively influences Job Satisfaction

H3: Sense of Community positively influences Job Satisfaction

H4: Meaningful work positively influences Trust

H5: Meaningful Work positively influences Employee Retention.

H6: Trust positively influences Employee Retention

H7: Sense of Community positively influences Employee Retention

H8: Sense of Community positively influences Trust

H9: Managerial Level positively influences Job Satisfaction

H10: Managerial Level positively influences Employee Retention

H11: Trust positively mediates the relationship between MW and JS

H12: Trust positively mediates the relationship between MW and ER

H13: Trust positively mediates the relationship between SC and JS

H14: Trust positively mediates the relationship between SC and ER

Research Framework Model
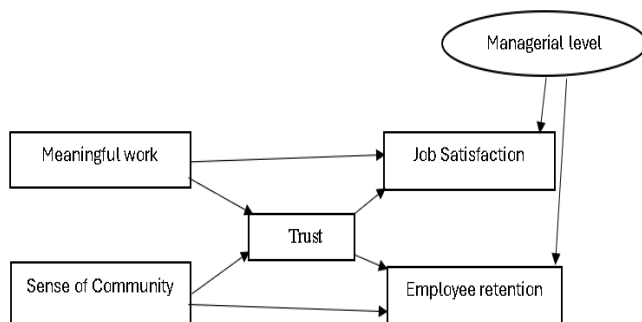
Figure 1: Research Framework Model

4. METHODOLOGY

Data Collection and Sampling

The model and proposed relationships were examined using data gathered from IT employees working in Hyderabad, India. Hyderabad was selected as the focal area for participants owing to its significant status as a centre for information technology enterprises. We conducted a survey using a questionnaire to test our hypotheses. Specifically, we analysed the data through an online survey, which is more cost-effective and efficient than a traditional paper-based survey (Couper, 2000). The data is collected through questionnaires with closed-ended questions for quantitative data. In this study, we used a data collection tool like an online survey platform like Google Forms for easy access and data collection. A total of 400 responses were collected, and 21 were incomplete or missing details. After removing

these 21 responses, the remain remaining 379 responses were used for structural equation analysis.

Measures for the Research Model:

There were two sections in the questionnaire. The first section contains questions about demographic information, including age, gender, highest level of education, no. of years of experience in the current organization, and current position in the organization. The second section focused on MW, SOC, Trust, JS, and ER. The questionnaire items utilized a 5-point Likert scale, and the scale is between strongly disagree (1) to strongly agree (5). We adapted WPS with two dimensions of MW and a SOC with 5 items for each from (Ashmos & Duchon, 2000). In addition, we measure JS and ER using the 5 items from (E.Spector, 1985) and (Mobley et al., 1978) respectively. We assessed the trust, as a mediator with 5 items adopted from Adi Sucipto et al., (2018).

5. DATA ANALYSIS

Demographic Characteristics

Out of 379 participants, 74.9% were males, and 25.1% were female respondents. It shows the highest percentage of males are working in the IT sector compared to females. Coming to the age of the respondents 47.2% of the respondents are below 25 years old, 32.5% of the respondents are 25-35 years old, and 20.3% of the respondents are 36-45 years of age. The frequency of age maximum of 179 respondents below 25 years, minimum of 77 respondents belong to 36-45 years of age. Only 2.4% of the participants have below one year of experience, 71.8% of the participants have 1-3 years of experience, 20 respondents have 4-6 years of experience, 7.4% of participants have 5 to 10 years, and experience having above 10 years are 13.2%. 12.9 % of the respondents are in the level of entry-level in the organization, 47.2% of the respondents are coming under mid-level, 30.1 % of the respondents are coming under senior-level, minimum of 9.8 % of respondents are coming under executive level.

Common Method Bias Testing

Common method bias (CMB) could impact the findings of this study, as the authors gathered data through self-reported questionnaires. To statistically assess the potential for CMB, Harman's single-factor test was conducted. Subsequently, the authors identified five factors with eigenvalues greater than one. All the items loaded into one factor that resulted in 42.622 percent explained variance which is less than 50 percent therefore no common method bias issues.

Assessment of measurement model

According to Harris et al., (2012) psychometric properties of the questionnaire were evaluated by examining its reliability and validity, in this point of view, Composite reliability scores and Cronbach's alpha were utilized to measure the

internal consistency. It is observed that both scores surpassed the required threshold of 0.7. Item loadings that are less than 0.5 were eliminated (TR1, TR3, ER4, MW2). The data in Table 1 clearly show that the loadings exceed 0.5. Therefore, we can conclude that the model satisfies the requirements for reliability.

All paths in the CFA model are significant (p <.001), with high standardized regression weights, which indicates that the observed variables effectively serve as indicators for their respective latent constructs. The Table 1 shows the reliability and validity measures for various constructs. Constructs like Job Satisfaction, Trust, Meaningful work, Employee Retention, and Sense of Community demonstrate Composite Reliability (CR) values exceeding a threshold of 0.7, indicating good internal consistency. Average Variance Extracted (AVE) values are above 0.5 for all constructs and Mean Square value (MSV) values are lower than AVE, confirming discriminant validity. The discriminant validity matrix indicates the square root of the Average Variance Extracted (AVE) values for each construct on the diagonal. Off-diagonal values represent the correlations between constructs. While the diagonal values exceed the correlations between constructs, indicating acceptable discriminant validity.

TABLE 1: Results of reliability and validity

Measure	Measurement items	Factor Loading	Composite Reliability	AVE	Cronbach Alpha
Job Satisfaction	JS1	.831	0.924	0.803	.922
	JS2	.877			
	JS3	.849			
	JS4	.837			
	JS5	.812			
Trust	TR2	.899	0.958	0.851	.957
	TR4	.900			
	TR5	.808			
Meaningful Work	MW1	.900	0.831	0.626	.805
	MW3	.824			
	MW4	.751			
	MW5				
Employee Retention	ER1	.855	0.889	0.728	.882
	ER2	.863			
	ER3	.824			
	ER5	.815			
Sense Of Community	SC1	.854	0.873	0.699	.855
	SC2	.814			
	SC3	.880			
	SC4	.876			
	SC5	.865			

Note: AVE represents average variance extracted score.JS= Job Satisfaction, TR= Trust, MW= Meaningful Work, ER= Employee Retention, SC= Sense of Community

TABLE 1: Discriminant validity

	CR	AVE	MSV	MaxR(H)	JS	TR	MW	ER	SC
JS	0.924	0.803	0.392	0.974	**0.896**				
TR	0.958	0.851	0.392	0.985	0.626	**0.922**			
MW	0.831	0.626	0.169	0.900	0.369	0.411	**0.791**		
ER	0.889	0.728	0.324	0.922	0.397	0.429	0.165	**0.853**	
SC	0.873	0.699	0.324	0.901	0.381	0.301	0.099	0.569	**0.836**

Note: The square roots of the Average Variance Extracted (AVE) are the diagonal elements shown in bold. CR= Composite Reliability, MSV= Mean Square values, JS= Job Satisfaction, TR= Trust, MW= Meaningful Work, ER= Employee Retention, SC= Sense of Community. The other elements represent simple bivariate correlations between the constructs.

Structural Equation Modelling
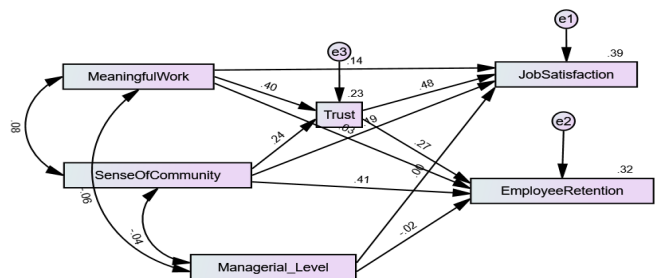
Figure 1: Structural Model

The above Figure:1 showing the relationships between the various variables such as Meaningful work, Sense of Community, Job Satisfaction, Employee Retention and Trust as a Mediator, Managerial Level as a Control variable. The hypothesized casual paths among variables represented by arrows, which showing the strength and direction of relationships among variables. Since these coefficients are standardized, their values fall between -1 and 1. The circles with the labels e1, e2, and e3 stand for the error terms for trust, employee retention, and job satisfaction, respectively. These error terms show the portion of each variable's variance that cannot be explained by the model's predictors. The error variance of e1 is.39, which indicates that this

model cannot account for 39% of the variation in job satisfaction. The Employee Retention error variance for e2 is.32. For Trust, e3's error variance is.14.

TABLE 3: Hypotheses Testing (Structural Model)

H. No.	Paths	Estimate	S.E.	C.R.	P	Remarks
H1	Meaningful Work>Trust	.399	.028	8.822	***	Supported
H2	Sense of Community>Trust	.237	.035	5.242	***	Supported
H3	Trust>Job Satisfaction	.476	.045	10.376	***	Supported
H4	Trust> Employee Retention	.273	.048	5.645	***	Supported
H5	Meaningful Work>Job Satisfaction	.138	.027	3.117	**	Supported
H6	Sense of Community>Employee Retention	.414	.034	9.382	***	Supported
H7	Meaningful Work>Employee Retention	.032	.029	.686	.493	Not Supported
H8	Sense of Community>Job Satisfaction	.188	.032	4.485	***	Supported
H9	Managerial Level> Employee Retention	-.022	.025	-.511	.609	Not Supported
H10	Managerial Level> Job Satisfaction	-.004	.023	-.105	.916	Not Supported
Model Fitness: X2=2.960, df=6, X2/df=2, RMSEA=.036, GFI=.997, NFI=.993, IFI=.998, TLI=.987, CFI=.998, Standardized RMR =.0173						

*<.05, **<.01, ***<.001

Hypothesis Testing

From Table 3 results found that a significant relationship between MW and the mediator TR was significantly positive, with path coefficient $\beta=0.399$ (p<0.01), supporting H1. The relationship between MW was a significant positive relationship with JS, path coefficient $\beta=0.138$ (p<0.1) supported H5. Also found that MW is not significantly related to ER, path coefficient $\beta=0.32$ (p=0.493). Hence H7 was not supported. Sense of community (SC) had a significant and positive relationship with Trust (TR), with path coefficient $\beta=0.237$(p<0.01), supporting H2. TR was also significantly related to JS, $\beta=0.476$ (p=0.01), supporting

H3. The relationship between TR and ER was significant and positive, $\beta=0.273$ (p<0.01), supporting H4. SC had a significant and positive relationship with ER, $\beta=0.414$ (p<0.01), supported H6. Also find a significant and positive relationship between SC and JS, $\beta=0.188$ (p<0.01), supporting H8. It is evident that the relationship between ML and ER was not significant, $\beta=-0.22$ (p=0.609), not supported H9. Along with this, ML and JS are also not significant, $\beta=0.04$ (p=0.916), not supported H10. Trust mediated the relationship between MW and JS, MW and ER, SC and JS, and SC and ER are significant, supported H11, H12, H13, and H14 respectively.

Coming to Model Fitness results from the Table3 the model fits the data very well, according to the model fit indices given: Using df = 6 and X²/df = 2, the chi-square (X²) is 2.960. The X2/df ratio is less than 3, which is generally regarded as a suitable cutoff point for a well-fitting model. A close model fit is shown by an RMSEA (Root Mean Square Error of Approximation) of.036 much below the.05 cutoff. TLI (Tucker-Lewis Index) =.987, CFI (Comparative Fit Index) =.998, NFI (Normed Fit Index) =.993, IFI (Incremental Fit Index) =.998, and GFI (Goodness of Fit Index) =.997: These indices are all extremely near to 1, indicating a very good fit..0173 is the standardized RMR. This shows a satisfactory match in terms of residuals because it is below the.08 criterion. From this point of view, we can say that the excellent fit indices demonstrate how well the model fits the data. This implies that the model's hypothesized relationships accurately reflect the data that has been seen. relationships that are hypothesized, especially those in which trust acts as a mediator. Meaningful work and a sense of community have a favourable impact on trust, which in turn has a positive impact on job satisfaction and employee retention. Job satisfaction and employee retention are directly impacted by a sense of community. Job satisfaction is directly impacted by meaningful work, but employee retention is not. Non-Supported Hypotheses, Meaningful Work has no direct effect on employee retention, and managerial level has no discernible effect on either job satisfaction or employee retention.

The model's mediation testing results are shown in the table 4, which investigates whether trust acts as a mediating variable in the connections between meaningful work and a sense of community and the outcomes of employee retention and job satisfaction. An explanation of each mediation-related hypothesis (H11–H14) is as follows.

TABLE:4 Mediation Testing

H. No.	Path	Total Effects	Direct Effects	Indirect Effects	Remarks
H11	Meaningful Work>Trust>Job Satisfaction	.328**	.138**	.190**	Partial Mediation

H12	Meaningful Work>Trust>Employee Retention	.141**	.032	.109**	Full Mediation
H13	Sense of Community>Trust>Job Satisfaction	.300**	.188**	.113**	Partial Mediation
H14	Sense of Community>Trust>Employee Retention	.479**	.414**	.065**	Partial Mediation

*<.05, **<.01, ***<.001

H11: Meaningful Work → Trust → Job Satisfaction

When both direct and indirect paths are considered, the overall effect of meaningful work on job satisfaction is .328, indicating a strong positive association. The significant direct effect of Meaningful Work on Job Satisfaction is .138, indicating that Meaningful Work has a positive impact on Job Satisfaction even in the absence of Trust's mediating function. The indirect effect through trust is .190, indicating that trust plays a significant role in the relationship between meaningful work and job satisfaction. The association between Meaningful Work and Job Satisfaction is somewhat mediated by trust, as both direct and indirect effects are noteworthy. Accordingly, meaningful work not only directly increases job satisfaction but also indirectly does so by fostering trust.

H12: Meaningful Work → Trust → Employee Retention

When considering both paths, the overall effect of meaningful work on employee retention is .141, indicating a positive correlation. There is no statistical significance in the direct effect, which is .032. This indicates that without the influence of trust, meaningful work has no discernible direct effect on employee retention.

The considerable indirect effect through trust (.109) shows that trust plays a moderating role in the relationship between meaningful work and employee retention. Trust completely mediates the relationship between Meaningful Work and Employee Retention because only the indirect channel is important. This implies that the main way that meaningful work affects retention is by fostering trust, which in turn motivates workers to stick with the company.

H13: Sense of Community → Trust → Job Satisfaction

When seeing both direct and indirect pathways, the overall effect of Sense of Community on Job Satisfaction is .300, suggesting a positive and significant influence on Job Satisfaction. Sense of Community has a large direct impact on job satisfaction (.188). This indicates that even in the absence of trust, a sense of community has a favourable effect on job satisfaction. The indirect effect through Trust is .113, indicating that Trust mediates a portion of the relationship between Sense of Community and Job Satisfaction. The association between Sense of Community and Job Satisfaction is somewhat mediated by trust, since both the direct and indirect effects are noteworthy. This suggests that a feeling of belonging improves job satisfaction both directly and through fostering greater trust.

H14: Sense of Community → Trust → Employee Retention

When taking into account both the direct and indirect pathways, the overall effect of Sense of Community on Employee Retention is .479, showing a substantial positive connection. Sense of Community has a high, direct positive impact on employee retention, as seen by the significant direct effect of .414. The significant indirect effect through trust is .065, suggesting that trust mediates some of the relationship between sense of community and employee retention. The association between Sense of Community and Employee Retention is somewhat mediated by trust, since both the direct and indirect impacts are noteworthy. This implies that a feeling of belonging not only directly promotes retention but also indirectly through the development of trust, which fortifies workers' will to stick around.

6. IMPLICATIONS

Theoretical Implications

The authors developed and proposed a model to investigate the impact of Meaningful work, Sense of community and Job satisfaction, and Employee retention mediated through Trust of IT employees. This study shows that Meaningful work is positively related to Job satisfaction. When employees find meaning and purpose in their work, leads to more job satisfaction. When they develop trust in their organization that may lessen their employee retention rate. This finding aligns with those of earlier researchers (Ashmos & Duchon, 2000). A sense of community was found to significantly enhance employee retention within the organization. Trust has a direct impact on job satisfaction and employee retention. Additionally, job satisfaction significantly affects employee retention, highlighting the interconnected nature of these factors. It aligns with the earlier researchers (Dirks, 2002). Interestingly, the level of management did not significantly predict job satisfaction or employee retention. This indicates that the impact of workplace spirituality and trust on these outcomes remains strong across various hierarchical levels within the organization.

Practical Implications

The IT industry is very dynamic and needs to face different challenges to maintain a competitive edge. The IT industry should pay attention to Workplace spirituality, the light of information like meaningful work and a sense of community, outcomes from workplace spirituality are job satisfaction and employee retention. Organizations should focus on creating a work environment that is meaningful and fosters a strong sense of community among employees. This can be accomplished through intentional job design, recognition

programs, and team-building activities. Efforts to build trust should be a fundamental part of organizational strategies. This involves clear communication, consistent and equitable practices, and leadership development programs that emphasize integrity and dependability. While the level of management may not significantly influence job satisfaction and retention, targeted interventions that foster trust and workplace spirituality can meaningfully enhance these outcomes across all levels of the organization. Engagement initiatives that focus on building trust and nurturing a sense of community can result in increased job satisfaction and lower turnover rates. The findings imply that trust, rather than direct effects, is the main way that meaningful work affects employee retention. When workers find their employment fulfilling, it may initially increase their faith in the company, which affects their retention. This is consistent with the full mediation result in H12, which shows that trust fully mediates the association between meaningful work and employee retention. Because organizational culture, work-life balance, and job satisfaction may have a greater influence on employees' retention decisions than any other aspect, independent of position, the managerial level may not have a direct impact on employee retention. Employee retention reasons may be more complicated than may be fully captured at the positional level alone. The work environment perceived organizational support, and job-role congruence may have a greater impact on job satisfaction than managerial level.

Limitations and Further Research Agenda

The study is geographically related to Hyderabad, India, the results may not be properly generalized. The study is empirical survey research, researchers can carry out cross-sectional studies in the future. Additional studies can test how trust affects individual spirituality and workplace spirituality. While the scales used showed good reliability and validity, measuring complex constructs like workplace spirituality and trust may still have limitations. Future research should develop and utilize more nuanced and comprehensive measurement tools. There may be other significant factors affecting the relationships explored in this study, such as organizational culture, leadership styles, and individual differences (e.g., personality traits). Future research should take these factors into account to enhance overall understanding. Given the rising trend of remote work, future studies should explore the role of workplace spirituality and trust in virtual settings, along with their effects on job satisfaction and employee retention in remote environments.

This study emphasizes the essential function of workplace spirituality and trust in boosting job satisfaction and employee retention. By promoting meaningful work and a robust sense of community, organizations can cultivate trust, which ultimately results in more satisfied and committed employees. The research offers both theoretical

advancements and practical suggestions for enhancing organizational effectiveness through the strategic development of workplace spirituality and trust. It underscores how these elements contribute to improving job satisfaction and retaining employees. While the findings offer valuable insights, it is crucial to address the limitations and explore the proposed future research directions to further enrich the understanding of these vital organizational dynamics. By doing so, both researchers and practitioners can formulate more effective strategies for creating positive work environments that foster employee well-being and drive organizational success.

7. DECLARATION

I, Jhansi. K. S. Nandini Bommisetti, hereby confirm that the manuscript titled " Spirituality-Driven Workplaces: How Trust Transforms Job Satisfaction and Employee Retention " authored by Jhansi. K. S. Nandini Bommisetti, Dr. Sai Manideep Appana, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspective Conference 2025.

we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Adi Sucipto, Hasanuddin Remmang, H. S. (2018). Journal of business and Management. Journal of Business and Management, 24, No.1(March), 76–89.

[2.] Adnan, N., Bhatti, O. K., & Farooq, W. (2020). Relating ethical leadership with work engagement: How workplace spirituality mediates? Cogent Business & Management, 7(1), 1739494.

[3.] Ahmed, A., Sadek, A., Mohamed, S., Elrhman, A., Fahmy, A. M., Gabra, S. F., & Hailey, H. (2022). The Organizational Trust and its Relation to Staff Nurse Retention in their job. December.

[4.] Arya, V. (2022). Does employee retention depend on spiritual work environment and organizational internal branding – A study in the context of emerging market. World Review of Science, Technology and Sustainable Development, 18(3/4), 239. https://doi.org/10.1504/wrstsd.2022.10047874

[5.] Ashmos, D. P., & Duchon, D. (2000). Spirituality at Work: A Conceptualization and Measure. Journal of Management Inquiry, 9(2), 134–145. https://doi.org/10.1177/105649260092008

[6.] Awada, N., Johar, S. S. H., & Ismail, F. B. (2020). The effect of employee happiness on employee performance in UAE: The moderating role of spirituality and emotional wellness. International Journal of Psychosocial Rehabilitation, 24(3), 1311–1321. https://doi.org/10.37200/IJPR/V24I3/PR200881

[7.] Couper, M. P. (2000). Review : Web Surveys : A Review of

Issues and Approaches Author (s): Mick P. Couper Published by : Oxford University Press on behalf of the American Association for Public Opinion Research Stable URL : https://www.jstor.org/stable/3078739. 64(4), 464–494.

[8.] Das, B. L., & Baruah, M. (2013). Employee Retention : A Review of Literature. 14(2), 8–16.

[9.] Degirmen, S., Hassan, M., Jalil, F., Islam, F., Campus, P. G., & Food, K. (2021). Revisiting the Role of Servant Leadership and Workplace Spirituality on Employees ' Retention : A Mediating Role of Employee Engagement. 15(2), 1158–1176.

[10.] Dirks, K. T. (2002). Institutional Knowledge at Singapore Management University Trust in Leadership : Meta-Analytic Findings and Implications for Research and Practice Trust in Leadership : Meta-Analytic Findings and Implications for Research and Practice. 611–628. https://doi.org/10.1037//0021-9010.87.4.611.

[11.] Duchon, D. (2005). Nurturing the spirit at work : Impact on work unit performance Nurturing the spirit at work : Impact on work unit performance. https://doi.org/10.1016/j.leaqua.2005.07.008

[12.] Dwiyanti, R., & Khoerunnisa, E. (2020). Job Satisfaction, Spirituality, and Happiness of the Employee of Correctional Institution. Social Values & Society, 3(1), 40–43. https://doi.org/10.26480/svs.01.2021.40.43

[13.] E.Spector, P. (1985). a7ca75cdd8bd805ef913f99d357dca73.pdf.

[14.] Febriani, R., Hasanah, S. N., Roz, K., & Hakim, A. R. (2023). the Impact of Workplace Spirituality, Work-Family Conflict, and Loneliness in Work on Intention To Stay: Case Study on Women Employees in Indonesia. International Journal of Professional Business Review, 8(4), 1–16. https://doi.org/10.26668/businessreview/2023.v8i4.1473

[15.] Garg, N. (2017). Workplace Spirituality and Employee Well-being: An Empirical Exploration. Journal of Human Values, 23(2), 129–147. https://doi.org/10.1177/0971685816689741

[16.] Ghayas, M. M., & Hussain, S. (2023). Happiness as a Mediator in the Relationship Between Workplace Spirituality and Job Satisfaction Among Nursing Staff Happiness as a Mediator in the Relationship Between Workplace Spirituality and Job Satisfaction Among Nursing Staff. March 2024.

[17.] Giacalone and Jurkiewicz. (2023). Right from wrong. Cutting Tool Engineering, 69(10), 23.

[18.] Gireesan, M., & Rajamannar, N. (2024). Spiritual Practices in the Workplace and Its Impact on Quality of Work Life among IT Employees with Special Reference To Ernakulam District. Educational Administration: Theory and Practice, 2024(5), 7808–7818. https://doi.org/10.53555/kuey.v30i5.4242

[19.] Golparvar, M., & Abedini, H. (2014). A comprehensive study on the relationship between meaning and spirituality at work with job happiness, positive affect and job satisfaction. Management Science Letters, 4, 255–268. https://doi.org/10.5267/j.msl.2013.12.030

[20.] Harris, L. C., & Ogbonna, E. (2012). Motives for service sabotage: an empirical study of front-line workers. Service Industries Journal, 32(13), 2027–2046. https://doi.org/10.1080/02642069.2011.582496

[21.] Hassan, M., Nadeem, A. Bin, & Akhter, A. (2016). Impact of workplace spirituality on job satisfaction : Mediating effect of trust Impact of workplace spirituality on job satisfaction : Mediating effect of trust. Cogent Business & Management, 12(1). https://doi.org/10.1080/23311975.2016.1189808

[22.] Jayswal, P. J. (2021). How the IT Industry is shaping the future of India?

https://timesofindia.indiatimes.com/readersblog/youth2020/how-the-it-industry-is-shaping-the-future-of-india-36519/

[23.] Lin, M. (2023). The Impact Of Organizational Trust On Employee Retention Intention : The Mediating Effects Of Management Innovation And Job Satisfaction. 5(42).

[24.] Mahipalan, M., & Sheena, S. (2019). Workplace spirituality, psychological well-being and mediating role of subjective stress: A case of secondary school teachers in India. International Journal of Ethics and Systems, 35(4), 725–739. https://doi.org/10.1108/IJOES-10-2018-0144

[25.] Malhotra, M., & Kathuria, K. (2017). Relationship between spiritual intelligence, job satisfaction and counterproductive work behaviour among employees of multinational companies in India. Journal of Psychosocial Research, 12(2), 315–323.

[26.] Manion, J., & Bartholomew, K. (2004). Community in the Workplace: A Proven Retention Strategy. JONA: The Journal of Nursing Administration, 34(1). https://journals.lww.com/jonajournal/fulltext/2004/01000/community_in_the_workplace__a_proven_retention.10.aspx

[27.] Milliman, J., Czaplewski, A. J., & Ferguson, J. (2003). Workplace spirituality and employee work attitudes: An exploratory empirical assessment. Journal of Organizational Change Management, 16(4), 426–447. https://doi.org/10.1108/09534810310484172

[28.] Mobley, W. H., Horner, S. O., & Hollingsworth, A. T. (1978). An evaluation of precursors of hospital employee turnover. Journal of Applied Psychology, 63(4), 408.

[29.] NWANZU, C. L. (2020). The Implications Of Workplace Spirituality And Workplace Attitudes On Job Performance: A Literature Review. Fulafia Journal of Social Sciences, 3(2), 14–26.

[30.] Oriol, E. de C., & Gomes, M. B. (2022). Influence of workplace spirituality in the job satisfaction of the public sector employees. Revista de Gestão e Secretariado, 13(3), 1533–1557. https://doi.org/10.7769/gesec.v13i3.1432

[31.] Panigrahy, N. P., Jena, L. K., & Pradhan, R. K. (2014). Effect of workplace spirituality towards human capital formation: a conceptual review.

[32.] Pawar, B. S. (2009). Workplace spirituality facilitation: A comprehensive model. Journal of Business Ethics, 90(3), 375–386. https://doi.org/10.1007/s10551-009-0047-7

[33.] Rego, A., & Pina E Cunha, M. (2008). Workplace spirituality and organizational commitment: An empirical study. Journal of Organizational Change Management, 21(1), 53–75. https://doi.org/10.1108/09534810810847039

[34.] Rezapouraghdam, H., Alipour, H., & Arasli, H. (2019). Workplace spirituality and organization sustainability: a theoretical perspective on hospitality employees' sustainable behavior. Environment, Development and Sustainability, 21, 1583–1601.

[35.] Sreeja, T., Mukherjee, U., & Jagadeeswari, I. U. (2023). Workplace Spirituality and Turnover Intentions: Mediating Role of Job Satisfaction. SDMIMD Journal of Management, September, 117–131. https://doi.org/10.18311/sdmimd/2023/32530

[36.] Tan, H. H. (2000). Institutional Knowledge at Singapore Management University Toward the Differentiation of Trust in Supervisor and Trust in Organization. 241–260.

[37.] The, S., Review, M., Jul, N., Rousseau, D. M., & Burt, R. S. (1998). Introduction to Special Topic Forum : Not so Different after All : A Cross-Discipline View of Trust Author (s): Denise M. Rousseau, Sim B. Sitkin, Ronald S. Burt and Colin Camerer Published by : Academy of Management Stable

URL : https://www.jstor. 23(3), 393–404.

[38.] Van Der Walt, F., & De Klerk, J. J. (2014). Workplace spirituality and job satisfaction. International Review of Psychiatry, 26(3), 379–389. https://doi.org/10.3109/09540261.2014.908826

[39.] Zeffane, R., & McLoughlin, D. (2006). Cooperation and stress. Management Research News, 29(10), 618–631. https://doi.org/10.1108/01409170610712326

[40.] Manning, T. T. (2002). Gender, managerial level, transformational leadership and work satisfaction. Women in Management Review, 17(5), 207–216. https://doi.org/10.1108/09649420210433166

[41.] Moon, M. J. (2000). Organizational Commitment Revisited in New Public Management: Motivation, Organizational Culture, Sector, and Managerial Level. Public Performance & Management Review, 24(2), 177. https://doi.org/10.2307/3381267

[42.] Rifadha, M. U. F. (2019). The Impact of Work Life Balance on Job Satisfaction of Managerial Level Employees of People's Bank, (Head Office), Sri Lanka. Journal of Management, 12, 27.

[43.] van der Voet, J., & Van de Walle, S. (2018). How Cutbacks and Job Satisfaction Are Related: The Role of Top-Level Public Managers' Autonomy. Review of Public Personnel Administration, 38(1), 5–23. https://doi.org/10.1177/0734371X15609409

Overview of Gig Workers' Challenges and Benefits for Sustainable Gig Economy

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ABSTRACT

The primary objective of the research is to analyze the overview of gig workers' challenges and benefits for a sustainable gig economy. The Gig work and Gig economy have been extensively discussed with thrust on their Pros and Cons from the stakeholder's perspective. The authors examined the various Gig workers' approaches to their job and task performance to analyze the differentiating factors that contribute to shifting towards the Gig business model by many business sectors. The role of human resource departments in enabling the strategies for gig employment that will enhance higher productivity of the Gig workers that drive economic progress should be deliberated from the Global economy's perspective. However, the impact of human resource management (HRM) policies concerning the Gig workers is not much explored as they are in the nascent stage.

The authors interviewed e-commerce delivery workers and the aggregate cab drivers who are the core gig workers in India and the sample is drawn from Bangalore City of certain chosen area. The responses were categorized based on thematic analysis and clusters were analyzed to assess their impact. The Global scenario is shifting towards Gig work in most countries, due to its flexible nature and the individual benefits of this nature of work. The Gig worker's statements are classified as First-Order Concepts (Respondent's Terms), Second-Order Themes (Researcher's Interpretation) and Aggregate Dimensions (Overarching Themes) which again further clustered into alphanumeric codes to derive the Thematic Analysis of the Gioia Methodology for qualitative analysis of the entire statements collected as data. This codding's of the themes resulted in a conceptual framework which is the crux of these dimensions considered from one aspect of the Gig worker's challenges of the work. The qualitative analysis focused on the narratives' of most common remarks mentioned by the Gig workers' interviewed excluding Expert roles of the Gig work.

Keywords: Gig Economy, Gig worker, Gig Employment, Gig stakeholder Challenges of Gig work, Rules and Guidelines of Gig employment

1. INTRODUCTION

Gig workers include independent contractors who carry out services or tasks, such as taskers, freelancers, delivery agents, and ride-share drivers; in situations where businesses acknowledge certain rights or benefits, gig employees. Candidates who are thinking about taking up gig work in order to supplement their income. Digital marketplaces such as Uber, Ola, Zomato, Swiggy, Amazon Mechanical Turk, Upwork, Fiverr, and others are in charge of supplying the technological infrastructure and marketplace. Customers or end users who use gig services because they are convenient and reasonably priced. Employing gig workers allows businesses to expand effectively without being constrained by conventional employment laws. Start-up's and SMEs (small and medium-sized businesses) gain from gig services, Creating rules, labor laws, and policies that strike a balance between platform innovation and worker protection. A gig economy worker is someone who does temporary jobs, usually as a freelancer or independent contractor in the service industry. Gig workers can establish their own hours, work from home, and be their own bosses—liberties that most full-time employees can only imagine.

The economic boom changed how people work and earn a living. In particular, online retail relies greatly on freelancers working in organizations such as Amazon and Flipkart.

There are concerns about pay fairness, job security, the treatment of these workers, and how they are treated. While the gig economy provides new flexibility and additional income, it also brings challenges that threaten worker security and quality of life. E-commerce has various gig economy jobs, such as delivery services and customer service, typically organized through contracts or freelance work, which is changing as digital platforms adapt the workforce to technological advancements. For workers, work's appeal stems from its flexibility, yet this flexibility can lead to unstable job conditions.

2. REVIEW OF LITERATURE

Compensation continues to be a debated topic, among workers due to the significant differences in pay rates depending on the platform and type of work involved. While certain platforms provide compensation packages there is criticism within the sector for the inconsistent and insufficient pay offered. The instability is further worsened by the absence of labour benefits and legal safeguards. Pant and Majumder (2022) shed light on the struggles in the gig economy focusing on issues surrounding fluctuating pay and inadequate support systems, for workers. Many independent contractors experience uncertainty because of work schedules and the absence of typical job perks found in conventional employment setups (source; Kuhn et al., 2021).

Human Resource Management practices have an impact, on the experiences of workers by influencing their job satisfaction and long-term success in gig careers according to a study conducted in Saudi Arabia by Asfahani et al., (2023). The study demonstrates the transformative power of HR tactics in the Saudi gig economy by finding a large positive association between job happiness, career durability, and effective HR practices. These findings highlight the necessity for advanced HR solutions catered to the particular Saudi gig environment, making them crucial for practitioners and policymakers concentrating on Vision 2030 targets. The research highlights the link between thought out HR strategies and job satisfaction as well as the sustainability of gig work careers among workers, in this sector. Unnikrishnan & Baral (2023) on the hand propose that e commerce businesses stand to gain advantages by implementing inclusive human resources strategies that involve and assist freelance workers. According to Dey et al. (2020)., technology is facilitating a transition, towards informal labour practices on a scale as part of a broader trend in the workforce evolution noted by Pant and Majumder (2022) highlighting the significant role of technology, in shaping labour dynamics.

The fast growth of the economy has ignited discussions, about revising legal safeguards for gig employees. The ongoing challenges like pay disparities based on gender, lack of healthcare coverage and job instability are causing worry. Rahman, Sultan and Tabassam (2024) stress the need for changes to safeguard workers' rights while maintaining the flexibility essential, for businesses. Ethical human resource procedures (McDonnell et al., 2021) paired with updated policies could address these conflicting demands. Offer security to gig employees. In their work, from (2022*, Dey along, Ture & Ravi) emphasize the importance of establishing laws and regulations that support workers in the economy while also preserving its economic benefits. In the coming years of us the gig economy is predicted to keep developing with a rising trend, towards job arrangements, within the online commerce sector. Nonetheless it's crucial that this expansion is handled ethically prioritizing pay and safeguarding worker rights. Tug and Basar (2023) propose that upcoming studies should delve into how gig work impacts employment setups and devise plans to tackle these hurdles. In their study conducted in (2024 by Ur et al.,) the authors emphasize the significance of gathering real world data to shape policies and improve strategies, for a gig economy that is both sustainable and fair, for all involved parties.

Challenges faced by Gig workers and the Sustainable Economy

The Gig economy, characterized by flexible, short-term work often facilitated through digital platforms, has emerged as both an opportunity and a challenge for workers. One of the most significant issues surrounding gig work is the unstable nature of income, as gig workers often struggle with financial instability due to the inconsistency of their income. Typically compensated per task or delivery completed produces an irregular worker income stream, heightened by fluctuating demand and the highly competitive landscape (Salleh et al., 2023; Palhad et al., 2023). A third big problem is that gig workers have few protections and receive no benefits(Donovan, 2016). Gig workers generally aren't afforded health insurance, paid leave, or retirement benefits like other employees. Salleh et al. (2023) discuss how structures of social safety net that mitigate against such dreary difficulties were almost absent when, during COVID-19 pandemic waves, many workers had no choice and only immediate lifelines. Silva and Nyobe (2023) state that these challenges create an ecosystem whereby gig workers are at higher risk of precariousness and long-term insecurity.

Considerations such as poor working conditions only add more complexity to the nature of the gig economy. Many gig workers, working unpaid overtime under arduous conditions, have drudged away under no social protection. An example is exposure to health risks, a critical topic during the pandemic, as workers were not provided adequate protection (Salleh et al., 2023). The framework for gig work which are both legal and regulatory is also still embryonic, Policymakers and regulators ought to think about ways to improve and broaden the laws pertaining to gig labour. (Stewart, & Stanford, 2017). The gig economy falls into a legal grey area when involving workers, as workers have no legal employment right, fair pay (Myhill & Sang, 2021) or rights to unionize (S. & V. 2023). However, this vagueness of the regulations makes the argument for sweeping labor reforms. Nevertheless, ethical and social issues arise in the gig economy, particularly issues of algorithmic control, discrimination, and exclusion of workers. Using algorithms to monitor worker performance has created a sense of injustice and lack of connection on digital platforms. Also, the impersonal and remote nature of digital labor contributes to its discriminatory and dehumanising atmosphere, leading to feelings of helplessness (Tan et al., 2020).

Human Resource Department (Neena P C, 2019), has to consider many aspects to frame the policies pertaining to their well-being and welfare which has to take into account many aspects which are as follows. A lot of delivery workers receive very little money for each order, and their income is sometimes dependent on tips from customers. Unpredictable Income due to the facts such as Platform algorithms, cancellations, and variations in demand all affect earnings. High Operating Costs due to the fact that employees are responsible for paying for fuel, upkeep, and auto repairs. Battery replacement is a major expense for users of e-bikes and scooters. Extended Working Hours with Working long shifts to reach financial goals might cause burnout and fatigue. Health Risks as Poor diet because to erratic meal schedules. Physical strain from walking or riding for extended periods of time while toting bulky food bags.

Weather and Pollution Exposure with these type of Employees spends a lot of time outside are susceptible to extremes in temperature, precipitation, heat, and air pollution. Traffic Accidents are quite common as fast driving is encouraged by strict delivery deadlines, which raises the danger of accidents. Personal Safety is also in question as there is a chance of violence or harassment in untried or dangerous delivery locations, particularly while working late nights. Despite these challenges and hardships (Lauren, & Anandan,, 2024), the gig economy is a proper solution to the promise of inclusion in the economy. It facilitates the accessibility of the labor market, providing opportunities to disadvantaged minorities and others seeking non-standard working arrangements. It has further enabled more participation in the labor market amongst those who struggle to find traditional work, such as seniors (Salleh et al., 2023; Palhad et al., 2023).

Benefits of Gig workers

Gig work helps to translate flexibility into reality as there is greater freedom to decide on what and when, firmly establishing a work-life balance that suits their needs (D., 2023; Palhad et al., 2023). This autonomy comes with great benefits. For some, the flexibility enhances their job satisfaction and, honestly, the freedom that the traditional job structure may not allow. However, without better policies, the gig economy will not be sustainable Iancu, (2023). Academics argue that regulatory mechanisms such as minimum wage and collective bargaining rights must be introduced as the first steps. They can also help create a fairer playing ground by extending social protections, such as health insurance and retirement plans, to gig workers (Silva & Nyobe, 2023). Integrating these reforms could create a sustainable economy that rides the line between the flexibility and independent nature of gig work while following the stability of social safety nets.

The study by Henley (2020) cover how employment regulations affect the trade-off between the advantages of flexibility and autonomy and the disadvantages of low pay and unstable work. The rapid definition of a task and payment for its completion—which may vary depending on reputation and spatial and temporal context—rather than contracted payment for hours of work is what defines gig-working, even though the growth of online platforms has made it easier to match job suppliers with customers.

As the Bengaluru Traffic Police (BTP) has recently highlighted, civil and traffic violations by e-commerce delivery personnel have been an increasing problem. In a particular enforcement drive, almost 6,000 cases were registered against delivery riders for different offenses, highlighting the growing demand for regulation and awareness of this industry (DHNS & DHNS 2024). From the data, the most common violation was pillion riders not wearing helmets at 2,304, which shows a lack of adherence to basic safety. Then came 1,260 illegal parking in no-

parking zones, feeding urban congestion and blocking traffic. Furthermore, 671 drivers had been booked for entry into no-entry zones, indicating a blatant disregard for restricted access areas, which might be a hazard on the road. These results reflect the extent of traffic violations by the delivery boys and indicate the need for strategic efforts to prevent violations and create safer road conditions (DHNS & DHNS, 2024, www.deccanherald.com/india).

Relevant theories - Motivational Theory of Hierarchy of Needs

The study also links to the most common Motivational theory of Abraham Maslow wherein the Employees are directed to take up the challenges of the Gig work to meet their basic needs for survival. The broader needs which encompass the survival instincts for any human being are the fundamental inner drive for any human being to meet their livelihood to live a better life. Maslow's Hierarchy of Needs offers a useful framework for examining the difficulties gig workers encounter. The theory is consistent with their experiences in the following ways: Due to irregular income, no minimum wage guarantees, and limited access to benefits like health insurance, many gig workers find it difficult to cover necessities like food, housing, and health care. The implication are workers may be unable to attain stability at this fundamental level due to the erratic nature of Gig labor income (Muhammad Ateeb & Ayaz Khan, (2020). Safety Needs Challenge are referred to as Gig labor frequently lacks financial safety nets like pensions or severance compensation, as well as job security and workplace safety laws. Without official contracts, employees are at risk of abrupt termination or platform deactivation. Employees may remain in survival mode due to this lack of safety, which makes it difficult for them to concentrate on more important tasks. The Belongingness and Love Needs Challenge are referred to as Gig workers frequently work alone, with little chance to connect with coworkers, generate a sense of community, or establish connections at work. Feelings of alienation brought on by a lack of support systems or professional networks might lower motivation and job satisfaction are the major implications.

Self-determination theory

Self-determination theory (SD) places a strong emphasis on the value of wellbeing, personal development, and intrinsic drive. It investigates the circumstances in which people flourish and find contentment in themselves. The goal of the study by Croteau et al., (2019) is to comprehend how the carrot and stick model motivates the Gig employees' to continue their work and to attain their needs of survival which might motivate employees in the gig economy's setting. The conceptual paper by Joshi, A, 2024 examines by how the design of the digital labor platforms that underpin the gig economy (as well as the nature of the jobs mediated through these IT artifacts) can affect important antecedents of self-motivation. It does this by drawing on the self-

determination theory, job-characteristic theory, and enterprise social media research. This study combines theory and empirical data to develop a mid-range theory that Results shows how companies can help gig workers stay motivated by integrating two social media tools (social networking and social badging) and designing their digital labor platforms thoughtfully.

Behavioural Dynamics and Influencing Factors in the Gig Economy

Many factors, including the work, organizational management systems, and individual motivations, shape gig worker behavioral dynamics. At the heart of this understanding is the psychological contract. Because gig work is more fragmented and task-oriented than regular employment, gig workers participate in job crafting and work identity management. Because organizations will offer minimal training opportunities (Cropanzano et al., 2022), they will learn to reconcile autonomy dependence, pay variability, and self-development. Moreover, fulfilling transactional and relational psychological contracts can improve gig workers' task performance and promote a strengthened sense of organizational identification for those working for a more extended period (Liu et al., 2020). The experience of gig/open work is already complex enough, and algorithmic management embodies another layer of this experience. On the other hand, gig workers often see algorithm management systems as a challenge and obstacle. Viewed as impediments, these systems can elevate stress and incite counterproductive deviant behaviors. On the other hand, when a threat is taken as a challenge, such behaviors may decrease. Workers' regulatory focus—whether they are more driven by promotion or prevention—regulates the effect of algorithmic management and leads them to interpret these management systems in different ways (Zhang et al., 2023).

The Gig Status are also represented as Food delivery workers whom are categorized as independent contractors and do not have health insurance, paid time off, or pensions. Algorithmic Control is another challenge where Employees' pay and platform access are impacted when orders are cancelled or ratings are low, frequently with no redress.

Platform algorithms give preference to delivery workers with higher ratings or those who are more recent, which limits prospects for others which leads to Inequitable Algorithms. Complicated Rules are also frustrating with confusion and discontent that are caused by opaque payment formulas, fees, and incentives. When devices or apps malfunction, it can interfere with productivity and result in lost revenue which is related to the external cause of Device Dependency.

The Isolation factor is higher because gig employment frequently involves little social interaction, people may feel alone. Anxiety is exacerbated by unfavourable ratings, unpleasant customer experiences, and pressure to fulfil

delivery deadlines which ends up in stress. Their achievements are frequently underappreciated by society, which exacerbates mental health issues and this creates Stigma. The impact of these differences is compounded by the organizational world in which they operate: the more they want autonomy and have it, or do not want it and are given security, the healthier they will be. Misalignment may decrease the well-being of workers, whereas alignment may increase it, but this also makes workers vulnerable to exploitation (Felix et al., 2023). Within the gig economy, factors like the nature of work relationships and the design of digital platforms shape motivation (Jiaojiao, & Lifei, 2023). Platforms designed to reinforce self-motivating elements can further engage workers and increase connectivity and support when coupled with social media tools (Jabagi et al. Gig workers must also be innovative; job crafting behaviors help bring this about. Through controlled and autonomous motivations, job crafting also facilitates knowledge workers to contribute more adequately in their work domains regarding their innovative behavior (Song & Jo, 2023). Economic and behavioral drivers are also at play in these gig workers' decision-making processes. Monetary incentives are still relevant in work engagement and time spent working.

Gig workers' motivations are complex and manifest through behavioral mechanisms, including income targeting and labor inertia (Allon et al., 2018). Moreover, emotional labor could mediate the relationship between digital platform's perceived behavioral control and job satisfaction. Therefore, emotional regulation and perceived autonomy or control over work tasks significantly shape worker experiences (Marquis et al., 2018).

Finally, the gig economy context calls for modification of traditional Organizational Citizenship Behavior (OCB) theories. That means gig workers may show citizenship behaviors, but the reasons for that may differ from those for conventional employees. Due to the substantial dissimilarity of gig work, this indicates the need to revisit the antecedents of extra-role behavior of employees (Moorman et al., 2023).

TABLE 2: Variables' Summary Statistics

Stakeholder Type	First-Order Concepts (Raw Data)	Second-Order Themes	Aggregate Dimensions
E-Commerce Delivery Worker	"I can choose my working hours, but it's hard to make enough during low-demand times."	Flexible but unpredictable work hours	Work Flexibility and Uncertainty
Cab Driver	"The app shows strange routes	Technology challenges in navigation	Technological Challenges in Gig Work

Stakeholder Type	First-Order Concepts (Raw Data)	Second-Order Themes	Aggregate Dimensions
	sometimes, and I lose time correcting it."		
Aggregator Worker	"There are no benefits; if I fall sick, I earn nothing."	No benefits or job security	Job Security and Worker Well-Being
Key Stakeholder	"We try to incentivize them, but it's hard to balance fair wages with profit margins."	Struggles with fair pay structures	Challenges with Platform Governance

Note: Comparative Insights from different classification of Gig- workers

The segmenting responses based on different types of gig workers are observed and tabulated which is mentioned above with the specific remarks. After grouping the second-order themes, link them to relevant theories (such as motivation theory, gig economy literature, etc.) to position your findings in a broader theoretical context.

First-Order Concepts (Respondent's Terms)	Second-Order Themes (Researcher's Interpretation)	Aggregate Dimensions (Overarching Themes)
"We don't have fixed hours, it's all about when the demand spikes."	Flexible but unpredictable working hours	Work Flexibility and Uncertainty
"Sometimes the pay is good, but other times it's not enough for a full day's work."	Unstable income and fluctuating earnings	Financial insecurity or variable compensation structures
"I enjoy the freedom of working on my own schedule."	Autonomy in work schedule	Job autonomy, self-directed work
"It's hard to rely on this job, there are no real benefits like healthcare."	Lack of job security and benefits	Job Security and Worker Well-Being
"We don't get paid if we're sick or unable to work."	No provision for paid leave or health coverage	Lack of employee benefits or benefit insecurity

First-Order Concepts (Respondent's Terms)	Second-Order Themes (Researcher's Interpretation)	Aggregate Dimensions (Overarching Themes)
"I've had issues with unfair deactivation from the app, and it's hard to reach anyone for help."	Challenges with platform-based management and support	Challenges with Platform Governance
"We're just numbers to them. They don't care if we lose work because of an app glitch."	Lack of communication and transparency from platforms	Communication breakdown, Employee engagement
"We don't have fixed hours, it's all about when the demand spikes."	Flexible but unpredictable working hours	Work Flexibility and Uncertainty

Note: Gig- workers and the **(Respondent's Terms), (Researcher's Interpretation) & (Overarching Themes)**

3. QUALITATIVE ANALYSIS - GIOIA METHODOLOGY

The purpose of the Gioia methodology is to maintain transparency in the development of themes, ensuring that the findings are clearly traceable from raw data to theoretical insights. Gioia methodology is applied to conduct the thematic analysis of the data collected from the 27 key stakeholders, 64 gig workers (e-commerce delivery partners for food and products), and 40 cab drivers and aggregator workers. Hence analysis went through three levels of abstraction: First-Order Concepts, Second-Order Themes, and Aggregate Dimensions. By using this method, the study could develop specific, in-depth viewpoints that contribute to more comprehensive, broadly applicable understandings of the experiences of gig workers and important gig economy stakeholders. Additionally, the analysis offers a clear and organized route from unprocessed data to theory.

1. Conceptual model or framework
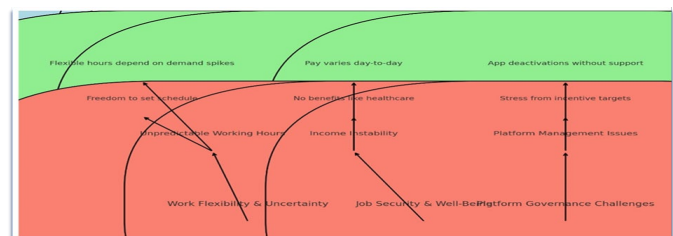
Figure I: Hierarchical tree-style Data Structure Diagram to represent the first-order concepts, second-order themes, and aggregate dimensions

The image appears to depict a conceptual framework, likely related to the challenges and features of gig work which is narrated based on the statements from the Gig workers on specific aspects of the challenges. The model explains that the positive and negative features of the Gig work with respect to the benefits as flexible hours and the increase in pay when there is a huge demand.

Important attributes: Green Zone (upper portion): highlights a few advantages or adaptability elements of gig work: Flexible hours based on periods of high demand imply scheduling autonomy. Daily pay fluctuations indicate both variability and income potential. Unsupported app deactivations seem to be a sign of a problem related to platform management.

The bottom part, or Red Zone: symbolizes difficulties or unfavorable experiences related to gig work: Work Flexibility & Uncertainty and Job Security & Well-Being are more general topics that include themes like unpredictable working hours and income instability. Concerns including stress from incentive targets and a lack of support systems give rise to platform management issues. control (red zone). These difficulties result from a lack of support systems, erratic working conditions, and reliance on demand fluctuations. The arrows connecting certain areas show how particular difficulties or advantages relate to more general thematic aspects, emphasising the two-pronged character of gig work—balancing flexibility with a great deal of unpredictability.

Conclusion: According to the model, gig labour has serious issues with job stability, well-being, and platform even though it also offers flexibility and autonomy (the "green zone").

Recommendations for Gig Work

Improved pay plans are suggested which covers operating expenses, offering more equitable wages, and establishing more transparent bonus structures. The improved working conditions should be extended to the gig work such as better health and safety safeguards, access to healthcare, and sufficient break times which are essential for a sustainable gig economy. The technological enhancements such as improving communication systems, reducing downtime, and optimizing delivery apps for more dependable routing are another aspect to be monitored regularly to reduce the frustration which also leads to the fatigue and dissatisfaction of this type of work, as part of the work nature is dependent on these technologies. Governments ought to establish or implement legislation that guarantee gig workers' access to minimum wage requirements, health insurance, and other necessary benefits as a part of their regulatory safeguards. By tackling these issues, e-commerce delivery workers can benefit from improved working circumstances, which will increase their job satisfaction and provide clients with more dependable service.

4. CONCLUSION

Since the majority of e-commerce delivery workers are categorized as independent contractors, they are not eligible for retirement savings, health insurance, or paid time off. In addition, they lack legal protections for equitable wages, overtime pay, and working hours. To address these issues, platforms, governments, and communities must come up with comprehensive solutions. Th absence of Legal Protections for Gig workers is not particularly protected by labor laws in many nations and this also to be addressed by the respective Goverments. The Government should ensure economic sustainability in bringing attention to concerns including job stability and worker exploitation by the Stakeholder's involved in this ecosystem. The Policies and regulations framing committee of the Labour rights can examine the gig economy's effects on society, culture, and technology by offering analysis and suggestions for practice and policy for sustainable Gig employment. The Labour welfare committees can advocate for gig workers' rights, benefits, and fair pay to avoid job precarity addressing social issues such as insecurity or instability which prevails among gig employment.

5. DECLARATION

I, [Dr. Neena PC], hereby confirm that the manuscript titled "[Overview of Gig Workers' Challenges and Benefits for Sustainable Gig Economy]" authored by [Author(s) Dr. Neena PC, Dr. Vinayak Anil Bhat[2] & Ms. Riya R], has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to [International Management Perspective Conference (IMPeC) 2025, with emphasis on Digitalization, Entrepreneurship, and Sustainability]. I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

Bibliography

[1.] Asfahani, A.M., Alsobahi, G., & Dahlan, D.A. (2023). Navigating the Saudi Gig Economy: The Role of Human Resource Practices in Enhancing Job Satisfaction and Career Sustainability. *Sustainability*.

[2.] Allon, G., Cohen, M., & Sinchaisri, W. (2018). The Impact of Behavioral and Economic Drivers on Gig Economy Workers. *The Wharton School*. https://doi.org/10.2139/ssrn.3274628.

[3.] Cropanzano, R., Keplinger, K., Lambert, B., Caza, B., & Ashford, S. (2022). The organizational psychology of gig work: An integrative conceptual review.. *The Journal of applied psychology*. https://doi.org/10.1037/apl0001029.

[4.] Dey, C., Ture, R.S., & Ravi, S. (2022). Emerging World of Gig Economy: Promises and Challenges in the Indian Context. *NHRD Network Journal, 15*, 71 - 82.

[5.] Donovan, S. A., Bradley, D. H., & Shimabukuru, J. O. (2016). What does the gig economy mean for workers?

[6.] Felix, B., Dourado, D., & Nossa, V. (2023). Algorithmic management, preferences for autonomy/security and gig-workers' wellbeing: A matter of fit?. *Frontiers in Psychology*, 14. https://doi.org/10.3389/fpsyg.2023.1088183.

[7.] Henley, A. (2020). Forms of self-employment: What do we know about the gig economy. *Economic Modelling*

[8.] Iancu, A. (2023). Sustainable management in the gig economy: traditional vs. Gig business model in the delivery sector. *Proceedings of the international management conference.* https://doi.org/10.24818/imc/2022/01.17.

[9.] Jabagi, N., Croteau, A. M., Audebrand, L. K., & Marsan, J. (2019). Gig-workers' motivation: thinking beyond carrots and sticks. Journal of Managerial Psychology, 34(4), 192-213. https://doi.org/10.1108/JMP-06-2018-0255.

[10.] Jiaojiao, L., & Lifei, M. (2023). The Dilemma and Thinking of Gig Workers in the Digital Organization Environment. *Information Systems and Economics.* https://doi.org/10.23977/infse.2023.040606.

[11.] Joshi, A., Jain, S., & Gupta, P. K. (2024). Challenges and impact of the gig economy. *Technological Forecasting and Social Change.*

[12.] Kuhn, K.M., Meijerink, J., & Keegan, A. (2021). Human Resource Management and the Gig Economy: Challenges and Opportunities at the Intersection between Organizational HR Decision-Makers and Digital Labor Platforms. *Research in Personnel and Human Resources Management.*

[13.] Lauren, R. M., & Anandan, C. C. (2024). Exploring the Challenges and Uncertainties faced by Gig Workers. *Journal of Academia and Industrial Research (JAIR)*, *12*(2), 24-30.

[14.] Liu, W., He, C., Jiang, Y., Ji, R., & Zhai, X. (2020). Effect of Gig Workers' Psychological Contract Fulfillment on Their Task Performance in a Sharing Economy—A Perspective from the Mediation of Organizational Identification and the Moderation of Length of Service. *International Journal of Environmental Research and Public Health*, 17. https://doi.org/10.3390/ijerph17072208.

[15.] Marquis, E., Kim, S., Alahmad, R., Pierce, C., & Robert, L. (2018). Impacts of Perceived Behavior Control and Emotional Labor on Gig Workers. *Companion of the 2018 ACM Conference on Computer Supported Cooperative Work and Social Computing.* https://doi.org/10.1145/3272973.3274065.

[16.] Meijerink, J. and Keegan, A. (2019), "Conceptualizing human resource management in the gig economy: Toward a platform ecosystem perspective", Journal of Managerial Psychology, Vol. 34 No. 4, pp. 214-232. https://doi.org/10.1108/JMP-07-2018-0277

[17.] Moorman, R., Lyons, B., Mercado, B., & Klotz, A. (2023). Driving the Extra Mile in the Gig Economy: The Motivational Foundations of Gig Worker Citizenship. *Annual Review of Organizational Psychology and Organizational Behavior.* https://doi.org/10.1146/annurev-orgpsych-111821-033012.

[18.] McDonnell, A., Carbery, R., Burgess, J., & Sherman, U. (2021). Technologically mediated human resource management in the gig economy. *International Journal of Human Resource Management.*

[19.] Muhammad Ateeb Ayaz Khan. (2020). Gig Economy: Value Comparison Against Noncontingent Income and Corporate Employment Benefits. Global Journal of Management and Business Research, 20(B3), 21–26. Retrieved from https://journalofbusiness.org/index.php/GJMBR/article/view/3055

[20.] Myhill, K, Richards, J & Sang, K 2021, 'Job quality, fair work and gig work: the lived experience of gig workers', International Journal of Human Resource Management, vol. 32, no. 19, pp. 4110-4135. https://doi.org/10.1080/09585192.2020.1867612 Digital Object Identifier (DOI): 10.1080/09585192.2020.1867612

[21.] Neena P C, (2019), Changing Role of Human Resource Management From The Perspective Of Gig Economy., Journal International Journal of Advance and Innovative, Volume 6, Issue 2 (XVI) ISSN 2394-7780, PP. 159-161

[22.] Pant, J.J., & Majumder, M.G. (2022). Themes and Narratives of Gig Economy: An Indian HR Perspective. *NHRD Network Journal, 15*, 83 - 99.

[23.] Palhad, S., Onwubu, S., Singh, R., Thakur, R., Thakur, S., & Mkhize, G. (2023). The Benefits and Challenges of the Gig Economy: Perspective of Gig Workers and Small Medium and Micro Enterprises (SMMEs) in South Africa. *African Journal of Inter/Multidisciplinary Studies.* https://doi.org/10.51415/ajims.v5i1.1051.

[24.] Silva, M., & Nyobe, S. (2023). Social sustainability in the gig economy era. *Revue Française de Gestion* Industrielle. https://doi.org/10.53102/2023.37.01.1140.

[25.] Salleh, N., Shukry, S., & Jokinol, V. (2023). Analyzing the Challenges, Effects, and Motivations of Gig Economy Workers. *International Journal of Academic Research in Business and Social Sciences.* https://doi.org/10.6007/ijarbss/v13-i6/17514.

[26.] Salleh, N., Shukry, S., & Jokinol, V. (2023). Analyzing the Challenges, Effects, and Motivations of Gig Economy Workers. *International Journal of Academic Research in Business and Social Sciences.* https://doi.org/10.6007/ijarbss/v13-i6/17514.

[27.] Tan, Z., Aggarwal, N., Cowls, J., Morley, J., Taddeo, M., & Floridi, L. (2020). The Ethical Debate about the Gig Economy: A Review and Critical Analysis. *Information Policy & Ethics eJournal.* https://doi.org/10.2139/ssrn.3669216.

[28.] Song, L., & Jo, S. (2023). How job crafting behaviors influence the innovative behavior of knowledge workers in the gig economy: based on the organismic integration theory. *Frontiers in Psychology*, 14. https://doi.org/10.3389/fpsyg.2023.1228881.

[29.] Stewart, A., & Stanford, J. (2017). Regulating work in the gig economy: What are the options?. The Economic and Labour Relations Review, 28(3), 420-437.

[30.] Tug, M.A., & Basar, P. (2023). FUTURE OF THE GIG ECONOMY. *Pressacademia.*

[31.] D.S., Rahman, Sultan, M.S., & Tabassam, A. (2024). The impact of the gig economy on traditional employment and the necessity for revised business, hr, and legal strategies. *Pakistan Journal of International Affairs.*

[32.] Unnikrishnan, P., & Baral, R. (2023). Reimagining HR Practices to Attract and Engage Gig Talent: An Organisational Perspective. *NHRD Network Journal, 16*, 248 - 257.

[33.] Zhang, L., Yang, J., Zhang, Y., & Xu, G. (2023). Gig worker's perceived algorithmic management, stress appraisal, and destructive deviant behavior. *PLOS ONE*, 18. https://doi.org/10.1371/journal.pone.0294074.

[34.] DHNS, & DHNS. (2024, November 13). *Bengaluru Traffic Police fines e-commerce delivery personnel of Rs 30.57 lakh for 6,000 traffic violations.* Deccan Herald. https://www.deccanherald.com/india/karnataka/bengaluru/e-comm-delivery-execs-fined-rs-30-57l-for-6-000-traffic-violations-3273644

The Role of Organizational Culture in Mediating the Impact of Talent Management on Job Satisfaction in Higher Education

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ABSTRACT

Purpose

The primary objective of this research is to study the role of organizational culture in mediating talent management strategies on facilitation of job satisfaction in higher education institutions, specifically in a developing region like Northern Odisha with a completely different institutional environment.

Design/methodology/approach

We conducted the research using a cross-sectional survey approach, collecting data from 207 respondents (teaching and administrative staff) in higher education institutions of Northern Odisha. A combination of the Structural Equation Modeling (SEM) method was utilized to examine relationships between talent management practices, organisational culture and job satisfaction.

Findings

Overall, the results present that none of the talent management practices had significant direct effects on job satisfaction scores. The organizational culture too was not a significant moderator between work engagement and performance quality.

Originality

This research is a pioneering evaluation of the interplay between organizational culture, talent management practices and job satisfaction in the context of higher education in Northern Odisha, where these dynamics have not been extensively explored previously.

Research limitations/implications

There is an indication from this study that other institutional factors may be at play in Northern Odishan higher education institutions, over and beyond talent management and organizational culture. Future studies can focus on identifying and understanding these factors.

Practical implications

The research outcomes highlight the imperative for leaders and administrators in higher education to contemplate broader organizational and socio-economic elements in their endeavor to enhance employee satisfaction and organizational efficacy.

Social implications

The study concludes that human resource strategies in higher education institutions of developing countries should be more than talent management practices and should consider broader organizational and socio-economic settings..

Keywords: Organizational culture, Talent management, Job satisfaction, Higher education. Sustainable Human resource management, Northern Odisha

1. INTRODUCTION

Universities and colleges are experiencing increasing pressure to attract, retain, and motivate competent academic and administrative personnel in the rapidly evolving domain of tertiary education. Talent management, encompassing recruitment, professional development, and staff retention strategies, is widely acknowledged as a critical factor in enhancing job satisfaction, which subsequently influences institutional performance and employee retention. Although the direct impact of talent management on job satisfaction has been extensively studied, there remains a paucity of knowledge regarding the mediating role of organisational culture in this relationship, particularly in resource-constrained settings. This study addresses a significant gap in extant research by investigating how organisational culture affects the efficacy of talent management in promoting job satisfaction, with a specific focus on higher education institutions in Northern Odisha, a region characterised by socio-economic challenges. In contrast to previous research that predominantly centres on developed nations or corporate environments, this investigation adopts a novel approach by exploring the interplay between organisational culture, talent management, and job satisfaction within the higher education sector of a developing region. The urgency of this research is underscored by the necessity for context-specific human

resource approaches that not only attract talent, but also foster an environment conducive to long-term job satisfaction and institutional success. As higher education institutions in developing areas contend with financial and governance obstacles, understanding how organisational culture mediates the impact of talent management becomes crucial for devising sustainable solutions.

2. REVIEW OF LITERATURE

Past researchers have continually stressed the role of talent management practice in improving job satisfaction especially in the higher education sector. To illustrate, Mabaso (2020) found that the performance management practices in South African tertiary institutions correlated with a high level of development of talent with increased job satisfaction among academic personnel. Here, a quantitative approach was used using a survey to gather the views of 250 academic staff and the finding revealed that talent development explained 42 percent of the variance in job satisfaction, proving that there is value in the investment in a structured career advancement programme. Similarly, an investigation of the Lebanese higher education sector revealed that enhanced sustainable talent management practices and positive organisational culture induced a highly significant positive impact on job satisfaction, as there was a 15 increase in employee satisfaction levels (Saleh & Atan, 2021). These results confirm that high education practices in talent management, including recruitment, training, and retention, are essential in creating motivated and content workforce.

As higher education institutions, it is crucial to manage talents for improving job satisfaction and organization success. This is about attracting, nurturing and retaining people with skills, who incidentally, are also in line with institutional objectives, because without these the overall excellence will slip into irrelevance in a competitive environment (Saleh, (2021). The studies in the Lebanese and South African higher education areas show that effective talent management leads to job satisfaction (as prompted through talent development and performance management practices) (Mabaso, 2020; Saleh & Atan, 2021). In addition, talent management has positive influence on organisational performance as it builds a context where employees are encouraged to perform better at their job as well as achieving institutional success (Putri et al., 2023).

The scope of the talent management and the sustainable talent management is the difference. Traditional talent management involves attracting and retaining talent for the short term purpose while sustainable talent management emphasises for long term employee development and retention for the long term purpose assisting in overall job satisfaction and organizational sustainability (Alparslan & Saner, 2020). Research also supports that job satisfaction and organisational commitment increase in institutions that adopt sustainable talent management (defined as structured development plans and supportive organisational cultures, as

reported by Saleh & Atan, 2021). Since higher education institutions need to attract and retain competent learners as well as improving their performance, there are both traditional and sustainable approaches they must adopt.

Further investigation revealed that organisational culture, leadership and opportunities for professional development all have an impact on the level of job satisfaction and thus, employee well-being and institutional success. Job satisfaction is affected by a positive organisational culture which involves collaboration and support as indicated in several studies from Ghana, where clarity of role and support influenced satisfaction of the employee (Kankam & Oppong, 2023). Career development and performance management processes directly lead to job satisfaction because they boost continuous learning and growth (Mabaso, 2020). Staff who are in an institution with developed culture in an inclusive manner exposed to development opportunity develop a high level of satisfaction and retention.

Organisational culture is the mediator between talent management and job satisfaction. Sideways Management fosters employee value and engagement (Saleh & Atan, 2021) more positively, with positive and cooperative environment. First of all, research shows that a culture of inclusivity that promote modernisation and recognition muscles a talent management culture, which inevitably aggravates a culture of happiness (Putri et al., 2023). On the other hand, if the culture is unsupportive for talent management practices, it will play a negative role to diminish the effectiveness of talents management practices (Rizwan et al., 2017).

The first hypothesis (H1) argues that talent attraction contributes to job satisfaction. Studies show that an effective talent attraction strategy including high compensation and development prospect, aligns employees' ability to the organisation's objectives resulting in greater satisfaction (Saleh & Atan, 2021). The second hypothesis (H2) implied that knowledge sharing positively affects job satisfaction through promotion of collaborative, innovative and problem solving activities to fulfill work (Malik & Kanwal, 2017). A third hypothesis (H3) suggests that employee training leads to positive differences for workers' feelings toward their jobs through workers' skill enhancement and creating a culture of growth (Chaudhary & Bhaskar 2016). Additionally, institutions that provide effective training to the workforce are better equipped to lead to upsurge satisfaction of the workforce (Hanaysha & Tahir, 2016). Fourth hypothesis (H4) is stated that; career development positively impacting on job satisfaction at working company is affected to the employees who have the clear advancement path of the higher degree of motivation and commitment (Heriyanti & Krisma, 2022). Career progression with structured progression gives the feeling of belonging and security, in turn further increase of satisfaction (Wau & Purwanto, 2021).

Organisational culture mediates the relationship between talent management and job satisfaction. Hypothesis 5a (H5a) also assumes that organisational culture partially mediates the relationship between attraction and satisfaction strategies, and that an attractive one have a facilitating impact on the attraction strategy (Kontoghiorghes, 2016). H5b hypothesizes that organisational culture fully mediates the knowledge exchange and subsequent satisfaction based upon an organisational culture that facilitates knowledge exchange (Azeem et al., 2021). Hypothesis 5C (H5c) states that part of the relationship between employee training and satisfaction is mediated through organizational culture when a culture values continuous learning increases the training effect (Meher & Mishra, 2021). Finally, Hypothesis 5d (H5d) hypothesizes that organisational culture partially mediates between career development and satisfaction since cultures supporting professional development and advancement exacerbate the influence of career development initiatives (Heriyanti & Krisma, 2022).

3.   RESEARCH GAP IDENTIFICATION

Despite these contributions, at best only limited knowledge of the mediating role of organizational culture in the link between talent management and job satisfaction exists. Though prior literature has depicted talent management practice positively associated with job satisfaction, relatively few have disentangled how organizational culture may amplify or mediate such a relationship. For instance, as Alparslan and Saner (2020) illustrated, while sustainable practices of talent management produce organizational commitment and job satisfaction, the precise channels through which organizational culture mediates these effects is ill explained. Like in Kankam and Oppong (2023), a supportive organizational culture was found to increase employee satisfaction in Ghanaian colleges of education, but their work did not investigate the way culture may actually mediate the impact of different talent management practices.

However, the existing research suffers from a key gap in that there has not been any context specific investigation, especially for developing regions such as Northern Odisha, where socio economic factors might influence the existence and effectiveness of talent management practices. Most existing work has taken place within developed countries, leaving a number of questions regarding institutional constraints and cultural nuances in developing areas regarding how these relationships operate. Moreover, while many of the studies have relied on quantitative methods, studies with a mixed method designs lending themselves to greater understanding of the underlying cultural factors and their mediating effects are still not common.

To fill these gaps, this study adopts a cross sectional design with structural equation modeling (SEM) approach to examine the mediating role of organizational culture in the relation between talent management and job satisfaction. Through applying this robust methodology which simultaneously allows analysis of multiple variables, the research able to more adequately account for the interaction of these factors. Finally, the inclusion of higher education institutions in Northern Odisha offers a new geographic and socio-economic context to empirical literature, which promises theoretical and practical insights that can complement existing theorization. By showing how organizing culture mediates the associations between talent management and job satisfaction in a geographic space that has been traditionally underrepresented, these findings will add to the growing body of knowledge.

This study seeks to address a critical research question: Focussing on higher education institutions of Northern Odisha, under what conditions and capability does organizational culture mediate the relationship between talent management practices and job satisfaction? This research addresses the problem caused by the lack of understanding of the very specific role that organizational culture is playing in the effect efficiency of talent management strategies on enhancing job satisfaction. Previous research has established the significance of both talent management and the company culture, but still there is a large void on how these two aspects play together by generating a culture of innovation, specifically in developing regions (Saleh & Atan, 2021).

Our research hypothesis is that organizational culture dramatically mediates the relationship between talent management practices (for example, talent attraction, development and retention) and job satisfaction. Hence, a supportive and collaborative organizational culture are expected to support the positive effect of talent management on the job satisfaction.

The objectives of this study are threefold: Second, examines the direct relationship between sustainable talent management practices and job satisfaction in higher education institutions. Second, I assess the mediating role of organizational culture in this relationship, especially those cultural elements that add to improved job satisfaction. Finally, thirdly to draw out context specific insights into how regional socio-economic factors in Northern Odisha shape these dynamics. The objectives of this study are to offer actionable recommendations for policymakers and institutional leaders aimed at improving employee satisfaction and organizational performance by achieving these objectives.

This study is capable of making the unique contribution due to its focus of the higher education sector in a developing region that has not been represented in previous research. Furthermore, structural equation modeling (SEM) used to assess the mediating role of organizational culture offers a more rich analysis than simply using traditional methods to examine these relationships. The study is also presented as an application of a mixed methods approach combining quantitative and qualitative data to explore how cultural

factors shape talent management outcomes in higher education institutions.

In terms of significance, this study extends beyond the particular context of this place in higher education and its focus on an underreported issue, the effects of staffing and scale on job satisfaction and retention, as policies are implemented in resource constrained environments. The findings of this research will highlight the importance of aligning talent management practices with a conducive organizational culture, hence assist institutions in such socio economic environments to adopt more effective human resource strategies. Although this research makes a unique contribution to the advancement of the field of sustainable human resource management by offering novel insights about how organizational culture can mediate the impact of talent management in nurturing dimensions of meaningful work that are critical to long-term institutional success and employee well-being.

4. METHODOLOGY

For this study, mainly, the methodological approach is mainly quantitative. A cross sectional research design is used by the study to examine the relationship between sustainable talent management practices and Job Satisfaction, with organizational culture as a mediating variable. The data necessary for this project was collected from academic and administrative staff from Higher Education Institutions in Northern Odisha using a structured questionnaire. The data, and the hypothesized relationships between variables, are studied using the structural equation modeling (SEM) technique.

4.1. Research Design

A quantitative research design was employed in this study to ascertain the relationship between independent (talent management practices) and dependent (Job Satisfaction) variables, which were also evaluated to ascertain the mediating role of organizational culture. Using the cross sectional design meant we could take our data at a single point in time at multiple institutions in Northern Odisha, which allowed us to obtain a snapshot of how the two variables studied are related in our context. Data analysis was carried out with the Structural equation modeling (SEM), which is appropriate for multivaried analysis and assessment of mediating effects.

4.2. Sample and Sampling Technique

Academic and administrative staff of higher education institutes located in northern Odisha were the target population of the study. The reasons for selection of these institutions were based on their regional importance and also the diversity in the membership of these institutions comprised of faculty members, executives, administrative or administrative as well as support staff. Based on the Kaiser Meyer Olkin (KMO) measure of sampling adequacy and

Bartlett's test of sphericity, sample size was determined so that the sample was sufficiently large to produce valid and reliable results. A sample size of 207 participants was targeted from a variety of public and private institutions within the region, based on previous research and consideration of statistical power.

Participants for the study were selected using the random sampling technique. This method prevented the selection bias that would occur if each person in the target population had an unequal chance of inclusion in the sample. We also included participants that had at least one year of work experience inside their respective institutions to guarantee that they are familiar with the talent management practices and organizational culture in their place of work.

4.3. Data Collection Tool

The data was collected using a structured questionnaire, which was developed as the primary tool. Questionnaire was designed after establishing validity and reliability from the scales used in the established studies which had high validity and reliability. The questionnaire included three main sections:

4.3.1 Sustainable Talent Management Practices: This section covered practices along talent attraction, knowledge sharing, employee training, and career development. Adapted from validated scales in similar studies, each of these variables was assessed using a five point Likert (1 = Strongly Disagree, 5 = Strongly Agree) scale.

4.3.2 Organizational Culture: This section investigated the measurement of perceived organizational culture in these institutions. These items assessed things like collaborative communication, leadership styles, shared values and openness to change. Secondly, the responses were measured on a five point Likert scale using items in the adapted form of recognized scales of organizational culture.

4.3.3 Job Satisfaction: Measurements of Job Satisfaction were the participants' intention to stay at the institution and their total job satisfaction. Questions regarding job satisfaction, commitment, and motivation to stay in performed were included in this section (using a five point Likert scale).

The questionnaire was composed of 65 items, 6 sections, all included demographic questions providing information about the participants background (e.g. gender, age, education, experience, etc). A pre-test questionnaire was undertaken on a pilot sample of 25 participants to ensure being clear, relevant, and reliable. The questionnaire was improved through feedback from the pilot study, adapting by making adjustments based on this feedback.

5. DATA COLLECTION PROCEDURE

Data was collected over three months between the months of July to August 2024. Google forms were used to distribute

the questionnaires and emails were sent to the principal of the selected faculties to allow them take part in the research. Study participants were notified of the study's objectives; their confidentiality promised; and assured that participation was voluntary. Respondents were anonymised, so no identifying information was collected.

As it concerns time, the online survey method was agreed as easily available and efficient. This meant that they were allowed to do the survey when they had some time to do it, thus increasing response rate. At the end of the data collection period, 207 valid responses were collected, considered sufficient to perform the subsequent statistical analyses.

5.1 Data Analysis Techniques

Descriptive statistics were conducted on the data collected using SPSS version 29 while SEM (structural equation modeling) was done using AMOS 24. The choice of SEM technique came from the ability for assessing the complex relationships between the independent variables (talent management practices), the dependent variable (Job Satisfaction) and the mediating variable (organizational culture) simultaneously. The data analysis procedure followed two key steps:

1. Descriptive Analysis: Means, standard deviations, and correlations of the study variables were computed descriptively to obtain a basic look at the data. This served as an analysis to identify patterns and relationships between Talent management practices, Organizational culture and Job Satisfaction.

2. Confirmatory Factor Analysis (CFA): The measurement model was tested and CFA was done to determine the validity and reliability of the measure items used to explain each construct were determined. Sampling adequacy and data suitability for factor analysis were confirmed by using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. Internal consistency was calculated for each construct using Cronbach's alpha values and a reliability threshold of 0.7 was considered acceptable.

3. Structural Equation Modeling (SEM): Then it was tested through SEM to see if the hypothesized relationships hold. Imagine that this technique was used to evaluate direct and indirect effects and especially to isolate the mediating role of organizational culture between talent management practices and Job Satisfaction. Several indices (chi-square ($\chi2$), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Square Error of Approximation, (RMSEA) were used to assess the model fit. CFI and TLI values greater than 0.90, an RMSEA value less than 0.08, indicated a good model fit.

6. ETHICAL CONSIDERATIONS

The study fully relies on strict ethical approach to the protection of the rights of the participants and the honesty of the study. All adult participants received an informed consent form detailing the study's purpose, if they choose to participate voluntarily, and if a participant wished to withdraw from the study at any time. No personal identifying information was required for data collection and they were collected anonymously.

7. RESULT

TABLE 1: Demographic information of respondent

Demographic	Group	Frequency	Percent	Valid Percent	Cumulative Percent
Age	21-30	13	6.3	6.3	6.3
	31-40	93	44.9	44.9	51.2
	41-50	81	39.1	39.1	90.3
	51-60	20	9.7	9.7	100.0
	Total	207	100.0	100.0	
Gender	Male	80	38.6	38.6	38.6
	Female	127	61.4	61.4	100.0
	Total	207	100.0	100.0	
Marital_Status	Married	183	88.4	88.4	88.4
	Unmarried	24	11.6	11.6	100.0
	Total	207	100.0	100.0	
Education_Qualification	Post Graduate	207	100.0	100.0	100.0
Occupation	Asst. Professor	162	78.3	78.3	78.3
	Asss. Professor	37	17.9	17.9	96.1
	Professor	8	3.9	3.9	100.0
	Total	207	100.0	100.0	

Source : Primary Data collection

The total sample size was 207. Below are summarized demographic characteristics of the participants. The age distribution of the respondents was as follows: 6.It also reported that 3% were under 21, 44.9% were between 21 and 30, 39.1% were between 31 and 40 and 9.7% were between 41 and 60. The respondents were in the 31 to 40 age group, accounting for 44.9 percent of the respondents. In terms of gender 38.6% were male and 61.4% were female. This means that there are more female participants than usual in the study. We had 88.4 percent married and 11.6 percent

unmarried as regards marital status. In the data, married individuals dominate the participants. Respondents were highly educated: all (100%) had a post graduate education. The occupational distribution was as follows: 78.Assistant Professors made up 3%, Associate Professor 17.9% and Professor 3.9%. Most of the respondents were Assistant Professors.

TABLE 2: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.760
Bartlett's Test of Sphericity	Approx. Chi-Square	4652.599
	df	1770
	Sig.	.000

Source: Primary Data collection

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.760, and therefore the sample size is appropriate for factor analysis. Generally KMO values of over 0.6 indicates that the data in question is suitable to be analyzed using this type of analysis.

The pvalue was less than 0.001 using Bartlett's Test of Sphericity and approx. chi square value = 4652.599,df=1770. This is an extremely significant result because it demonstrates that, in fact, the correlation matrix is a non identity matrix, yet another confirmation that factor analysis is indeed appropriate for the dataset.

Taken together, these results collectively indicate this data to be amenable to factor analysis, and form a useful starting point for further investigation of the underlying factor structure.

TABLE 3 : Total Variance Explained

Comp onent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.376	10.627	10.627	6.376	10.627	10.627	6.279	10.466	10.466
2	4.898	8.164	18.791	4.898	8.164	18.791	4.816	8.027	18.493
3	4.546	7.576	26.368	4.546	7.576	26.368	4.406	7.343	25.836
4	4.000	6.667	33.035	4.000	6.667	33.035	4.040	6.734	32.570
5	3.537	5.895	38.930	3.537	5.895	38.930	3.537	5.896	38.465
6	2.603	4.339	43.268	2.603	4.339	43.268	2.882	4.803	43.268
7	1.430	2.384	45.652						
8	1.327	2.212	47.864						

Source : Authors own source

The data was assessed with Principal Component Analysis and the factor structure of the data was determined. The first six components had eigenvalues greater than 1 and provided 43.27% of total variance. More specifically, Component 1 accounted for 10.63%, Component 2 accounted for 8.16%, and Component 3 accounted for 7.58%. On rotation, the first six components together accounted for 43.27 per cent variance, with Component 1 accounting for 10.47 per cent, Component 2 accounting for 8.03 per cent, and Component 3 accounting for 7.34 per cent. Together, components 4, 5, and 6 accounted for an additional 6.73, 5.90 and 4.80 percent of the variance.

The components with eigenvalue less than 1 did not contribute much explained variance. This implies that a six factor model may be a suitable structure of the data according to the eigenvalue threshold 1.
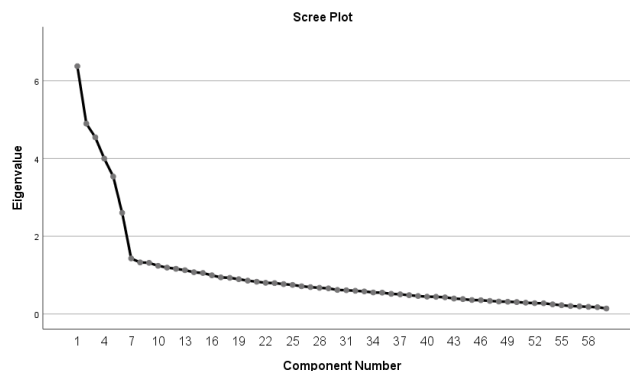
Figure 1: scree plot for this study for CFA analyse

This scree plot gives us the eigenvalues for each of the components that where extracted by Principal Component Analysis (PCA). The plot indicates a clear "elbow" after the sixth component, where the eigenvalues drop sharply and then begin to level off. By looking at the eigenvalues, we can see that the first six components explain a considerable chunk of the variance, and these eigenvalues are significantly larger than the rest of the components contribute a little bit towards explained variance.

The scree plot is based on the idea that six components should be retained, since they explain the most of the data structure. The "elbow" point is typically used as a criterion to

determine the optimal number of factors to retain, and in this case, the data suggests that beyond the sixth component, additional factors contribute minimal variance and may be less meaningful.

TABLE 4: Rotated Component Matrix of all six factors

Rotated Component Matrix[a]						
	Component					
	1	2	3	4	5	6
TA1	.815					
TA9	.806					
TA4	.791					
TA6	.789					
TA8	.786					
TA2	.778					
TA10	.761					
TA3	.749					
TA7	.747					
TA5	.742					
OC8		.732				
OC2		.716				
OC7		.705				
OC5		.677				
OC6		.675				
OC1		.675				
OC9		.666				
OC3		.665				
OC4		.665				
OC10		.602				
ET9			.673			
ET8			.671			
ET6			.664			
ET4			.661			
ET5			.653			
ET7			.647			
ET2			.644			
ET1			.628			
ET3			.618			
ET10			.591			
JS9				.686		
JS5				.659		
JS1				.649		
JS4				.638		
JS10				.633		
JS3				.627		
JS6				.611		
JS7				.573		
JS2				.560		
JS8				.518		
KS4					.632	
KS8					.627	
KS10					.621	
KS3					.603	
KS9					.597	
KS1					.572	
KS2					.571	
KS6					.552	
KS5					.537	
KS7					.461	
CD1						.577
CD5						.568
CD8						.543
CD2						.531
CD10						.530
CD4						.513
CD7						.474
CD9						.465
CD3						.458
CD6						.407
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 5 iterations.						

Source : Authors own source

A Principal Component Analysis (PCA) with Varimax rotation was conducted to explore the underlying structure of six factors: Job satisfaction (JS), Talent Attraction (TA), Career Development (CD), Knowledge Sharing (KS), Employee training (ET), Organizational Culture (OC). After 5 iterations, the rotation converged and the Rotated Component Matrix found is presented.

Items TA1 to TA10 have high loadings for the first factor, Talent Attraction (TA), which lie between.742 and.815, indicating that these items load strongly onto this factor.

Organizational Culture (OC) is defined by loadings of OC1-OC10 having value between.602-.732 and these items resulting in other high loadings under this construct.

The third factor, Employee Training (ET), consists of ET1 through ET10; ET1 through ET9 have factor loadings from.591 to.673 and signify the grouping of training related items.

Job Satisfaction (JS) is the fourth factor, which is characterized by items: JS1 - JS10 and loadings ranging from.518 to.686 with acceptable cohesion defining factor structure of job satisfaction.

The fifth factor, Knowledge Sharing (KS), factors load on items KS1-10 from.461 to.632 showing that these items cluster well underneath the knowledge sharing construct.

However, there was already a weaker, but still coherent, factor structure for career development indicated by loadings.407-.577; we added to this, with the items from Career Development (CD), as the sixth factor, CD1 to CD10, loadings.577-.407.

Table 5: Reliability Statistics of all factors

Reliability Statistics		
Factors	Cronbach's Alpha	N of Items
Talent Attraction	0.92	10
Knowledge Sharing	0.78	10
Training And Development	0.84	10
Career Development	0.71	10
Organizational Culture	0.87	10
Job Satisfaction	0.82	10

Source: Authors own source

A reliability analysis was conducted to assess the internal consistency of the six factors: These areas of Talent Attraction, Knowledge Sharing, Training and Development, Career Development, Organizational Culture, and Job Satisfaction were provided. Measurement of reliability was done through using Cronbach's Alpha, and the results are presented in Table 5.

Talent Attraction factor was highly reliable and Cronbach's Alpha of.92 showed very high internal consistency across the 10 items. The Cronbach's Alpha for the Knowledge Sharing factor was 0.78 across its 10 items and this reliability appeared good too. Training and Development had also high internal consistency, coefficient (Alpha) 0.84.

Consistent with exploratory research, the Cronbach's Alpha of the Career Development factor (0.71) is generally acceptable reliability. The reliability for Organizational

Culture was high: Cronbach's Alpha= 0.87, indicating for a strong internal consistency. Job Satisfaction had a good reliability with a Cronbach's Alpha of 0.82.

Finally, the Cronbach's Alpha values show that, overall, the scales for each of these factors are reliable, most of the factors demonstrating strong internal consistency, making them suitable for further Confirmatory Factor Analysis (CFA) and other inferential analyses.
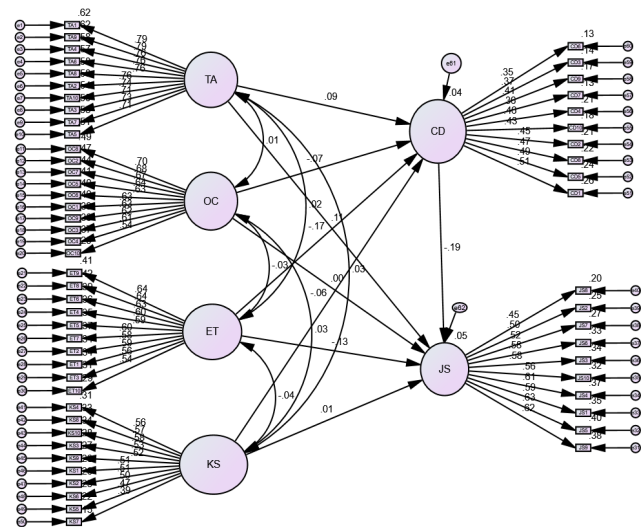
Figure 2 : Model for Organizational Culture in Mediating the Impact of Talent Management

TABLE 6: Model Fit Measures

Measure	Estimate	Threshold	Interpretation
CMIN	1861.368	--	--
DF	1695.000	--	--
CMIN/DF	1.098	Between 1 and 3	Excellent
CFI	0.951	>0.95	Excellent
SRMR	0.061	<0.08	Excellent
RMSEA	0.022	<0.06	Excellent
PClose	1.000	>0.05	Excellent

Source : Gaskin, J. & Lim, J. (2016), "Model Fit Measures", AMOS Plugin.

To test the hypothesized model, we conducted a Confirmatory Factor Analysis (CFA) and model fit indices indicate a very good fit between the hypothesized model and the data.This indicates an excellent fit according to the recommended range of 1–3 for the Chi-square/degree of freedom ratio (CMIN/DF); the value of 1.098 was calculated.

The model was tested against the threshold of 0.95 for CFI here, which was 0.951, surpassing the threshold at excellent fit for model.Cutoff of 0.08 was exceeded with an Standardized Root Mean Square Residual (SRMR) of 0.061,

indicating good fit.• This was reflected in a Root Mean Square Error of Approximation (RMSEA) of 0.022, below the recommended threshold of 0.06 indicating good fit.• Additionally, very good model fit was confirmed by the PClose value (PClose=1.000) being significantly above the threshold of 0.05. the hypothesized model and the data. Table 2 presents the model fit measures, along with their interpretations:

The Chi-square/degree of freedom ratio (CMIN/DF) was 1.098, which falls between the recommended range of 1 and 3, indicating an excellent fit. The Comparative Fit Index (CFI) was 0.951, surpassing the threshold of 0.95, indicating an excellent fit for the model. The Standardized Root Mean Square Residual (SRMR) was 0.061, which is below the cutoff of 0.08, signifying excellent fit. The Root Mean Square Error of Approximation (RMSEA) was 0.022, well below the recommended threshold of 0.06, suggesting excellent fit. The PClose value was 1.000, significantly above the threshold of 0.05, further confirming excellent model fit.

Hu and Bentler's (1999) criteria provide that if CFI greater than and equal to 0.95, SRMR inferior that or equal to 0.08, and RMSEA inferior that or equal to 0.06 it is indicated very well that the model fits on the data. Each of the model fit indices meets or exceeds the "excellent" threshold, supporting the validity of the model structure. The model is also robust, because of the low CMIN/DF ratio and high PClose.

Table 7: Regression Weights among variables

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
CD	<---	TA	.053	.053	.999	.318	par_65
CD	<---	OC	-.045	.060	-.750	.453	par_66
CD	<---	ET	-.128	.071	-1.795	.073	par_67
CD	<---	KS	-.051	.078	-.653	.514	par_68
JS	<---	TA	.090	.064	1.405	.160	par_61
JS	<---	OC	-.002	.072	-.025	.980	par_62
JS	<---	ET	-.124	.085	-1.471	.141	par_63
JS	<---	KS	.014	.092	.147	.883	par_64
JS	<---	CD	-.248	.127	-1.945	.052	par_69

Source : Authors own source

The structural equation modeling (SEM) was used in order to test the relationships between the given variables, and the table displays the regression weights. The regression weights, and the corresponding C.R. and p-values are used to evaluate hypotheses. Hypothesis were supported if p <.05.

Hypothesis 1 (H$_1$): Employee job satisfaction is positively and significant influenced by talent attraction.

The regression weight between TA and JS was β = 0.090, C.R. was 1.405, p =.160, Therefore the relationship was not statistically significant. Hence, even H1 is not supported.

Hypothesis 2 (H$_2$): Results showed that, with a positive relationship, knowledge sharing has positively affected employees' job satisfaction.

No statistically significant relationship: The regression weight for Knowledge Sharing (KS) to Job Satisfaction (JS) was β = 0.014, C.R. = 0.147 and p =.883. Thus, H2 is not supported.

Hypothesis 3 (H$_3$): There is a positive influence of training and development on employees' job satisfaction and a significant relationship.

The relationship between Employee Training (ET) and Job Satisfaction (JS) was not significant, because β was -0.124 and C.R. was -1.471 and p was.141. It is then concluded that H3 is not supported.

Hypothesis 4 (H$_4$): The effects that career development has a positive and significant influence on the employees' job satisfaction.

The coefficient beta for Career Development to Job Satisfaction was β = -0.248, C.R. = -1.945, p =.05, and statistically significant implication at.05 level. H4 is slightly supported as such.

Hypothesis 5a (H$_{5a}$): The relationship between talent attraction and job satisfaction is partially mediated by organizational culture.

In the case of the direct effect of Organization Culture (OC) onto Job Satisfaction (JS), β = -0.002, C.R. = - 0.025 and p =.980, which implies that there is no significant relationship. No mediation of H5a is therefore indicated, since no mediator could be found.

Hypothesis 5b (H$_{5b}$): The relationship of knowledge sharing and job satisfaction has a fully significant mediating effect of organizational culture.

Above, we noted that the direct impact of Organizational Culture (OC) on Job Satisfaction (JS) was insignificant, and the relationship between Knowledge Sharing (KS) and Job Satisfaction (JS) was also insignificant (β = 0.014, p =.883). Thus, H5b is not supported.

Hypothesis 5c (H$_{5c}$): The relationship between employee training and job satisfaction is partially mediating by organizational culture.

None of these relationship (the relationship between Employee Training (ET) and Job Satisfaction (JS) and the direct effect of Organizational Culture (OC) on Job Satisfaction (JS)) were significant (β = -0.124, p =.141) Thus, H5c is not supported.

Hypothesis 5d (H5d): The relationship between career development and job satisfaction has a partially significant mediated effect by organizational culture.

The inverse of the regression line was β = -0.248, p =.052, not significant but indirect of Job Satisfaction (JS) and Organizational Culture (OC); β = 0.037, p =.612. H5d is not therefore supported.

8.   FINDINGS

Specifically, talent attraction, knowledge sharing, employee training, and career development did not have statistically significant direct relationships with job satisfaction, in direct contrast to expectations. For instance, talent attraction was found to have a positive influence (β = 0.090) however did not pass significance (p = 0.160). Knowledge sharing also failed to show significant influence over job satisfaction (β = 0.014, p = 0.883) and employee training was significant negative (β = -0.124, p = 0.141). There was a marginally significant negative relationship between job satisfaction and career development (β= - 0.248, p=0.052) indicating that, at least in this context, career development is not perceived to contribute much to job satisfaction or may entail unrated challenges or expectations to employees.

The hypothesis was that greater talent management practices will be related to job satisfaction through organizational culture. But these findings did not support this hypothesis. None of the talent management variables mediated through organizational culture: all p > 0.05. For example, the effect on job satisfaction of organisational culture was close to zero (β = -0.002, p = 0.980) and of the indirect effects through various talent management practices also of no statistical significance. The implication of this result is that in Northern Odisha's higher education sector, the influence of organizational culture in mediating talent management impact on job satisfaction is not sharp.

A structural equation model accounted for 43.27 per cent of variance in job satisfaction on the basis of the six talent management and organizational culture factors. The largest share (10.47%) of the total impact was on talent attraction, but it was only moderately efficacious, due to the interaction and complexity of forces in the higher education institutions at the study sites. The Cronbach's alpha values for the constructs tended to be strong (0.71) to (0.92) and indicated that there is consistency of the measurement scales used.

There were no significant relationships between talent management practices and job satisfaction, as well as no mediating effects of organizational culture, which suggests that some external or institutional factor is influencing job

satisfaction in the higher education sector of Northern Odisha. Logically, the impacts of talent management and an enabling organizational culture are expected to illuminate the contrasting results in the case of the region. However, socio-economic context, resource limitations and institutional governance structures may make them overshadow results that should be otherwise positive.

9.   DISCUSSION

In direct contrast to expectations, the study found that core talent management practices (i.e. talent attraction, knowledge sharing, employee training, and career development) had no statistically significant direct effect on job satisfaction. For example, talent attraction positively associated with the β of 0.090 and p of 0.160 was not significant, as well as career development was not significant but negatively associated with the β of –0.248 and p of 0.052. It seems these practices, in the Northern Odisha context, may not be viewed as meeting employee expectations for inherent increases in job satisfaction.

Socio economic and institutional conditions specific to this region may provide one of the potential explanation for this. Consonant with previous studies (Saleh & Atan, 2021; Mabaso, 2020), resource constraint and governance challenges in developing regions can moderate the desired impact of talent management practices. In resource constrained institutions, a marginal negative relationship between career development and job satisfaction may signal that the pursuit of career advance does not provide a positive benefit, and may instead add additional pressures or unmet expectations leading to overall job dissatisfaction. These findings are consistent with Putri et al. (2023) who argue that talent management may not realize the same positive outcomes in under-resourced settings as in richer environments.

A central hypothesis of this paper is that organizational culture will empirically mediate the relationship between talent management and job satisfaction. But the data contradicted this assumption. The effects of transnational strategy variables that were not mediated by organizational culture were not preconditioned by talent management practices. This is at odds with most previous literature that either focuses on the beneficial nature of supportive culture in enhancing job satisfaction (Alparslan & Saner, 2020; Rizwan et al., 2017), or finds no significant effect of culture outside specific situations (Sharma & O'Reilly, 1995). For instance, in settings where organizational culture emphasizes recognition, collaboration and employee development, there is evidence that the extent of the positive effects of talent management on job satisfaction are dramatically magnified (Saleh & Atan, 2021).

So the absence of this mediative effect in Northern Odisha could be due to contributions from at least the contextual factors listed above. Second, the institutions in this study

might not have built a strong enough organizational culture to support, or complement, talent management initiatives in these institutions. According to Kankam and Oppong (2023), supportive and inclusive culture enhances the realisation of the full potential of talent management strategies. In such areas of Northern Odisha, where higher education institutions may suffer from governance challenges and leadership roles, these cultural elements may not be developed to any great extent, or may be inconsistently applied, thereby being rendered ineffective at mediation. Furthermore, a disengaged workforce following poor institutional fit: mismatch between institutional goals and employees' needs (personal or professional) can lead to the negative effects of organizational culture.

10. THEORETICAL IMPLICATIONS

The implications that these findings have for the broader theory of human resource management in higher education, particularly in resource constrained regions, are important. Most of the existing literature assumes a linear, positively relationship between standard practices of talent management implementation to employees' satisfaction, which is anchored on the organizational culture (Putri et al., 2023; Mabaso, 2020). Yet this study finds that in certain socioeconomic circumstances, these relationships can fray or reverse themselves.

As an example one can wonder if the mainstream talent management theories applied to developing regions are suitable, when the marginal negative relation between career development and job satisfaction is evident. It proposes that while career advancement opportunities generally provide motivation, conditions can be reached where institutions lack resources and structures to create authentic experience of professional growth leading to dissatisfaction. In consequence, this study underscores the importance of regional, economically, institutional and culturally specific HRM frameworks which take into account the institutional and economic realities of the regions where the frameworks operate.

10.1 Practical Implications

These findings have important lessons for policymakers and administrators in higher education in developing regions like Northern Odisha. It may be first of all necessary to review the design and implementation of talent management practices so that they suit the employees' needs and expectations better. In other words, career development programs need to be accompanied by realistic paths to advancement and sufficient institutional support, rather than simply raising expectations that can not be met.

For the second, another constructive pressure is at the work on expanding and protecting the organizational culture, that really supports employee well-being and contentment. While organizational culture did not mediate this study, this may

actually be an opportunity and not a limitation. Although various efforts to promote collaboration, openness, and recognition could still greatly increase the effectiveness of talent management practices, the initiatives must be robust, deliberate, and consistent with both the institutional mission and a strong set of employee values.

This study adds culture and talent management to the relatively scarce literature on human resource management in higher education in developing regions. It is important to note that talent management practices have been widely advocated, however they may not automatically automatically translate to job satisfaction and indeed may not be delivering on those promises unless the practices are implemented in an organisational context supportive of local realities. In addition, the absence of an organizing culture mediating effect suggests that further work is needed into the limited conditions under which culture is likely to contribute towards or prevent changes in HRM outcomes.

11. CONCLUSION

So the hypothesis that we started out with was that organizational culture would act as this great mediating factor and would influence the effectiveness of talent management in influencing job satisfaction within higher education institutions. In particular, we intended to examine whether employing practices such as talent attraction, knowledge sharing and career development could make a huge difference in job satisfaction, and more importantly, in an environment where the organizational culture highly supports its pursuit.

Although theoretically important, our findings indicate that talent management practices do not have statistically significant direct effects on job satisfaction for higher education institutions in Northern Odisha. An example of this would be that neither of the talent attraction, nor employee training impacted employee satisfaction, as expected. Moreover, instead of finding significant mediating effects, organizational culture did not underly these relationships as expected.

Several challenges were encountered by this study including: the complexity to capture the socio-economic and institutional nuances of the socio economic and institutional nuances that influence job satisfaction in developing regions. While we found it unlikely that talent management alone is sufficient to increase job satisfaction, we are unclear precisely how other, broader institutional factors may influence these outcomes. This provides a promising avenue for future research into the intersection of economic constrains, institutional governance and human resource management in higher education.

Our findings have important implications. Standard talent management frameworks are not sufficient, especially at higher education institutions in developing regions, and have

to be eclipsed by strategies adapted to the contexts of the institutions themselves. On the basis of these research findings, policymakers and administrators have to take into account how institutional governance and local socio economic conditions may play out their effects on the effectiveness of human resource interventions. Northern Odisha is likely to demand a one size fits all approach is unlikely to work.

Finally, the importance of the context when adopting talent management practices in higher education is highlighted in this study. In the face of increasing pressures on the sector to build talent retention and promote satisfaction of work, it falls upon institutions to capture that this is not merely an organizational culture success, but in fact a function of the environment within which they sit. If higher education institutions wish to meet the demands of a rapidly evolving educational landscape, they now have no choice but to rethink, and tailor, their HR approaches.

12. LIMITATIONS OF THE STUDY

There were some limitations in study, which are mostly regarding to the cross-sectional design, which describes that data being collected at a single point of time, which might not fully capture nature of organizational culture, talent management practice. Furthermore, the study was limited to the case of Northern Odisha and higher educational institutions. Future studies might include a longitudinal design and expansion of the sample to institutions and sectors beyond those studied here.

Furthermore, this methodology presents a sound structure for the mediating role of organizational culture in the association between talent management practices and Job Satisfaction in higher education institutions. SEM is advantageous for the study of the complex interactions between these variables, providing useful insight to policy makers, and academic administrators, who are trying to improve Job Satisfaction through effective talent management strategies.

13. DECLARATION

I, Dr. Tulasi Bej, hereby confirm that the manuscript titled "The Role of Organizational Culture in Mediating the Impact of Talent Management on Job Satisfaction in Higher Education " authored by Dr. Tulasi Bej, Dr. Ashok Kumar Dash & Dr. Dhirendra Kumar Jena, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission International Management Perspective Conference 2025 (IMPeC-25) Sambalpur, Odisha, India.

We declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Alparslan, A., & Saner, T. (2020). The Influence of Sustainable Talent Management on Job Satisfaction and Organizational Commitment: Moderating Role of In-service Training. *Revista De Cercetare Si Interventie Sociala*, 69, 96-121. https://doi.org/10.33788/rcis.69.6.

[2.] Azeem, M., Ahmed, M., Haider, S., & Sajjad, M. (2021). Expanding competitive advantage through organizational culture, knowledge sharing and organizational innovation. *Technology in Society*, 66, 101635. https://doi.org/10.1016/J.TECHSOC.2021.101635.

[3.] Chaudhary, N., & Bhaskar, P. (2016). Training and Development and Job Satisfaction in Education Sector. *Journal of Resources Development and Management*, 16, 42-45.

[4.] Hanaysha, J., & Tahir, P. (2016). Examining the Effects of Employee Empowerment, Teamwork, and Employee Training on Job Satisfaction☆. *Procedia - Social and Behavioral Sciences*, 219, 272-282. https://doi.org/10.1016/J.SBSPRO.2016.05.016.

[5.] Heriyanti, S., & Krisma, I. (2022). Effect of Career Development, Compensation and Leadership Style on Job Satisfaction. *Journal of Research in Business, Economics, and Education*. https://doi.org/10.55683/jrbee.v4i2.396.

[6.] Heriyanti, S., & Krisma, I. (2022). Effect of Career Development, Compensation and Leadership Style on Job Satisfaction. *Journal of Research in Business, Economics, and Education*. https://doi.org/10.55683/jrbee.v4i2.396.

[7.] Ip, W. (2013). The impact of knowledge sharing on the relationship between organization culture and job satisfaction: the perception of Information Communication and Technology (ICT) practitioners in Hong Kong. *International Journal of Human Resource Studies*, 3, 19-47. https://doi.org/10.5296/IJHRS.V3I1.3112.

[8.] Kankam, G., & Oppong, C. (2023). The Relationship between Organisational Culture and Job Satisfaction among Employees of Colleges of Education: The Ghanaian perspective. *E-Journal of Humanities, Arts and Social Sciences*. https://doi.org/10.38159/ehass.2023412.

[9.] Kontoghiorghes, C. (2016). Linking high performance organizational culture and talent management: satisfaction/motivation and organizational commitment as mediators. *The International Journal of Human Resource Management*, 27, 1833 - 1853. https://doi.org/10.1080/09585192.2015.1075572.

[10.] Mabaso, C. (2020). Performance management and talent development : their impact on job satisfaction at selected higher education institutions. *Journal of Contemporary Management*, 17, 369-392. https://doi.org/10.35683/jcm18005.80.

[11.] Mabaso, C. (2020). Performance management and talent development : their impact on job satisfaction at selected higher education institutions. *Journal of Contemporary Management*, 17, 369-392. https://doi.org/10.35683/jcm18005.80.

[12.] Mabaso, C. (2020). Performance management and talent development : their impact on job satisfaction at selected higher education institutions. *Journal of Contemporary Management*, 17, 369-392.

https://doi.org/10.35683/jcm18005.80.

[13.] Malik, M., & Kanwal, M. (2017). Impacts of Organizational Knowledge Sharing Practices on Employees' Job Satisfaction: Mediating Roles of Learning Commitment and Interpersonal Adaptability.. *Journal of Workplace Learning*, 30, 2-17. https://doi.org/10.1108/JWL-05-2016-0044.

[14.] Meher, J., & Mishra, R. (2021). Examining the role of knowledge sharing on employee performance with a mediating effect of organizational learning.. https://doi.org/10.1108/VJIKMS-04-2020-0056.

[15.] Putri, S., Rivai, H., & Syahrul, L. (2023). The effect of talent management and organizational culture on employee performance with job satisfaction as a mediating variable. *Enrichment : Journal of Management*. https://doi.org/10.35335/enrichment.v13i1.1278.

[16.] Rizwan, M., Zeeshan, C., & Mahmood, S. (2017). The Impact of Perceived Ethical Leadership and Organizational Culture on Job Satisfaction with the Mediating Role of Organizational Commitment in Private Educational Sector of Islamabad, Pakistan. *Journal of Intercultural Management*, 9, 100 - 75. https://doi.org/10.1515/joim-2017-0004.

[17.] Saleh, R., & Atan, T. (2021). The Involvement of Sustainable Talent Management Practices on Employee's Job Satisfaction: Mediating Effect of Organizational Culture. *Sustainability*. https://doi.org/10.3390/su132313320.

[18.] Saleh, R., & Atan, T. (2021). The Involvement of Sustainable Talent Management Practices on Employee's Job Satisfaction: Mediating Effect of Organizational Culture. *Sustainability*. https://doi.org/10.3390/su132313320.

[19.] Saleh, R., & Atan, T. (2021). The Involvement of Sustainable Talent Management Practices on Employee's Job Satisfaction: Mediating Effect of Organizational Culture. *Sustainability*. https://doi.org/10.3390/su132313320.

[20.] Saleh, R., & Atan, T. (2021). The Involvement of Sustainable Talent Management Practices on Employee's Job Satisfaction: Mediating Effect of Organizational Culture. *Sustainability*. https://doi.org/10.3390/su132313320.

[21.] Saleh, R., & Atan, T. (2021). The Involvement of Sustainable Talent Management Practices on Employee's Job Satisfaction: Mediating Effect of Organizational Culture. *Sustainability*. https://doi.org/10.3390/su132313320.

[22.] Trivellas, P., Akrivouli, Z., Tsifora, E., & Tsoutsa, P. (2015). The Impact of Knowledge Sharing Culture on Job Satisfaction in Accounting Firms. The Mediating Effect of General Competencies. *Procedia. Economics and finance*, 19, 238-247. https://doi.org/10.1016/S2212-5671(15)00025-8.

[23.] Wau, J., & Purwanto, P. (2021). The Effect Of Career Development, Work Motivation, And Job Satisfaction On Employee Performance. *Jurnal Aplikasi Bisnis dan Manajemen*. https://doi.org/10.17358/jabm.7.2.262.

Monday Morning Blues: A Study of Engineering College Employees in Hyderabad

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ABSTRACT

The primary objective of this research is to investigate the prevalence, causes, and impacts of Monday Morning Blues (MMB) among faculty and non-teaching staff in engineering colleges across Hyderabad. The study aims to identify work-related stressors contributing to MMB and evaluate its effect on employee well-being, job satisfaction, and performance in academic institutions. This research will also offer strategies for improving employee engagement and reducing MMB.

1. INTRODUCTION

The term Monday morning blues refer to specific objectives but rather describes the feelings of reluctance or low motivation that some people experience at the start of the workweek. It is more about the emotional state rather than a set of goals or objectives. However, addressing Monday morning blues can indirectly aim to improve productivity, Morale, and work satisfaction by helping individuals feel more engaged and motivated at the beginning of the week. The Monday morning blues typically describe a transient mood state characterized by feelings of anxiety, stress, or low motivation as individual's transition from the weekend to the workweek. It can manifest as reluctance to engage in work-related tasks and a general sense of dissatisfaction.

Productivity and Performance on Monday Morning Blues

Monday Morning Blues can have a significant impact on productivity and performance at work. This phenomenon, characterized by feelings of reluctance and lethargy at the start of the workweek, affects employees' motivation, engagement, and overall output.

Impact on Productivity and Performance

- Reduced Motivation and Engagement:
  Employees experiencing Monday Morning Blues often show lower levels of motivation and engagement, which can lead to decreased productivity. Lack of enthusiasm and interest in work tasks can result in slower completion rates and reduced quality of work.

- Increased Absenteeism and Tardiness:
  The reluctance to return to work after the weekend can lead to higher rates of absenteeism and tardiness on Mondays. This not only affects individual performance but also disrupts team dynamics and overall organizational productivity.

- Lower Cognitive Function:
  Feelings of anxiety and stress associated with Monday Morning Blues can impair cognitive functions such as memory, concentration, and decision-making. This can lead to errors, inefficiencies, and a general decline in work performance.

- Higher Stress Levels:
  The stress of transitioning from a relaxed weekend to a demanding work environment can elevate stress levels, leading to burnout and long-term health issues. High stress can further diminish productivity and job satisfaction.

  Monday Morning Blues can significantly impact workplace morale, leading to decreased motivation, engagement, and productivity. Understanding and addressing this phenomenon is crucial for maintaining a positive work environment and enhancing overall employee well-being.

Impact on Workplace Morale

- Decreased Motivation and Engagement:
  Employees experiencing Monday Morning Blues often exhibit lower levels of motivation and engagement. This lack of enthusiasm can lead to reduced productivity and a decline in the quality of work.

- Negative Atmosphere:
  The pervasive feeling of reluctance and lethargy on Mondays can create a negative atmosphere in the

workplace. This can affect team dynamics and overall workplace morale, as the mood of individuals can influence the collective mood of the team.

- Higher Absenteeism and Tardiness:

  The dread of returning to work can lead to higher rates of absenteeism and tardiness on Mondays. This not only disrupts workflows but also places additional stress on present employees, further affecting morale.

- Impaired Communication and Collaboration:

  Low morale can hinder effective communication and collaboration among team members. When employees are not feeling their best, they may be less likely to engage in productive discussions or contribute to team efforts

Impact on Mental Health

Increased Anxiety and Stress:

The anticipation of a busy workweek can cause anxiety and stress, particularly if the workload is overwhelming or if there are unresolved issues from the previous week. This anxiety can manifest as physical symptoms such as headaches, muscle tension, and digestive problems.

Depression and Mood Swings:

Feelings of sadness or lethargy on Monday mornings can be a symptom of depression, especially if these feelings persist over time. Mood swings are common, with individuals experiencing a noticeable drop in mood at the start of the week compared to weekends.

Sleep Disturbances:

The disruption of sleep patterns over the weekend can contribute to poor sleep quality on Sunday night, leading to fatigue and irritability on Monday morning. Chronic sleep deprivation exacerbates mental health issues, reducing cognitive function and emotional resilience.

Burnout:

Persistent Monday Morning Blues can lead to burnout, characterized by emotional exhaustion, cynicism, and a sense of reduced personal accomplishment. Burnout is a serious mental health issue that can have long-term consequences if not addressed.

2. COPING STRATEGIES AND ORGANIZATIONAL INTERVENTIONS

1. Flexible Work Hours:

Allowing flexible start times on Mondays can help employees ease into the workweek and reduce the stress associated with strict schedules.

2. Wellness Programs:

Implementing wellness programs that focus on stress management, mental health support, and physical well-being can help employees cope with Monday Morning Blues.

3. Positive Work Environment:

Creating a positive and inclusive work environment where employees feel valued and supported can enhance job satisfaction and reduce feelings of reluctance on Mondays.

4. Engagement Activities:

Organizing team-building activities or motivational sessions on Monday mornings Can boost morale and set a positive tone for the week.

Objectives of the Study

- To explore the phenomenon of Monday Morning Blues (MMB) among faculty and non-teaching staff in engineering colleges across Hyderabad.

- To examine the prevalence, causes, and impacts of MMB on employee well-being, job satisfaction, and performance.

- To identify work-related stressors contributing to MMB and evaluate the role of organizational culture, workload distribution, and work-life balance in mitigating these effects.

- To propose actionable strategies for academic institutions to enhance employee engagement, alleviate MMB, and foster a supportive workplace environment.

3. NEED FOR THE STUDY

In today's fast-paced academic environment, faculty and staff often experience work-related stress, which can lead to the Monday Morning Blues, adversely impacting their productivity and morale. Engineering colleges in Hyderabad, due to evolving standards of quality being highly competitive and demanding, provide a unique context for studying this issue. Despite significant attention given to workplace mental health in corporate sectors, little focus has been directed toward the academic domain, particularly in the Indian context. Understanding MMB's impact on educators and support staff is crucial, as their mental well-being directly affects institutional effectiveness and student learning experiences. This research fills a critical gap by providing insights into MMB in academic institutions and offering tailored solutions to enhance employee satisfaction and retention.

4. SCOPE OF THE STUDY

The study focuses on engineering colleges in Hyderabad, covering both faculty and non-teaching staff to provide a comprehensive view of MMB across different roles in

academic institutions. It examines key factors such as workload imbalance, work-life balance, organizational culture, and mental health support, assessing their influence on MMB. The research evaluates the effects of MMB on absenteeism, job satisfaction, and employee performance. While geographically limited to Hyderabad, the findings have broader implications for similar academic settings across India. The study aims to contribute to the growing body of research on workplace mental health and extend its scope to educational institutions, providing practical solutions for improving employee engagement and well-being.

5. METHODOLOGY

Structured questionnaires are distributed to faculty and non-teaching staff across a representative sample of engineering colleges in Hyderabad. The quantitative component includes measuring MMB prevalence, job satisfaction, and organizational culture using validated scales. Data will be analysed using descriptive statistics, correlation analysis, and regression analysis to identify key factors influencing MMB and its impact on employee performance. The qualitative component involves open-ended responses to understand personal experiences and perceptions regarding MMB.

6. REVIEW OF LITERATURE

Literature Review

Charles S. Areni (2008) conducted an Internet survey to examine day-of-the-week (DOW) stereotypes, such as "Monday blues" and "TGIF." The survey revealed that these stereotypes were pronounced when participants predicted their moods for the upcoming week, less evident when recalling moods from the preceding week, and least apparent in their momentary moods for each day. A second study involving 2-hour, in-home interviews found that participants looked forward to weekends due to the lack of structure and freedom to choose activities.

However, much of their weekend time was spent on productive activities that often resembled paid work. These interviews indicated that people overvalue future discretionary weekend time, assuming it will be more enjoyable than it actually is. The findings suggest that predicted and remembered moods are influenced by DOW stereotypes, which facilitate rapid judgments.

However, the in-depth interviews revealed that experienced moods throughout the week are more nuanced, linked to recent, current, and anticipated events. This complexity explains why DOW stereotypes were less evident in reported momentary moods.

Charles S. Areni, Mitchell Burger, and Natalina Zlatevska (2011) conducted a meta-analysis of 34 samples to investigate the "Monday blues" effect. They found a consistent but minor effect size (−.08 to −.06) in real-time

mood reports for each day of the week, indicating small but reliable mood variations on Mondays. The study also revealed that recalled mood summaries vary significantly. University students showed a substantial Monday blues effect (d = −.25), while married non-student men reported smaller and more variable effects (−.19 to −.01).

Samples recalling moods over multiple days had broader effect ranges (−.25 to −1.28), but the variance was too high to determine a precise aggregate effect size. These findings underscore the importance of demographic factors and recall methods in the perception of Monday blues, emphasizing the need for tailored interventions to mitigate its impact on specific populations, such as employees in the IT industry in India.

Yasin Bez (2011) aimed to compare state and trait anxiety levels of office workers on Monday and Thursday. On Monday morning, 230 office workers were given a sociodemographic form, State Anxiety Inventory (SAI), Trait Anxiety Inventory (TAI), and Beck Depression Inventory (BDI). Usable data were collected from 144 participants. On Thursday morning, the same inventories were administered again to these 144 workers, and valid forms were collected from 61 participants. The mean SAI scores of 61 participants on Monday and Thursday were 44.4±10.2 and 42.2±9.9 (t=2.226, p=0.030) respectively, while their TAI scores were 44.7±8.8 and 43.0±8.2 (t=2.123, p=0.038). Mean BDI score was 14.4±10.5. Workers had higher TAI scores on both Monday and Thursday compared to managers, and their mean BDI score on Monday was also higher than managers'. Middle-aged workers had higher TAI scores than younger workers, and women had higher TAI scores than men. Additionally, high school graduates had higher SAI and TAI scores than university graduates. The study concluded that higher anxiety levels on Monday were associated with being female, over middle age, having longer job experience in the same work, lower education level, and being a blue-collar employee.

Pindek et al. (2021) explored whether employees experience different levels of job satisfaction and job stressors throughout the workweek. Contrary to the assumption that the employee experience is uniform across the week, their study examined the trajectories of job satisfaction and stressors from Monday to Friday. Using a daily diary design with 139 employees (681 matched daily observations) working a traditional workweek, the study found that employees reported lower job satisfaction and higher perceived job stressors, such as incivility and organizational constraints, at the beginning of the workweek compared to later days. Moreover, the relationship between perceived incivility and job satisfaction was stronger at the start of the week. These findings support the "Monday blues" perspective, indicating that employees experience more dissatisfaction and stress on Mondays, reinforcing the notion that workdays are not experienced equally.

Hülsheger et al. (2022) investigated the dynamic nature of employees' affective well-being, emphasizing the need to understand how these experiences change over time. Drawing on temporal schema theories and the concept of temporal depth, they developed the anticipation of work account as a theoretical explanation for systematic weekly changes in positive and negative affect. Using a 7-day experience-sampling design and latent growth curve modeling, they hypothesized and found that anticipation of work and negative affect decreased linearly over the workweek. This linear change in work anticipation was significantly related to changes in evening affect, supporting their hypothesis that anticipation patterns drive affective changes.

Furthermore, the study identified that the structure of the workweek and chronic workload levels interact to shape these weekly change patterns. Decreasing anticipation was most pronounced for employees with a regular Monday–Friday workweek and high chronic workload, while it was weakest for those with a regular workweek but low chronic workload. These findings highlight the significant role of work conditions in the dynamic aspects of affect, providing theoretical and practical insights into the study of affect and its work-related experiential and behavioral consequence

7. DEMOGRAPHIC INFORMATION

Gender Distribution

Gender	No. of Respondents	Percentage
Male	305	40%
Female	459	60%

Age Group

Age Group	No. of Respondents	Percentage
18–25	114	15%
26–35	305	40%
36–45	229	30%
46–55	76	10%
56 and above	40	5%

Role in Institution

Role	No. of Respondents	Percentage
Faculty	535	70%
Non-teaching	229	30%

Years of Service

Years of Service	No. of Respondents	Percentage
Less than 1 year	76	10%
1–3 years	153	20%
4–7 years	229	30%
8–10 years	153	20%
More than 10	153	20%

Energy or Motivation on Monday Mornings

Response	No. of Respondents	Percentage
Always	191	25%
Often	229	30%
Sometimes	229	30%
Rarely	76	10%
Never	38	5%

Mood on Monday Mornings

Response	No. of Respondents	Percentage
Very positive	76	10%
Somewhat positive	153	20%
Neutral	229	30%
Somewhat negative	229	30%
Very negative	76	10%

8. WORK-RELATED STRESSORS

Experience of Work-Related Stressors

Stressor	Always	Often	Sometimes	Rarely	Never
Workload imbalance	114	229	305	76	40
Lack of work-life balance	191	229	229	76	39
Unrealistic deadlines	76	229	305	114	40
Inadequate support	191	229	229	76	39
Poor relationships	76	153	305	153	77

Overwhelmed on Mondays

Response	No. of Respondents	Percentage
Always	153	20%
Often	229	30%
Sometimes	229	30%

Rarely	114	15%
Never	39	5%

Support for Workload Management

Rating	No. of Respondents	Percentage
Excellent	76	10%
Good	229	30%
Average	305	40%
Poor	114	15%
Very poor	40	5%

9. IMPACT OF MMB

Impact on Job Performance

Response	No. of Respondents	Percentage
Significantly	191	25%
Moderately	229	30%
Slightly	229	30%
Not at all	114	15%

Impact on Job Satisfaction

Response	No. of Respondents	Percentage
Strongly agree	229	30%
Agree	305	40%
Neutral	153	20%
Disagree	76	10%
Strongly disagree	1	0%

10. STRATEGIES AND SOLUTIONS

Effective Strategies for Reducing MMB

Strategy	No. of Respondents	Percentage
Flexible work hours	535	70%
Reduced workload on Mondays	382	50%
Mental health support	382	50%
Team-building activities	459	60%
Recognition and rewards	306	40%

Effectiveness of Institutional Measures

Measure	Very Effective	Effective	Neutral	Ineffective	Very Ineffective
Workload management	114	229	305	76	40
Open	153	229	305	76	1

communication					
Opportunities for development	191	229	229	76	39
Mental health counselling	153	305	229	76	1

Descriptive Statistics

Category	N	Mean	Median	Standard Deviation (SD)	Minimum	Maximum
Gender	764	-	-	-	Male (305)	Female (459)
Age (in years)	764	34.5	33	8.1	18	56+
Role in Institution	764	-	-	-	Faculty (535)	Non-teaching (229)
Years of Service	764	6.7	6	4.1	<1	>10

Prevalence of MMB

Category	N	Mean	Median	Standard Deviation (SD)	Minimum	Maximum
Energy on Monday Morning (Likert)*	764	3.4	3	1.12	1	5
Mood on Monday Morning (Likert)*	764	3	3	1.01	1	5

Work-Related Stressors

Category	N	Mean	Median	Standard Deviation (SD)	Minimum	Maximum
Workload Imbalance (Likert)*	764	3.3	3	1.02	1	5
Lack of Work-Life Balance (Likert)*	764	3.25	3	1.03	1	5
Unrealistic Deadlines (Likert)*	764	3	3	1.1	1	5
Inadequate Support	764	3.25	3	1.01	1	5

(Likert)*						
Poor Relationships (Likert)*	764	3	3	1.15	1	5

Impact of MMB

Category	N	Mean	Median	Standard Deviation (SD)	Minimum	Maximum
Job Performance Impact (Likert)*	764	3.2	3	1.1	1	4
Job Satisfaction (Likert)*	764	3.3	3	0.97	1	5

Strategies and Solutions

Category	N	Mean	Median	Standard Deviation (SD)	Minimum	Maximum
Flexible Work Hours (Likert)*	764	3.5	3	1.02	1	5
Reduced Workload (Likert)*	764	3.25	3	1.1	1	5
Mental Health Support (Likert)*	764	3.4	3	1.05	1	5

Hypotheses and Tests

Hypothesis (H_0)	Dependent Variable	Independent Variable	Test
1. Employees' energy levels on Monday morning do not significantly differ based on their role.	Energy levels (Likert)	Role (Faculty vs. Non-Teaching)	Independent Samples t-test
2. Workload imbalance has no significant effect on employees' mood on Monday morning.	Mood on Monday (Likert)	Workload imbalance (Likert)	Linear Regression
3. Lack of work-life balance does not significantly impact job satisfaction.	Job satisfaction (Likert)	Work-life balance (Likert)	Pearson Correlation / Linear Regression
4. The prevalence of MMB is not significantly different between male and female employees.	Prevalence of MMB (Likert)	Gender (Male, Female)	Chi-Square Test of Independence
5. Flexible work hours do not significantly improve employees' perceptions of MMB.	Perception of MMB (Likert)	Flexible work hours (Likert)	Linear Regression
6. Mental health support has no significant impact on reducing the perception of MMB.	Perception of MMB (Likert)	Mental health support (Likert)	Linear Regression
7. There is no significant relationship between job performance and MMB among employees.	Job performance (Likert)	Perception of MMB (Likert)	Pearson Correlation

H_{01}: Employees' energy levels on Monday morning do not significantly differ based on their role (Faculty vs. Non-Teaching).

Independent Samples t-test is used to compare the mean energy levels between faculty and non-teaching staff. The data is based on 764 staff members in engineering colleges in Hyderabad.

Role	Number of Respondents	Average Energy Level (Likert Scale 1-5)	Standard Deviation
Faculty	480	3.2	0.8
Non-Teaching Staff	284	2.8	0.7

Results

$t \approx 7.64$

Degrees of freedom: ~700 (calculated using the Welch-Satterthwaite equation)

p-value: $p < 0.001$ $p < 0.001$.

Interpretation

Since the p-value is less than 0.05, we reject the null hypothesis (H_0). This means there is a statistically significant difference in the energy levels on Monday mornings between faculty and non-teaching staff.

H_{02}: Monday Morning Blues (MMB) does not significantly differ based on age group.

Dependent Variable: MMB levels (Likert scale 1–5).

Independent Variable: Age groups.

One-Way ANOVA is used to compare the mean MMB levels across different age groups.

Results

F-Statistic: 112.9.
Critical F-Value ($\alpha = 0.05$, df_b = 3, df_w = 760): 2.60 (from F-table).
p-value: $p < 0.001 p < 0.001$.

Interpretation

Since the calculated F-statistic (112.9) is much larger than the critical value (2.60) and the p-value is less than 0.05, we reject the null hypothesis (H_0).

There is a significant difference in MMB levels across age groups. This suggests that age plays an important role in influencing the experience of Monday Morning Blues. Targeted strategies may be required for different age groups to manage MMB effectively.

The Interplay of Leadership, Motivation, and Performance: A Systematic Exploration of Their Interconnectedness in Business Settings

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ABSTRACT

Transformational leadership emerged in the 1970s. Gained significant attention by the late 1970's. Within industries focused on performance driven results a customer centric strategy is crucial. Transformational leadership is key, to achieving success. This study uses social exchange theory to investigate how transformational leadership impacts motivation and performance. Understanding leadership from this perspective helps us uncover how different leadership actions affect employee motivation and performance, across business settings. Organizational success is intricately tied to how it performs and transformational leadership plays a role, in creating an atmosphere that sparks inspiration and motivation among employees while also positively impacting their behavior – fostering a culture that nurtures progress and success. The main goal of this research is to carry out a review of existing literature to explore the relationships between transformational leadership effectiveness on employee motivation and overall performance levels. In this study utilizing the Scopus database a total of 321 research articles focusing on these core themes were analyzed. A comprehensive scrutiny of these materials was undertaken following the PRISMA approach, with the objective of conducting a review of the existing literature. This review aims to set the groundwork, for studies on factors that require thorough examination. With a focus, on all facets of leadership and how it influences performance this article provides perspectives that can be utilized in upcoming research endeavors.

Keywords: Transformational leadership, Motivation, Employee performance, PRISMA, Systematic review.

1. INTRODUCTION

The philosophy of transformational leadership was first introduced in the second half of the 20th century by James MacGregor (Burns, 1978), who characterized it in his 1978 book "Leadership." Burns made distinction between transactional and transformational leadership styles, emphasising the latter's importance in empowering and motivating subordinates to put the needs of the organization ahead of their own. (Bernard M. Bass, 1985) developed Burns' ideas over the next ten years, offering a more systematic explanation of transformational leadership in his 1985 book "Leadership and Performance Beyond Expectations." Bass highlighted key concepts that are still at the core of the theory, including idealized influence, intellectual stimulation, inspirational drive, and individual concern.

In the views of Bass et al., (2003), leadership is essential to review employee performance and the capacity of an organization to change to shifting situations. (Yukl, 2013), efficient leadership implies encouraging and leading followers toward a common goal. Leaders need to have the ability and understanding necessary to lead efficiently. Among the various theories of leadership, transformational leadership has emerged as the most extensively studied and implemented framework in both scholarly research and real-world applications. In the face of growing environmental uncertainties and operational challenges, organizations must demonstrate adaptability by identifying internal challenges and implementing essential changes (Vigoda-Gadot & Beeri, 2012)

Effective organizations need leaders who can elevate team spirit and engagement through their magnetic personality and individual traits. These leaders required to have a capacity to motivate and assist employees in order to achieve organizational goals. These attributes occur frequently among transformational leaders (Bass & Avolio, 1997). When staff members observe a leader's self-assurance, commitment, and appreciation, they are motivated to surpass expectations (Yukl, 2013). This leadership approach emphasizes employee development and progression (Avolio, 2004). Transformational leaders favor using intrinsic motivators like dedication over extrinsic incentives such as rewards (Avolio, B. J., & Bass, 2001). In business environments, transformational leadership has been demonstrated to improve employee job satisfaction and company loyalty, leading to enhanced customer service and overall organizational performance (Dai et al., 2013).

Transformational leaders forge emotional connections with their followers, and their compelling visions lead to significant organizational changes. Such leaders enhance their followers' abilities as leaders while motivating and encouraging them to achieve remarkable results (Bass, B. M.,

& Bass Bernard, 1985);(Bass, 1998). This type of leadership might encourage subordinates to go above and beyond their duties, which leads to satisfaction and commitment to the organization (Bass, B. M., & Riggio, 2006). According to (Yukl, 1989), transformational leadership involves affecting organizational attitudes and expectations as well as encouraging attention to the objectives, goals, and tactics of an organization. This kind of leadership can produce extraordinary outcomes, with followers attaining goals and achieving more, according to (Downton, 1973). (Bass, 1998),Bass, B. M., & Bass Bernard, 1985) emphasizes that transformational leaders desire to cultivate an association of loyalty among those who follow them, and their persuasive vision communication results in numerous business transformations.

Optimizing employee performance can be effectively achieved when individuals receive direction from organizational leaders. Effective direction can be exemplified through diverse leadership paradigms within the institution. One leadership paradigm frequently utilized to augment employee performance is transformational leadership.

Transformational leadership is characterized as a methodology wherein leaders inspire their subordinates to recognize the objectives and interests of the organization and to exceed normative expectations (Buil et al., 2019). The application of transformational leadership is intended to enhance both employee performance and organizational commitment (Buil et al., 2019). So transformational leadership assumes a pivotal role in facilitating the requisite transformations for successful management, which includes the elevation of employee performance. Numerous empirical investigations concerning the impact of transformational leadership on employee performance have been undertaken by scholars. For example, a study conducted by Rivai, (2020) transformational leadership exerts a favorable influence on the enhancement of employee performance. This indicates that the performance of employees is likely to enhance when leaders demonstrate proficient transformational leadership qualities. This finding is consistent with the research conducted by Rosa Hasibuan & Farida Ferine, (2023), which asserts that transformational leadership exerts a positive and significant influence on employee performance. Nevertheless, this perspective stands in contrast to the study conducted by Vipraprastha et al., (2018), wherein it was determined that transformational leadership did not exhibit a significant effect and, in fact, had a detrimental impact on employee performance.

The present study examined the influence of transformational leadership style on employee performance, transformational leadership on motivation, motivation on employee performance, and transformational leadership on employee performance mediated by motivation. The paper's main aim is to systematically review the literature regarding transformational leadership, work motivation, and employee performance in the context of the interrelationship between these key variables.

2. LITERATURE REVIEW

Transformational Leadership

The challenges of globalization, technological innovation, and transforming labor standards have given transformational leadership new relevance as we enter the modern era. Today's leaders need to cultivate creativity, diversity, and emotional intelligence in order to motivate their employees. Transformational leaders create an enthusiastic and engaged workforce by matching personal values with business objectives. The principles of transformational leadership are vital for managing change and attaining sustainable achievement in a world that is becoming more and more concerned with sustainability and ethical behavior, continuing on Burns and Bass's legacy.

The practice of transformational leadership aims towards changing people, helping them grow beyond their own self interests and working towards the common objectives of the organization. Generally speaking, whereas more classical types of leadership often serve to preserve existing situations, transformational leaders develop new situations and promote change. Such leaders build synergies: they not only strengthen the team and enhance individual development, but also share the common goal and worldview with the team. Through this type of leadership, not only the team form but the collective also achieves its objectives as the people, principles, and objectives are all synergetic and create lasting change.

Relationship between Transformational leadership and employee Motivation

The theory of transformational leadership plays an important role in the examination of leadership, and many studies suggest a favourable relationship between transformational leadership and other dependent variables such as employee performance, motivation, commitment, and satisfaction (Kane & Tremble, 2000)Lowe et al., 1996). According to (Trottier et al., 2008), transformational leadership is highlighted by desired influence, intellectual stimulation, and inspiring motivation. A leader motivates others to accomplish goals by stepping on challenges that get and standing as an example and having this capacity to inspire others and convey the significance of obstacles they must overcome is a result of transformational leadership (Ahmad et al., 2014).

In summary, transformational leadership makes boosting employee motivation easy. Transformational leaders generate enthusiasm and passion by connecting personal values with organisational goals and developing an atmosphere of creativity and emotional intelligence. This way of thinking not only improves individual performance but also promotes

long-term success in an era that is growing more varied and ethically engaged.

Employee performance

The foundation of success for any organization is the exceptional performance by its team, where every employee plays a key role. This is made possible by enablers who support, nurture and create incentives for people to do their best work. Out of evaluating job performance and management processes, employee productivity rises as the best indicator of success. As a result, organizations seeking insight into and improvement for their productivity seek to analyze it. Employee performance is a measure of how effectively an individual accomplishes peers assigned tasks. Efficiency in handling these tasks is a straightforward reflection of employee productivity.

The style of leading the people is a key factor that affects employee's performance behavior and transformational leadership is known to be the most effective and widely used style. Transformational leadership encourages intrinsic and extrinsic motivation, increases job satisfaction, gains trust, enhances engagement behavior as well as employee effectiveness performance. This leadership style elevates individual performance but owning them, the work culture becomes such that it is also a win-win for employees and the organization too because of the positive environment they get to work in. Transformational Leadership is powerful and holds the key to a workplace that works for everyone, enabling sustainable growth and long-term stakeholder form of prosperity.

Relationship between Transformational leadership and employee job performance

Numerous scholars have uncovered that transformational leadership is extensively employed in organizations and has a significant impact on employee job performance. Eliyana et al. (2019) study indicated that transformational leadership positively affects employee work performance through the indirect pathways of work commitment and job satisfaction. Likewise, research by Thamrin (2012), Hasmin (2017), Putri &Meria (2022), and Curado & Santos (2022) has emphasized the consistently positive direct correlation between transformational leadership and employee job performance, with an additional enhanced positive relationship mediated by job satisfaction and work commitment.

Researchers have delved into the influence of transformational leadership on employee job performance across diverse sectors such as education, private and public organizations, sports, and healthcare. These studies consistently illustrate the favorable impact of transformational leadership on employee performance. Furthermore, they underscore the importance of various mediating factors that serve to reinforce the link between transformational leadership and employee job performance.

Employee motivation

Motivation is essentially intended to aid in changing behavior. It serves as a driving force that empowers a person to move toward a specific goal.A research examination centered on employee motivation identified that motivation is vital in influencing results such as improved productivity, superior performance, and ongoing dedication to tasks. This underscores that motivation affects not only the caliber of work but also an individual's capability to sustain effort over an extended period (Grant, 2008).

Maslow, Alderfer, McClelland, Hackman, and Herzberg highlight that the drive for growth serves as a significant motivator for individuals, enabling them to reach their full potential. Studies have demonstrated a robust relationship among employee motivation, job satisfaction, and commitment to the organization (Jones & Lloyd, 2005; Chen et al., 2004). Employee motivation plays a vital role in the success and accomplishment of any organization, whether it functions in the public or private domain. When employees are motivated, they are more inclined to give their best efforts, which enhances the organization's overall productivity, efficiency, and capacity to achieve its objectives. Consequently, cultivating motivation is a crucial approach for organizations seeking sustainable growth and competitive edge (Chintallo& Mahadeo, 2013).

Relationship between Employee motivation and employee job performance

Staff members are the initial contact when interacting with clients. Therefore, it is crucial for organizations to provide employees with the necessary support to inspire them to excel and enhance their performance for the company. According to various researchers, motivation boosts efficiency within the workforce (Greeno, 2002). Motivation plays a crucial role in organizational performance by boosting employees' productivity, helping them reach their individual objectives, improving job satisfaction, and cultivating a deeper bond between employees and the organization (Ibrahim, 2015).Motivation is crucial in influencing employee performance and is an essential element for attaining organizational success. When employees feel motivated, they are inspired to put forth more effort and enthusiasm into their responsibilities, resulting in better performance results. An engaged workforce not only boosts productivity but also aids in the overall efficiency and development of the organization (Azar and Shafighi, 2013). Organizations frequently prioritize meeting customer needs but may neglect the significance of ensuring employee satisfaction. Nevertheless, the truth is that employee satisfaction is intricately linked to customer satisfaction. When employees are happy and engaged, they tend to carry out their responsibilities with increased enthusiasm and dedication, positively impacting the customer experience. Content employees not only operate more effectively but also foster a welcoming environment that resonates with

customers, resulting in higher overall satisfaction (Ahmad, 2012).

Research Methodology

By referencing the available literature, the authors chose to conduct a systematic literature review to offer an ordered and comprehensive analysis of transformational leadership and its effect on work motivation and employees' performance. The technique called PRISMA is employed in systematic literature reviews when it comes to social science research, though it had been limited to the medical field (Mensah & Casadevall, 2019). PRISMA provides a framework with which to appraise review articles on literature reviews to combine their results. By applying the PRISMA protocol during systematic literature reviews, a researcher can identify the crucial studies that can be used in future empirical research ventures. The implementation of the PRISMA methodology involves three key phases: identification, screening, and inclusion. The researchers initially identified 321 articles from the Scopus database using relevant search terms **"Transformational leadership", "Motivation", and "Performance".** Specific inclusion and exclusion criteria were set to streamline the article selection process. After a meticulous evaluation, 215 articles were deemed irrelevant to the research theme. Additionally, 20 articles were excluded due to their presence in conference proceedings, and another 20 were removed as they focused on organizational or team performance instead of individual performance. One paper was excluded as it was part of a handbook. Ultimately, 65 papers were selected as they align effectively with the research theme.

Inclusion criteria refer to the guidelines used to incorporate articles that address transformational leadership, employee motivation, and employee performance. Research studies incorporating at least two of these variables, both qualitative and quantitative, from any country or industry sector are deemed acceptable.

Exclusion criteria outline the guidelines to exclude conference proceedings, studies that do not exclusively focus on individual employee performance and papers that are not part of any articles.

In the table below, a comprehensive systematic analysis of 65 papers is presented, which were included in the research paper following the application of inclusion and exclusion criteria. The information included highlights significant details from all the studies that have notably contributed to the literature in the ascending year-wise order, encompassing the author's name, publication year, journal name, research industry, research methodology, variables examined, and the study's findings. Methodology, variables included, and findings of the study.

Figure 1: PRISMA analysis
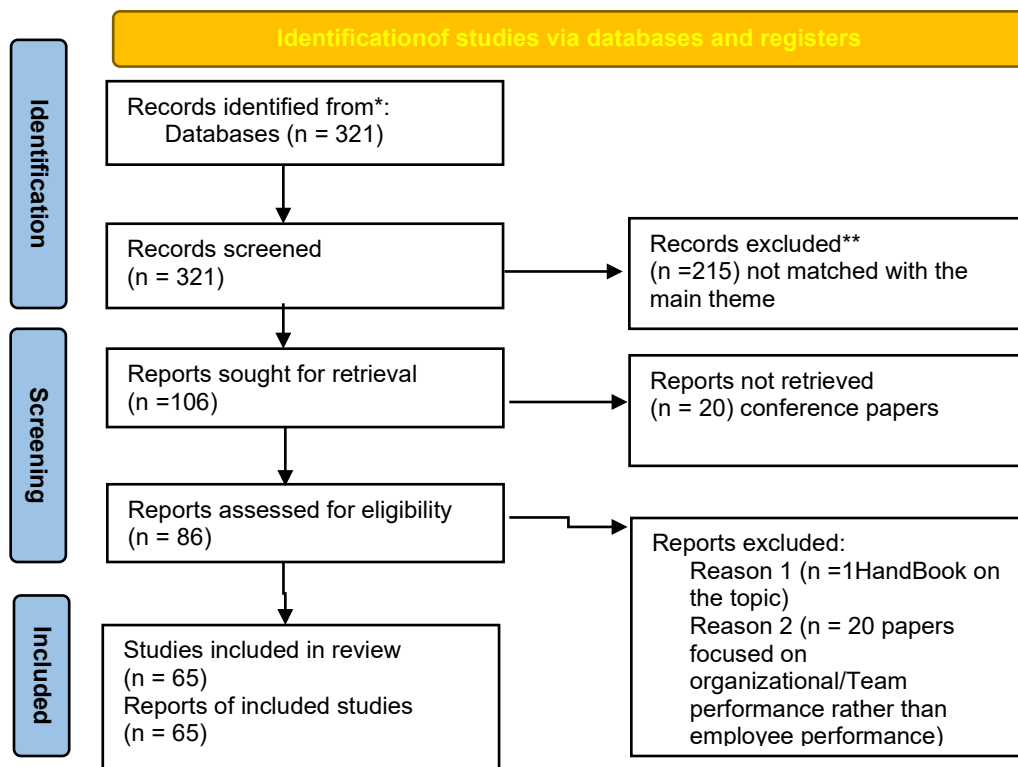
Table 1: Detailed analysis of the included paper

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
1	2001	Charbonneau et al.	Canada	Journal of Applied Social Psychology	Sports	Empirical	Transformational leadership, intrinsic motivation, and sports performance.	The study explicitly examined and discovered that transformational leadership improves sports performance through the beneficial mediation impact of intrinsic motivation.
2	2009	Li & Huang	Taiwan	Social Behavior and Personality: An international journal	Education	Empirical	Transformational leadership, task performance	Through the participation of leaders, member exchange, and coworker relationships, the study on elementary teachers revealed a strong correlation between transformational leadership and task performance.
3	2010	Brown & Arendt	Iowa, USA	Journal of Human Resources in Hospitality and Tourism	Hotel	Empirical	Transformational leadership and employee performance.	The results of the study showed that there is no relationship between transformative leadership and employee performance because these leaders don't appear to supervise workers who perform better.
4	2010	Brown et al.	United States	Journal of Human Resources in Hospitality and Tourism	Hospitality	Empirical	Transformational leadership and employees' performance	The Front desk staff maintained that their managers exhibited leadership traits such as idealistic impact and inspirational motivation more often than they did modified attention and intellectual stimulation.
5	2011	Salanova et al.	Portugal	Journal of Advanced Nursing	Healthcare	Empirical	self-efficacy, work engagement, transformational leadership, and extra role performance.	The study's findings indicated that self-efficacy and work engagement acted as mediators in the positive relationship between transformational leadership and extra-role performance.
6	2012	Hussain et al.	Pakistan	World Applied Sciences Journal	Healthcare	Empirical	transformational and transactional leadership as leadership styles and work performance and job satisfaction as outcomes	It is probable to draw the conclusion that transformational leadership and, to a smaller extent, transactional leadership can both increase followers' motivation levels.
7	2013	Leung et al.	China	Asia Pacific Journal of Management	N/A	Empirical	Learning goal orientation, creative performance, and challenge and enjoyment intrinsic motivation.	According to the study, learning goal orientation and creative performance are positively correlated, and challenging intrinsic motivation is enhancing this correlation.
8	2013	Bellé, N.	Italy	Journal of Public Administration Research and Theory	Healthcare	Empirical	transformational leadership, performance, and public service motivation	The study found that hospital nurses' performance and transformational leadership are positively correlated, with public service motivation strengthening the relationship.
9	2014	Caillier J.G.	N/A	Public Personnel Management	Public organisations	Empirical	Transformational leadership, employee performance, and mission valence	The results indicate that there is a direct correlation between employee performance and transformational leadership, and that the relationship between transformational leadership and employee performance is strengthened by mission valence.
10	2015	Tajasom et al.	Malaysia	Asian Journal of Technology	SME's	Empirical	Transformational leadership, innovative Performance, and	The study's conclusions showed that all of the components—idealized influence, intellectual stimulation, and

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
				Innovation			perceived organizational support	individualization—aside from transformational leadership's inspirational motivation—were positively correlated with innovative performance, with perceived organizational support acting as a mediating factor.
11	2015	Rawat, S.	India	Indian Journal of Science and Technology	Education	Empirical	Transformational eadership, Moral and motivation	The study's findings indicated that transformational leadership had a favourable effect on workers' motivation and morale.
12	2015	Fernet et al.	Canada	Work and Stress	Healthcare	Empirical	Transformational leadership, Pychological health, and employee motivation	The study's findings indicated that transformational leadership had a favourable effect on nurses' psychological well-being and staff motivation, which ultimately led to improved performance.
13	2016	Bormann et al.	Germany	Journal of Sport and Exercise Psychology	Sports	Empirical	Transformational leader coach and atheleteperformance	Results indicate that regardless of athlete characteristics, there is a positive correlation between coach transformative leadership and athlete performance.
14	2016	Mansouri, N.	Malaysia	Asian Social Science	ICT	Conceptual	HRM practice, transformational leadership, employee performance	According to the study, transformational leadership moderates the association between HRM practices and employee performance. Employee performance results are made up of development and growth, internal processes, and innovation.
15	2016	Syaifuddin	N/A	Academy of Strategic Management Journal	Manufac-turing	Empirical	Transformational leadership,work motivation, and employees performance	The study found that employee performance is influenced by job motivation, which is positively impacted by transformational leadership.
16	2016	Pongpearchan, P.	Thailand	Journal of Business and Retail Management Research	Education	Empirical	Transformational leadership, High – performance work system, work motivation, and power distance	The study's conclusions showed that transformational leadership has a positive impact on the high performance work system in public universities, and that work motivation has an effect on the high performance work system as well. The relationship between transformational leadership, high performance work systems, and work motivation has been proven to be negatively impacted by power distance.
17	2017	Wiyono, B.B	Indonesia	International Journal of Learning and Teaching	Education	Empirical	Principal's transformational leadership and teacher's motivation.	The findings of the study indicated the positive correlation between principal's transformational leadership and teachers work motivation.
18	2017	Delano, A.	Indonesia	Advanced Science Letters	Education	Empirical	Transformational leadership, Work motivation, and lecturer performance	According to the findings of the Navy Command School study, transformational leadership by the principal improved employee motivation at work, this in turn affected lecturer performance.
19	2017	Banerjee & Gupta	India	Asian Journal of Business and	Mixed	Empirical	Transformational leadership, intrinsic motivation, and	The study indicated that while transformative leadership has an effect on employees' intrinsic motivation and

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
				Accounting			performance.	performance, there is no significant positive correlation between the two.
20	2018	Andriani et al.	Indonesia	International Journal of Scientific and Technology Research	Education	Empirical	Transformational leadership, teacher performance, and work motivation.	According to the study, teachers' performance, work motivation, and transformational leadership are all positively correlated. The relationship between two people is being significantly strengthened by work motivation.
21	2018	Rita et al.	Indonesia	International Journal of Law and Management	Public	Empirical	transformational leadership, organizational commitment, motivation, organizational citizenship behavior (OCB) and employee performance	Studies show that the relationship between organizational commitment, transformational leadership, work motivation, and employee performance at the District Secretariat in Papua Province is not significantly affected by OCB moderating.
22	2018	Guerrero et al.	Canada	Journal of Services Marketing	Marketing	Empirical	Transformational leadership and task performance.	The relationship between task performance and transformational leadership was mediated entirely by psychological empowerment. Furthermore, the indirect association between task performance and transformational leadership was only significant and advantageous when customer feedback was low, as it was regulated by positive customer feedback.
23	2018	Sok et al.	Australia	Journal of Service Theory and Practice	Service	Empirical	Frontline service employees (FSEs) motivation, transformational leadership, and employee job performance	The results suggest an important connection between TFL and employee service performance, which improves when motivated to work but mitigated when work is pleasurable. Furthermore, employee service performance has a negative relationship with the three-way interaction of TFL, job satisfaction, and customer service skills, as well as TFL driven to work and customer service skills.
24	2019	Upadhyay et al.	India	European Journal of Work and Organizational Psychology	Higher education	Empirical	Organisational commitment; Transformational leadership; Work motivation	Transformational leaders have become crucial for developing organisational commitment in higher education institutions. It will enhance work motivation and promote a positive work the environment. According to the literature, organizations with motivated and committed employees show an improvement in their overall performance.
25	2019	Dunnweber & Paunescu	Romania	Eurasian Studies in Business and Economics	Marketing	Empirical	Transformational leadership, Inspirational motivation;	The performance of salespeople is positively impacted when a transformational leadership style is applied in the sales industry. The results of the interviews with sales executives and agents suggest the application of transformational leadership strategies has a greater effect on salespeople's performance than is often seen in

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
								research that doesn't concentrate on sales. The effect measured was highly significant for multiple instances.
26	2019	Hadiana et al.	Indonesia	International Journal of Scientific and Technology Research	public	descriptive	performance employee and Transformational leadership	Employee performance the work of quality and quantity achieved by an employee in carrying out his duties with transformational leadership, commitment organization. The methodology used is descriptive survey and a type of conclusive research whose main purpose to describe something that is usually in the form market characteristics or functions, and characterized by the formulation of specific hypothesis. Considered as the activity of providing a structured questionnaire to a large number of respondents
27	2019	Peng & Tseng	China	Journal of Psychology: Interdisciplinary and Applied	hospital	Empirical	Job performance and transformational leadership	The findings offer new insights on how and why TFL can improve nurses' job performance, particularly underlining the vital role of their work engagement and conscientiousness when evaluating the character of the relationship between TFL and job performance.
28	2019	Talib et al.	Malaysia	Opcion	Education	Empirical	Transformational leadership and job performance	Findings prove that transformational leadership has a cross-level influence on commitment, motivation, and performance and suggests that transformational leadership is an important factor.
29	2019	Matar et al.	Dubai	International Journal of Recent Technology and Engineering	Public	Empirical	Employee Performance and Transformational Leadership	Employee performance could be significantly predicted by each of the four independent factors, though in different percentages. The suggested model was able to account for 37% of the disparity in employee performance.
30	2020	Chan & Simon	Hong Kong	Journal of Management Development	Service	Empirical	Transformational leadership, self-efficacy, and performance of volunteers	Transformational leadership was positively associated with the volunteers' performance. In addition, self-efficacy mediated the relationship between transformational leadership and volunteers' performance.
31	2020	Karam et al.	Abu Dhabi	International Journal of Advanced and Applied Sciences	Public	Case study	Transformational Leadership, Employees' motivation; Employees' performance	This paper considered the specific case study of the Abu Dhabi National Oil Company (ADNOC). Three distinct situations were taken into consideration while evaluating the impact of the leadership shift, and its impact on overall performance was thoroughly examined.
32	2020	Bastari et al.	Indonesia	Management Science Letters	Public	Empirical	transformational leadership, employee performance, and employee motivation	As an intervening variable, job motivation showed an important effect on transformational leadership's influence on workers' job performance. Employee performance was significantly affected by their degree of job motivation.
33	2020	Lee &	South	Transylvania	Public	Empirical	performance	Performance management's

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
		Hyung	Korea	n Review of Administrative Sciences			management, motivation, leadership, transformational, and transactional leadership	motivational influence is highly contingent on the leadership style, and transformational and transactional leadership have various impacts on employee motivation. Therefore, in the age of performance management, managers must effectively encourage people by balancing the application of transformational and transactional leadership.
34	2020	Devi et al.	India	Indian Journal of Forensic Medicine and Toxicology	Healthcare	Empirical	Performance and Transformational Leadership	Transformational leadership has advantages in numerous sectors of the health care delivery system, and it may be used in maternity hospitals and labor rooms for enhanced outcomes for both mothers and newborns.
35	2020	Lai et al.	China	SAGE Open	Healthcare	Empirical	Transformational leadership and task performance.	Evaluated job engagement as a possible foundational process to address the influence of transformational leadership on followers' task performance and helpful behavior.
36	2020	Torlak & Kuzey	Pakistan	International Journal of Productivity and Performance Management	Education	Empirical	Transformational leadership and employee job performance	The study highlighted the absence of research on the relationship between leadership styles, performance, and satisfaction in the educational system of Pakistan.
37	2020	Morkeviciute&Endriulaitiene	Lithuania	Gender in Management		Empirical	Perceived transformational leadership style; Work motivation	Studies showed that when the leader appeared as a person who demonstrated the future vision, presenting as an appropriate leader model, encouraging the acceptance of group goals, and using cognitive stimulation, the intrinsic and extrinsic work motivation of female employees was improved. Women are more intrinsically motivated when they are held to high expectations of performance by the transformational leader.
38	2021	Seitz & Owens	United States	European Journal of Work and Organizational Psychology	Healthcare	Empirical	transformational leadership; performance;engagement	Engagement and performance have a direct association with transformational leadership, though the relationship between transformational leadership and employee performance is moderated by followers' implicit person theories. Furthermore, the outcomes of a four-factor model of transformational leadership suggest that idealised impact and inspirational motivation are behavioral factors that only work for followers who believe to ongoing theory.
39	2021	Chu et al.	China	Frontiers Media S.A.	Healthcare	Empirical	performance; transformational leadership	Cross-level path analysis findings showed that transformational leadership enhanced physicians' performance by affecting techniques for coping after achieving motives. Furthermore, the path that had the greatest cross-level indirect effect was "transformational

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
								leadership → positive coping (PC) style → physicians' performance." In result, public health leaders should encourage personal growth, particularly in the areas of accomplishment motivation and PC style, with the objective to improve the performance of physicians.
40	2021	Kusumah et al.	Indonesia	Management Research Review	hotel Industry	Empirical	transformational leadership, self-efficacy, gender, intrinsic motivation and employee performance	Employee performance is significantly and positively affected by transformational leadership, and that that connection between transformational leadership and employee performance is mediated by self-efficacy. Furthermore, intrinsic motivation contributes as a moderating variable by improving the association between self-efficacy and employee performance, and gender functions as a moderating variable by raising the relationship between transformational leadership and employee performance.
41	2021	Taamneh et al.	Jordan	Academy of Strategic Management Journal	Public	Empirical	Transformational leadership and task performance.	Suggested raising understanding of techniques for transformational leadership by maintaining workshops and training sessions for municipalities that would motivate them to accept the idea and practice of transformational leadership and the need for municipal leaders to prioritize providing for the needs of their employees using motivational tools.
42	2021	Virgiawan et al.	Indonesia	Academic Journal of Interdisciplinary Studies	Public	Empirical	Employee Performance, Motivation, and Transformational Leadership	Work culture has an important and beneficial effect on the performance of state civil servants at the Ministry of PUPR of the Republic of Indonesia, especially when it comes to using working time productively and effectively. It is additionally strongly related to how well a manager serves as a role model, providing employees with an example of how to implement time management effectively.
43	2022	Liu & Wei Liu	China	Frontiers in Public Health	Healthcare	quantitative methodology	Transformational Leadership,Employee General Health, Loyalty, and Performance	Transformational leadership plays a crucial role in influencing job performance and business cycles, while financial incentives also affect job performance and public health.
44	2022	Teoh et al.	Malaysia	Frontiers in Psychology	Hospitality industry		Employee performance, transformational leadership, Idealized influence,Individualized consideration, Inspirational motivation, Intellectual stimulation	The results indicate that among the dimensions of transformational leadership, only idealized influence and inspirational motivation has a notably positive impact on employee performance.
45	2022	Budur & Demir	Iraq	Iranian journal of	small-medium	Empirical	Transformational Leadership, Employee	Employee performance was shown to be significantly and favorably impacted by

| Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
				Management Studies	enterprises (SMEs) in the Kurdistan region of Iraq		Performance, Organizational Citizenship Behaviors	inspirational motivation (EP). EP was partially impacted by organizational citizenship behavior (OCB), with conscientiousness and civility having a strong beneficial impact on EP.
46	2022	Ibrahim et al.	Indonesia	Frontiers in Psychology	Manufacturing Industry	Quantitative	Organizational culture, transformational leadership, motivation, performance	The motivation of millennial employees is greatly increased by organizational culture and transformational leadership, which has a beneficial effect on their performance. However, the relationship between transformational leadership and performance is very weakly mediated by motivation, and organizational culture has little direct effect on performance.
47	2022	Fareed et al.	Pakistan	Administration and Society	Public service	Empirical	Transformational Leadership, Project Success, Public Service Motivation	Transformational leadership, Public service motivation(PSM), and (Project success) PS were positively correlated in public projects. Additionally, it shown that the link between TL and PS is partially mediated by PSM.
48	2022	Garad et al.	N/A	Management and Production Engineering Review	N/A	Meta analysis	Transformational Leadership, Improving Employee's Performance and the Raising Efficiency of Organizations	Transformational leadership improves job performance by encouraging employees' creativity and skill development via attributes including individual assistance, inspiration, and positive impact. Such leadership improves organizational efficiency by greatly increasing staff capacities.
49	2023	Udin et al.	Indonesia	International Journal of Sustainable Development and Planning	Healthcare	Empirical	Transformational Leadership, Employee Performance, Organizational Learning Culture and Intrinsic Work Motivation	According to the study, employee performance, intrinsic motivation, and organizational learning culture are all enhanced by transformational leadership. Although performance is not directly impacted by corporate learning culture, intrinsic motivation greatly improves it and is a crucial component of the relationship between transformational leadership and worker performance.
50	2023	Marlita et al.	Indonesia	Quality - Access to Success	N/A	cross-sectional and quantitative survey methods	Transformational Leadership, Motivation, Performance, Work Method Variety	The findings show that motivation has a major effect on work technique variation and performance. Although transformational leadership has no direct effect on performance, it has a major impact on the variety of work methods, which in turn improves performance. Furthermore, the link between transformational leadership and performance is somewhat mediated by the variety of work methods.
51	2023	Udin	Indonesia	Journal of Social Economics Research	community health center	Empirical	transformational leadership, intrinsic work motivation, employee performance	Employee performance is increased by transformational leadership through the development of intrinsic motivation, creative inspiration, and creative ideas for the success of the company.
52	2023	Kuntadi et al.	Indonesia	Cogent Business and Management	National Transportation Safety	Empirical	Transformational leadership, work motivation, employee	The study demonstrates that transformational leadership has a favorable impact on employee

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
					Committee		performance, work engagement	performance, motivation, and job engagement. Additionally, motivation and involvement at work both directly and indirectly improve performance by acting as mediators.
53	2023	Mohammad et al.	Jordan	International Journal of Procurement Management	petroleum retailing sector	Empirical	Leadership style, employee performance,retention in employee engagement	Employee engagement (EE) mediates the significant and favorable relationships between transformational leadership (TSFL) and laissez-faire (LF) and employee retention (ER) and performance (EP).
54	2023	Astuti et al.	Indonesia	Quality - Access to Success	Public	Empirical	transformational leadership, servant leadership, ethical leadership, and competence in employee performance	Public service motivation and employee performance were unaffected by servant and transformational leadership, competence enhanced employee performance through public service motivation, and ethical leadership improved employee performance through public service motivation.
55	2023	Rotimi et al.	New zealand	International Journal of Construction Management	construction organisations in Wellington,	descriptive and inferential statistics were employed	Leadership style, worker performance outcomes	All leadership styles showed a strong link to worker performance, with transformational leadership emerging as the most effective, driving task completion and goal achievement.
56	2023	Alamri M.	Saudi Arabia	Leadership and Organization Development Journal	Public sector	This study adopts a quantitative methodology	transformational leadership behavior, employees' work engagement, promotion focus, public service motivation	The study revealed that transformational leadership positively impacts employees' work engagement and promotion focus. Promotion focus mediates the link between leadership and work engagement, highlighting how leaders can enhance motivation and drive better engagement outcomes.
57	2023	Kao et al.	Taiwan	Frontiers in Psychology	National Immigration Agency	quantitative	Perceived organizational support, organizational citizenship behavior, volunteer participation motivation, and cross-level effect of transformational leadership and organizational climate	Employees' perceived organizational support (POS)positively influenced OCB, with volunteer motivation moderating these relationships. Additionally, transformational leadership and organizational climate enhanced POS, encouraged volunteer motivation, and promoted OCB.
58	2023	Habib et al.	Pakistan	RAUSP Management Journal	public and private sector organizations	Comparative research	Transformational leadership, ethical leadership, organizational effectiveness	Transformational leadership (TL) had a stronger influence on organizational effectiveness (OE) than ethical leadership (EL), both before and during COVID-19. During the pandemic, TL's effectiveness grew, while EL's declined. TL was more impactful in private sectors, whereas EL was better suited for public sectors.
59	2024	Arifin et al.	Indonesia	SA Journal of Human Resource Management	District Civil Service Agency	quantitative approach using a self-administered survey method	transformational leadership, organizational commitment and employee performance	The results of this study reveal that both transformational leadership and organizational commitment positively influence organizational citizenship behavior (OCB) and employee performance.

Sr. No.	Year of publication	Authors' name	Country	Journal's name	Research Industry	Research type	Variables included	Findings of the study
60	2024	Abiddin& Norhasni	Pakistan	Pakistan Journal of Life and Social Sciences	education	Systematic Literature Review (SLR)	Leadership Styles Employee Performance Competency	The findings show that transformational leadership significantly enhances performance and competence, fostering innovation and employee involvement.
61	2024	Lingmin et al.	china	Library Progress International	Education	quantitative and qualitative	Organisational commitment, leadership style, performance on the job.	Teachers reported higher job satisfaction under transformational leaders, while passive-avoidant leadership led to decreased employee productivity.
62	2024	Almaqableha et al.	Jordan	Revista de Gestao Social e Ambiental	Jordanian Telecommunications	Empirical	Leadership style, organizational climate, motivation, and organizational citizenship behaviors	Results show a strong correlation between organizational citizenship behaviors(OCB), motivation, organizational atmosphere, transformational leadership, and transactional leadership.
63	2024	Dinesh Babu	India	International Research Journal of Multidisciplinary Scope	ICT	Empirical	Transformational leadership, innovative performance, organizational culture	In this study transformational leadership has a positive influence on the innovative performance of individuals.
64	2024	Madrid et al.	Peru	Journal of Educators Online	Private universities	cross-sectional study	digital competencies, transformational leadership, and job performance	In this study finding reveals that Job performance was directly correlated with transformative leadership.
65	2024	Ali & Bavik	China	Service Industries Journal	hospitality	SLR	Transformational leadership, work motivation, and perrformance.	The study reveals that TFL's influence and it improves worker motivation, performance, and satisfaction. The study also emphasizes the similarities between TFL and Servant leadership (SL), indicating that the two leadership philosophies may work well together in this sector.

Upon finishing an in-depth examination of 65 articles, the authors of this research paper identified the following trends.

Figure 2: Year wise publication trends of the identified research paper.

Figure 3: The top 10 leading Journals for Publishing Research on the Variables.
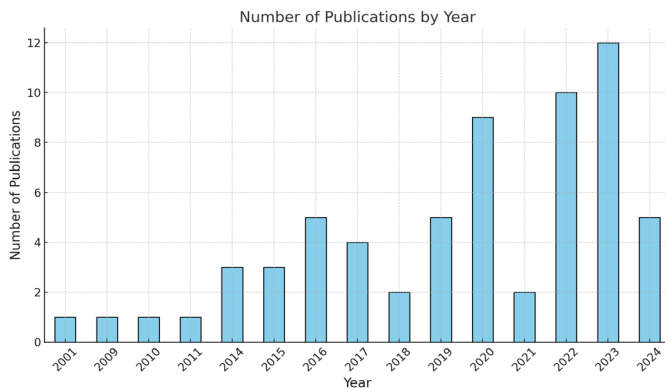
The bar graph above illustrates the rising trend in the publication of researched variables. The highest number of publications was recorded in 2023, which highlights the significance of transformational leadership's impact on employee job performance.

The journal publication trend identifies these 10 journals as the leading outlets for studies on transformational leadership and employee job performance. *Frontiers in Psychology*

stands out, having published three articles that emphasize the significance of transformational leadership in its research.

Figure 4: Illustrating the highest number of citations received for the topic.
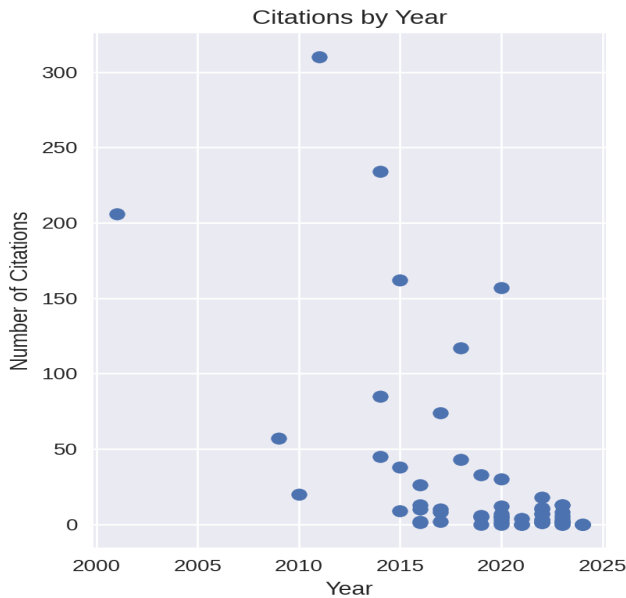
In the above, plot diagram illustrating the highest number of citations received by the published research paper. The peak citation indicated here is 300, after which the citations for the researched topic have demonstrated an upward trend.

3. FINDINGS

Based on a comprehensive systematic literature review, our detailed analysis of 65 research papers indicates that transformational leadership has a substantial impact on both employee motivation and performance. Our results from the period 2002 to 2024 highlight the ongoing and dynamic nature of transformative leadership by showing that its effects on employee motivation and performance display unique traits. By performing a comprehensive review of the current literature, various trends have emerged in this analysis. Notably, 2023 saw the highest number of publications on transformational leadership, underscoring its significance as a major research focus. The journal "Frontiers in Psychology" featured the most articles on this topic, highlighting the sustained interest in examining the psychological aspects of leadership in organizations. Furthermore, studies connecting transformational leadership to employee performance received 300 citations, indicating the substantial attention this topic continues to attract within the academic community. These observations are particularly helpful for both business professionals and scholarly academics. Furthermore, various mediators and moderators like public service motivation, work motivation, intrinsic motivation, moral, self-efficacy, engagement organisational commitment, inspirational motivation, organizational

citizenship behavior, culture, organizational culture, loyalty and many more have been identified as critical factors enhancing the intricate relationship between transformational leadership, employee motivation and employee performance Notably, research indicates heightened global awareness of the significance of transformational leadership, with recent specific attention paid to countries like USA, China, Malaysia, Indonesia, India, Pakistan, Dubai, where the importance of implementing transformational leadership in organizations has been acknowledged. Moreover, studies spanning various industries such as public and private sector, health care education, hospitality industries, manufacturing industries, higher education, ICT, have been conducted to assess the impact of transformational leaders employee motivation on employee job performance. While the majority of studies have empirically tested the relationship between transformational leadership, employee motivation and employee performance, a limited number have delved into providing a conceptual and theoretical understanding, offering valuable insights into the nuanced positive relationship that exists between transformational leadership, employee motivation and employee performance.

4. CONCLUSION

This article seeks to examine the research landscape surrounding of transformational leadership and consolidate insights from previous studies. As a result, it enhances the current understanding of transformational leadership, employee motivation, and performance by addressing research gaps, underscoring the connections among these variables, and utilizing a systematic methodological framework. As detailed, the study carries important implications for both scholars and practitioners. It underscores the growing interest in this research area and presents comprehensive findings concerning the impact of transformational leadership on employee motivation and performance, as well as the influence of mediating mechanisms and contextual factors.

In addition, this article suggests future research avenues, including possible topics, methodological improvements, variable selection, clarity in terminology, and a more cohesive approach to comprehending employee performance. For practitioners, the findings offer a helpful resource for leadership training and informed decision-making.

This study, characterized by its systematic approach, ensures transparency in highlighting the transformational leadership importance as an independent variable and its impact on employee's performance. Despite their usefulness, systematic literature reviews have drawbacks, as they incorporate only a limited selection of studies that satisfy specific inclusion criteria, which may leave out numerous important papers that could have significantly contributed to this research.

5. RECOMMENDATIONS

Based on the results, it is recommended that upcoming studies encompass a variety of industries of varying sizes within the Indian setting to provide a more thorough analysis. This variety would aid in capturing the distinct characteristics of transformational leadership across different organizational frameworks and sectors. Additionally, the research promotes the idea of conducting longitudinal studies to investigate the changing dynamics between transformational leadership, employee motivation, and performance over time. Such investigations would yield important insights into the long-term impacts of transformational leadership.

To enhance the analysis further, it is advised to include multiple moderators and mediators. This approach would allow for a more in-depth examination of the factors that affect the relationship between transformational leadership, employee motivation, and performance. Gaining an understanding of these contextual variables could assist in identifying situations where transformational leadership exerts either a stronger or weaker influence on employee outcomes.

6. FUTURE DIRECTIONS

Mixed method and exploratory studies contrasting the impact on employee performance in the presence and absence of transformational leadership and employee motivation are suggested. These studies can offer a more nuanced understanding of the outcomes associated with transformational leadership and the effects of its absence, highlighting the critical role of transformational leadership in fostering positive workplace dynamics. Previous studies often focused on organizational performance as a key variable. Researchers can refine this approach by emphasizing employee performance as the primary outcome, incorporating various mediating and moderating variables to explore the relationship between transformational leadership and employee performance more comprehensively. These studies offer a valuable roadmap for guiding future research efforts aimed at delving deeper into the complexities of transformational leadership. By expanding the scope of investigation, it pave the way for exploring how this leadership style operates within a variety of cultural and organizational contexts. Such research has the potential to uncover unique patterns, dynamics, and influences that may vary across settings, ultimately contributing to a more holistic and nuanced understanding of transformational leadership and its impact.

REFERENCES

[1.] Abiddin, N. Z. (2024). A Deep Dive into Leadership Styles in Shaping the Higher Education Institution's Value and Culture. *Pakistan Journal of Life and Social Sciences (PJLSS)*, *22*(2).https://doi.org/10.57239/PJLSS-2024-22.2.00283

[2.] Ahmad, F., Abbas, T., Latif, S., & Rasheed, A. (2014). *Impact of Transformational Leadership on Employee Motivation in Telecommunication Sector* (Vol. 2, Issue 2). Online.

[3.] Ahmad, M. B., Wasay, E., & Ullah, S. (2012). Impact of Employee Motivation on Customer Satisfaction: Study of Airline Industry in Pakistan. *Interdisciplinary Journal of Contemporary Research in Business*, *4*(6), 531–539.

[4.] Alamri, M. (2023). Transformational leadership and work engagement in public organizations: promotion focus and public service motivation, how and when the effect occurs. *Leadership & Organization Development Journal*, *44*(1), 137–155.https://doi.org/10.1108/LODJ-12-2021-0544

[5.] Ali, B. (2024). What we know about transformational leadership in tourism and hospitality: a systematic review and future agenda. *The Service Industries Journal*, *44*(1–2), 105–147.https://doi.org/10.1080/02642069.2023.225030

[6.] Almaqableha, A., & Omarb, K. (2024). Nexus of Leadership Style, Organizational Climate, Motivation and OCB in Jordanian Telecommunications. *Revista de Gestão Social e Ambiental*, *18*(5), e05594.https://doi.org/10.24857/rgsa.v18n5-071

[7.] Andriani, S., Kesumawati, N., &Kristiawan, M. (2018). The influence of the transformational leadership and work motivation on teachers performance. *International Journal of Scientific and Technology Research*, 19–29.

[8.] Arifin, S., &Narmaditya, B. S. (2024). Fostering employee performance of civil servants in Indonesia: The mediating role of organisational citizenship behaviour. *SA Journal of Human Resource Management*, *22*.https://doi.org/10.4102/sajhrm.v22i0.2412

[9.] Astuti S.D., Riyanto F, &Ingsih. (2023). Is Ethical Leadership Style More Suitable For Millennial State Civil Apparatus? *Quality - Access to Success*, *24*(192).https://doi.org/10.47750/QAS/24.192.29

[10.]Avolio, B. J., & Bass, B. M. (2001). Developing potential across a full range of Leadership Tm: Cases on transactional and transformational leadership. Psychology Press.

[11.]Avolio, B. J. (2004). Examining the full range model of leadership: Looking back to transform forward. In Leader development for transforming,Psychology Press. organizations.

[12.]Azar, M., & Shafighi, A. A. (2013). The Effect of Work Motivation on Employeesâ€™ Job Performance (Case Study: Employees of Isfahan Islamic Revolution Housing Foundation). *International Journal of Academic Research in Business and Social Sciences*, *3*(9).https://doi.org/10.6007/IJARBSS/v3-i9/231

[13.]Babu M, D., & Kushwaha, B. P. (2024). Does Transformational Leadership Influence Employees' Innovativeness and Mediate the Role of Organisational Culture? Empirical Evidence. *International Research Journal of Multidisciplinary Scope*, *05*(01), 428–440.https://doi.org/10.47857/irjms.2024.v05i01.0244

[14.]Banerjee, B., & Gupta, B. (2017). Transformational Leadership and Creative Performance: A Dyadic Analysis of Salespeople and Their Supervisors. *Asian Journal of Business and Accounting*, *10*(1).

[15.]Bass, B. M., & Bass Bernard, M. (1985). *Leadership and performance beyond expectations*.

[16.]Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership 2nd ed.*

[17.]Bass, B. M. (1998). *TransfoBass, BM (1998). Transformational Leadership: Industrial, Military, and Educational Impact. Transformational Leadership Industry Military and Educational Impact.*

[18.]Bass, B. M., Avolio, B. J., Jung, D. I., & Berson, Y. (2003).

Predicting unit performance by assessing transformational and transactional leadership. *Journal of Applied Psychology*, *88*(2), 207–218. https://doi.org/10.1037/0021-9010.88.2.207

[19.]Bernard M. Bass. (1985). *Leadership and Performance Beyond Expectations*.

[20.]Bass, B. M. (1997). Full range leadership development: Manual for the Multifactor Leadership Questionnaire. *Mind Garden*.

[21.]Bassett-Jones, N., & Lloyd, G. C. (2005). Does Herzberg's motivation theory have staying power? *Journal of Management Development*, *24*(10), 929–943.https://doi.org/10.1108/02621710510627064

[22.]Bellé, N. (2014). Leading to Make a Difference: A Field Experiment on the Performance Effects of Transformational Leadership, Perceived Social Impact, and Public Service Motivation. *Journal of Public Administration Research and Theory*, *24*(1), 109–136.https://doi.org/10.1093/jopart/mut033

[23.]Bormann, K. C., Schulte-Coerne, P., Diebig, M., & Rowold, J. (2016). Athlete Characteristics and Team Competitive Performance as Moderators for the Relationship Between Coach Transformational Leadership and Athlete Performance. *Journal of Sport and Exercise Psychology*, *38*(3), 268–281. https://doi.org/10.1123/jsep.2015-0182

[24.]Brown, E. A., & Arendt, S. W. (2010). Perceptions of Transformational Leadership Behaviors and Subordinates' Performance in Hotels. *Journal of Human Resources in Hospitality & Tourism*, *10*(1), 45–59.https://doi.org/10.1080/15332845.2010.500205

[25.]Budur& Demir A. (2022). The Relationship Between Transformational Leadership and Employee Performance: Mediating Effects of Organizational Citizenship Behaviors. *Iranian Journal of Management Studies*, *15*(4).

[26.]Buil, I., Martínez, E., & Matute, J. (2019). Transformational leadership and employee performance: The role of identification, engagement and proactive personality. *International Journal of Hospitality Management*, *77*(May), 64–75. https://doi.org/10.1016/j.ijhm.2018.06.014

[27.]Burns, J. M. (1978). *Leadership and followership,Leadership, 18-23*.

[28.]Caillier, J. G. (2014). Toward a Better Understanding of the Relationship Between Transformational Leadership, Public Service Motivation, Mission Valence, and Employee Performance. *Public Personnel Management*, *43*(2), 218–239.https://doi.org/10.1177/0091026014528478

[29.]Caillier, J. G. (2014). Toward a Better Understanding of the Relationship Between Transformational Leadership, Public Service Motivation, Mission Valence, and Employee Performance. *Public Personnel Management*, *43*(2), 218–239.https://doi.org/10.1177/0091026014528478

[30.]Chan, S. C. H. (2020). Transformational leadership, self-efficacy and performance of volunteers in non-formal voluntary service education. *Journal of Management Development*, *39*(7/8), 929–943.https://doi.org/10.1108/JMD-03-2020-0078

[31.]Charbonneau, D., Barling, J., & Kelloway, E. K. (2001). Transformational Leadership and Sports Performance: The Mediating Role of Intrinsic Motivation [1]. *Journal of Applied Social Psychology*, *31*(7), 1521–1534.https://doi.org/10.1111/j.1559-1816.2001.tb02686.x

[32.]Chen, Y., & Lou, H. (2002). Toward an Understanding of the Behavioral Intention to Use a Groupware Application. *Journal of Organizational and End User Computing*, *14*(4), 1–16.https://doi.org/10.4018/joeuc.2002100101

[33.]Chintalloo, S &Mahadeo, J. (2013). Effect of Motivation on Employees' Work Performance at Ireland Blyth Limited: Proceedings of 8th Annual London Business Research Conference Imperial College, London, UK, 8 ISBN: 978-1-922069-28-3.

[34.]Curado, C., & Santos, R. (2022). Transformational leadership and work performance in health care: the mediating role of job satisfaction. *Leadership in Health Services*, *35*(2), 160–173.https://doi.org/10.1108/LHS-06-2021-0051

[35.]Dai, Y. De, Dai, Y. Y., Chen, K. Y., & Wu, H. C. (2013). Transformational vs transactional leadership: Which is better?: A study on employees of international tourist hotels in Taipei City. *International Journal of Contemporary Hospitality Management*, *25*(5), 760–778. https://doi.org/10.1108/IJCHM-Dec-2011-0223

[36.]Delano, A. (2017). The Effect of Transformational Leadership and Motivation on the Lecturer Performance in Environment of Navy Command School (NCS). *Advanced Science Letters*, *23*(11), 10935–10938.https://doi.org/10.1166/asl.2017.10191

[37.]Downton, J. V. (1973). *Rebel leadership: Commitment and charisma in the revolutionary process*.

[38.]Eliyana, A., Ma'arif, S., & Muzakki. (2019). Job satisfaction and organizational commitment effect in the transformational leadership towards employee performance. *European Research on Management and Business Economics*, *25*(3), 144–150.https://doi.org/10.1016/j.iedeen.2019.05.001

[39.]Fareed, M. Z., & Su, Q. (2022). Transformational Leadership and Project Success: A Mediating Role of Public Service Motivation. *Administration & Society*, *54*(4), 690–713.https://doi.org/10.1177/00953997211040466

[40.]Fernet, C., Trépanier, S.-G., Austin, S., Gagné, M., & Forest, J. (2015). Transformational leadership and optimal functioning at work: On the mediating role of employees' perceived job characteristics and motivation. *Work & Stress*, *29*(1), 11–31.https://doi.org/10.1080/02678373.2014.1003998

[41.]Fernet, C., Trépanier, S.-G., Austin, S., Gagné, M., & Forest, J. (2015). Transformational leadership and optimal functioning at work: On the mediating role of employees' perceived job characteristics and motivation. *Work & Stress*, *29*(1), 11–31.https://doi.org/10.1080/02678373.2014.1003998

[42.]Ferrari, R. (2015). Writing narrative style literature reviews. *Medical Writing*, *24*(4), 230–235.https://doi.org/10.1179/2047480615Z.000000000329

[43.]Garad, A., Haryono, S., Yaya, R., Pratolo, S., & Rahmawati, A. (2022). The Relationship Between Transformational Leadership, Improving Employee's Performance and the Raising Efficiency of Organizations. *Management and Production Engineering Review*, *13*(2), 15–30.https://doi.org/10.24425/mper.2022.142052

[44.]Grant, & Adam M. (2008). Does intrinsic motivation fuel the prosocial fire? Motivational synergy in predicting persistence, performance, and productivity. *Journal of Applied Psychology*, *93*(1), 48–58.

[45.]Greeno, S. (2002). Human capital management: achieving added value through people. *Kogan: Pager limited*.Hasmin, E. (2017). Effect of Transformational Leadership on Employee Job Satisfaction and Performance. *SSRN Electronic Journal*.https://doi.org/10.2139/ssrn.2968062

[46.]Habib, N., Naveed, S., Mumtaz, M., Sultana, R., & Akhtar, S. (2023). What type of leadership is more effective for managing change during force majeure? Achieving organizational effectiveness during the pandemic. *RAUSP Management Journal*, *58*(4), 318–340.https://doi.org/10.1108/RAUSP-01-

2023-0007

[47.] Hasibuan, N. R., & Ferine, K. F. (2023). The Influence Of Transformational Leadership On Employee Performance With Organizational Commitment As An Intervening Variable In The National Unity And Political Body Of Binjai City. *SIBATIK JOURNAL: JurnalIlmiahBidangSosial, Ekonomi, Budaya, Teknologi, Dan Pendidikan, 2*(9), 2675-2686.

[48.] Hasmin, E. (2017). Effect of Transformational Leadership on Employee Job Satisfaction and Performance. *SSRN Electronic Journal*.https://doi.org/10.2139/ssrn.2968062

[49.] Ibrahim, M., & Adu Brobbey, V. (2015). IMPACT OF MOTIVATION ON EMPLOYEE PERFORMANCE THE CASE OF SOME SELECTED MICRO FINANCE COMPANIES IN GHANA.*International Journal of Economics, Commerce and Management, United Kingdom, 3*(11).

[50.] Ibrahim, M., Karollah, B., Juned, V., & Yunus, M. (2022). The Effect of Transformational Leadership, Work Motivation and Culture on Millennial Generation Employees Performance of the Manufacturing Industry in the Digital Era. *Frontiers in Psychology, 13*.https://doi.org/10.3389/fpsyg.2022.908966

[51.] Kane, T. D., & Tremble, T. R. (2000). Transformational Leadership Effects at Different Levels of the Army. *Military Psychology, 12*(2), 137–160. https://doi.org/10.1207/S15327876MP1202_4

[52.] Kao, J.-C., Cho, C.-C., & Kao, R.-H. (2023). Perceived organizational support and organizational citizenship behavior–A study of the moderating effect of volunteer participation motivation, and cross-level effect of transformational leadership and organizational climate. *Frontiers in Psychology, 14*.https://doi.org/10.3389/fpsyg.2023.1082130

[53.] Kuntadi, C., Widyanty, W., Nurhidajat, R., Cahyandito, M. F., Sariadi, P., &Fahlevi, M. (2023). Driving performance at the National Transportation Safety Committee: The mediating role of engagement and motivation in transformational leadership. *Cogent Business & Management, 10*(3).https://doi.org/10.1080/23311975.2023.2285265

[54.] Kuswati, Y. (2020). The effect of motivation on employee performance. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal), 3*(2), 995-1002.

[55.] Leung, K., Chen, T., & Chen, G. (2014). Learning goal orientation and creative performance: The differential mediating roles of challenge and enjoyment intrinsic motivations. *Asia Pacific Journal of Management, 31*(3), 811–834.https://doi.org/10.1007/s10490-013-9367-3

[56.] Li, C.-K., & Hung, C.-H. (2009). The influence of transformational leadership on workplace relationships and job performance. *Social Behavior and Personality: An International Journal, 37*(8), 1129–1142.https://doi.org/10.2224/sbp.2009.37.8.1129

[57.] Lingmin, W., Abdul Ghani, K. B., & Islam, A. (2024). The Influence Of The Principal's Leadership Style On Teacher Motivation And Job Performance In Rural Schools In China Article Sidebar. *Library Progress International, 44*(3).

[58.] Liu, W., & Liu, Y. (2022). The Impact of Incentives on Job Performance, Business Cycle, and Population Health in Emerging Economies. *Frontiers in Public Health, 9*. https://doi.org/10.3389/fpubh.2021.778101

[59.] Lowe, K. B., Kroeck, K. G., & Sivasubramaniam, N. (1996). Effectiveness correlates of transformational and transactional leadership: A meta-analytic review of the mlq literature. *Leadership Quarterly, 7*(3), 385–425.

https://doi.org/10.1016/S1048-9843(96)90027-2

[60.] Madrid, C., Chimborazo, J. L., Morales-García, W. C., Quispe-Sanca, D., Huancahuire-Vega, S., Sánchez-Garcés, J., &Saintila, J. (2024). Digital Competencies and Transformational Leadership as Predictors of Job Performance in University Teachers. *Journal of Educators Online, 21*(3).https://doi.org/10.9743/JEO.2024.21.3.18

[61.] Mansouri, N. (2016). Moderating Role of the Transformational Leadership in the Relationship between HRM Practices and Performance: A Study of ICT Companies of Malaysia. *Asian Social Science, 12*(7), 1. https://doi.org/10.5539/ass.v12n7p1

[62.] Marlita D, Setyawati S.M, &Indrayanto A. (2023). The Influence of Transformational Leadership and Motivation on Performance with Work Method Variety as a Mediation Variable. *Quality-Access to Success, 24*(196).https://doi.org/10.47750/QAS/24.196.21

[63.] Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Social Sciences, 5*(1).https://doi.org/10.1080/23311886.2019.1653531

[64.] Mohammad, A., Menhat, M., Zaideen, I. M. M., & Saadon, M. S. I. (2023). Leadership style and its influence on employee performance and retention in employee engagement mediation: evidence from Jordan's petroleum retailing sector. *International Journal of Procurement Management, 18*(4), 437–469.https://doi.org/10.1504/IJPM.2023.134633

[65.] Nastavia Putri, & Lista Meria. (2022). The Effect of Transformational Leadership on Employee Performance Through Job Satisfaction and Organizational Commitment. *IAIC Transactions on Sustainable Digital Innovation (ITSDI), 4*(1), 8–21.https://doi.org/10.34306/itsdi.v4i1.565

[66.] Pongpearchan P. (2016). Effect of transformational leadership and high performance work system on job motivation and task performance: Empirical evidence from business schools of Thailand Universities. *Journal of Business and Retail Management Research, 10*(3).

[67.] Rawat, S. R. (2015). Impact of Transformational Leadership Over Employee Morale and Motivation. *Indian Journal of Science and Technology, 8*(S6), 25.https://doi.org/10.17485/ijst/2015/v8iS6/62118

[68.] Rivai, A. (2020). EFFECT OF WORK MOTIVATION AND PARTICIPATIVE LEADERSHIP TO UNDERSTAND FUNCTIONAL EMPLOYMENT BEHAVIOR (Study at the Office of Education and Culture, East Nusa Tenggara Province). *Jurnal Eduscience, 7*(2), 40–49.

[69.] Rosa Hasibuan, N., & Farida Ferine, K. (2023). the Influence of Transformational Leadership on Employee Performance With Organizational Commitment As an Intervening Variable in the National Unity and Political Body of Binjai City. *Sibatik Journal | Volume, 2*(9), 2675–2686. https://publish.ojs-indonesia.com/index.php/SIBATIK

[70.] Rotimi, J. O. B., Witton, F., & Rasheed, E. O. (2023). The predictive power of managers' leadership attributes on workers' performance: a case of New Zealand construction industry. *International Journal of Construction Management, 23*(7), 1214–1222.https://doi.org/10.1080/15623599.2021.1964919

[71.] Salanova, M., Lorente, L., Chambel, M. J., & Martínez, I. M. (2011). Linking transformational leadership to nurses' extra-role performance: the mediating role of self-efficacy and work engagement. *Journal of Advanced Nursing, 67*(10), 2256–2266.https://doi.org/10.1111/j.1365-2648.2011.05652.x

[72.] Syaifuddin. (2016). *THE INFLUENCE OF WORK STRESS*

AND TRANSFORMATIONAL LEADERSHIP ON WORK MOTIVATION AND IMPLICATION OF EMPLOYEE'S PERFORMANCE (CASE STUDY). *15*(3), 42–48.

[73.] Tajasom, A., Hung, D. K. M., Nikbin, D., & Hyun, S. S. (2015). The role of transformational leadership in innovation performance of Malaysian SMEs. *Asian Journal of Technology Innovation*, *23*(2), 172–188.https://doi.org/10.1080/19761597.2015.1074513

[74.] Teoh, B. E. W., Wider, W., Saad, A., Sam, T. H., Vasudevan, A., &Lajuma, S. (2022). The effects of transformational leadership dimensions on employee performance in the hospitality industry in Malaysia. *Frontiers in Psychology*, *13*.https://doi.org/10.3389/fpsyg.2022.913773

[75.] Thamrin, H. M. (2012). The Influence of Transformational Leadership andOrganizational Commitment on Job Satisfaction andEmployee Performance. *International Journal of Innovation, Management and Technology*.https://doi.org/10.7763/IJIMT.2012.V3.299

[76.] Thamrin, H. M. (2012). The Influence of Transformational Leadership andOrganizational Commitment on Job Satisfaction andEmployee Performance. *International Journal of Innovation, Management and Technology*.https://doi.org/10.7763/IJIMT.2012.V3.299

[77.] Trottier, T., Van Wart, M., & Wang, X. (2008). Examining the nature and significance of leadership in government organizations. *Public Administration Review*, *68*(2), 319–333. https://doi.org/10.1111/j.1540-6210.2007.00865.x

[78.] Udin, U., Dharma, R. D., Dananjoyo, R., & Shaikh, M. (2023). The Role of Transformational Leadership on Employee Performance Through Organizational Learning Culture and Intrinsic Work Motivation. *International Journal of Sustainable Development and Planning*, *18*(1), 237–246.https://doi.org/10.18280/ijsdp.180125

[79.] Udin, U. (2023). A mediation-moderation model of transformational leadership and intrinsic work motivation for nurturing employee performance. *Journal of Social Economics Research*, *10*(2), 22–33.https://doi.org/10.18488/35.v10i2.3321

[80.] Vigoda-Gadot, E., & Beeri, I. (2012). Change-oriented organizational citizenship behavior in public administration: The power of leadership and the cost of organizational politics. *Journal of Public Administration Research and Theory*, *22*(3), 573–596. https://doi.org/10.1093/jopart/mur036

[81.] Vipraprastha, T., Sudja, I. N., & Yuesti, A. (2018). The Effect of Transformational Leadership and Organizational Commitment to Employee Performance with Citizenship Organization (OCB) Behavior as Intervening Variables (At PT Sarana Arga Gemeh Amerta in Denpasar City). *International Journal of Contemporary Research and Review*, *9*(02), 20503–20518. https://doi.org/10.15520/ijcrr/2018/9/02/435.

[82.] Wiyono, B. B. (2017). The Effectiveness of the Implementation of Principals' Transformational Leadership in Motivating Teachers to Carry Out Their Profession Duties. *International Journal of Learning and Teaching*. https://doi.org/10.18178/ijlt.3.2.144-147

[83.] Yukl, G. (1989). Managerial Leadership: A Review of Theory and Research. *Journal of Management*, *15*(2), 251–289. https://doi.org/10.1177/014920638901500207

[84.] Yukl, G. (2013). *Leadership in organizations 8th ed.*

The Future of Work: Opportunities and Challenges in Gig Employment

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1. INTRODUCTION

In recent years, gig employment has completely changed the Indian economy by giving people a lot of jobs and eventually increasing the GDP of the nation. Due to its convenience and flexibility, gig work is become so popular that people are deliberately selecting it over regular employment. Gig workers benefit from flexible work schedules, the chance to do what they enjoy, and the option to earn more money by taking on numerous gigs. Companies that hire gig workers save money on office space, equipment, and other expenses.

Gig jobs were already common before the pandemic, but after the COVID breakout, many people who lost their regular occupations have resorted to gigs because they are readily accessible and provide a great way to earn money. Because more companies are using gig workers instead of full-time employees, their operational strategies are changing. As a result, they may hire more people at a reduced cost.

Employees operate under contract in a gig economy, which is distinct from regular employment. The positions are transitory, flexible, and primarily involve building digital networks. People begin earning a living by taking on several project-based jobs, which is undoubtedly enjoyable because they may work whenever and however they want.

The NITI Aayog report on India's thriving gig and platform economy projects that by 2029–2030, the gig labor will have grown to 2.35 crore (23.5 million) people. By 2029–2030, gig workers are predicted to make up 6.7% of India's non-agricultural workforce, or 4.1% of the country's overall income.

They can be broadly divided into two categories: location-based platforms, which mediate tasks performed in person at specific locations (such as taxis, deliveries, home services, domestic work, and care services); and web-based platforms, which mediate tasks performed online, either by a crowd or by specific individuals. This brief focuses on the latter kind of platforms that cater to freelancers or online gig workers.

Gig workers are those who perform flexible, temporary jobs or assignments, frequently made possible by digital networks. These positions are usually independent, and instead of earning a set pay, employees are paid on a task, project, or delivery basis. The gig economy has grown significantly in India as a result of on-demand services, smartphone usage, and urbanization.

2. TYPES OF GIG WORK

- Platform-based work: Jobs include food delivery, ride-hailing, and freelancing that are organized through applications or websites.

- Non-Platform-Based Work: This category comprises temporary employees or independent contractors that are employed directly by companies or customers.

Sector wise Summary of Gig Workers

Sno	Sector	Key roles	platforms
	Delivery and Logistics	Food delivery, e-commerce logistics, grocery delivery, parcel delivery.	Swiggy, Zomato, Amazon Flex, Flipkart Logistics, Dunzo.
	Freelancing and Digital services	C Content creation, web development, graphic design, online tutoring, translation, IT services.	Upwork, Fiverr, Freelancer, Toptal, Chegg, Vedantu.
	Home services	B Beauticians, plumbers, electricians, carpenters, appliance repair technicians.	Urban Company, Housejoy, Mr. Right.
	Ride Hailing and Transportation	Drivers, bike taxis, carpooling.	Uber, Ola, Rapido.
	Creative and content driven roles	Influencers, graphic designers, writers, photographers.	Instagram, YouTube, Canva, Behance.
	E-Learning and online Tutoring	O Online tutors, course creators, test preparation experts.	Vedantu, Byju's, Unacademy,

Sno	Sector	Key roles	platforms
			Chegg.
	Health and wellness	F Fitness trainers, yoga instructors, nutritionists.	Cure .fit, Healthify Me, Urban Company.
	Agritech and Rural Gig Work	Crop advisors, drone operators, rural logistics workers	DeHaat, AgroStar, Gramophone.

According to a Hyderabad study, inadequate compensation and a lack of independence were the primary causes of gig workers' departures from their prior positions. They did not, however, notice any notable changes from their prior jobs when they switched to gig labor. Gig workers who work 0–8 hours a day make between Rs. 6000 and Rs. 12000, while those who work 8–12 hours a day might make up to Rs. 25000, according to the study. Employees who work more than 12 hours a day could get up to Rs. 35,000. Furthermore, 40% of participants gave field managers' or team leaders' services a rating of less than three out of five, according to the survey. Additionally, it was found that most gig workers were not aware of the several types of insurance that they might choose from (Behera et al., 2019).

Workers are encouraged to enter the gig economy by greater compensation, greater flexibility, and greater autonomy in their working methods. Regarding their prior employment, the majority of the employees we spoke with had salaried positions as junior engineers, clerks, sales executives, hotel employees, security guards, private drivers (including school buses, ambulances, and private taxis), and sales executives. However, many were either laid off or resigned their positions because of the excessive hours and low pay. The need for part-time or supplemental income is frequently the first reason people turn to gig work, in addition to unemployment and layoff-related factors. However, the demands of "gig work" are similar to those of "full-time" jobs, and more than 80% of respondents rely on platform jobs as their only source of income. Moreover, a third of the workers surveyed reported an increase in the number of dependants due to the COVID-19 pandemic in their respective households.

3. NEED FOR THE STUDY

In the current situation, a lot of employees desire to work on their own to relieve organizational tension. Globally, gig platforms such as Uber, Fiverr, and Upwork generate job opportunities, particularly in areas with high unemployment rates. Gig economy principles are being applied to other sectors, such as healthcare and education. This study is crucial to ensuring that gig employment promotes social justice, economic progress, and worker empowerment by highlighting both opportunities and difficulties.

4. REVIEW OF LITERATURE

Saraswathi C (2023): Because gig workers are not regarded as full-time, permanent employees, they cannot anticipate receiving any form of employment benefits or social security measures in the future. As a result, they will not receive any benefits from gig work in the long run. - Since gig workers are temporary workers and operate on a flexible schedule, they are not eligible for perks like pay increases, promotions, or work identification, and their experience is not taken into account.

Suresh Nakka and Vani Chintha(2023) : This study aims to determine how the gig economy's employment opportunities benefit the dependent workforce over the long term due to its lax or nonexistent regulatory environment. The hypothesis tested in this study leads to the conclusion that the gig economy will continue to be a source of employment creation for some time to come. Through this study, it is recommend the creation of a strong policy to create a structured workplace for gig economy workers.

Tejaswini Sugumaran, Abirami Vishwanathaan(2023):Given the variety of employer-employee relationships in India, the gig worker scenario is complicated and presents both opportunities and disadvantages. Even if gig labor is still one of the most flexible job arrangements, there are some serious drawbacks. It is crucial to establish a legal framework that ensures no one is left in danger while taking into consideration the financial standing of both gig workers and aggregators.

According to a study by Suresh Chand Aggarwal (2023): the future of employment will change as a result of the quick advancements in technology. "Gig" labor would be more in demand and used more frequently. There will inevitably be a discrepancy between the supply and demand of labor in such a situation. For this reason, appropriate education and future-oriented employment planning are required.

Prathima and Suraj (2022): have discovered that encouraging, the gig economy at the skilled and consulting levels could encourage workers to take up moonlighting, which is the practice of working for two or more employers at the same time. If the individual works for competing companies or competitors, this moonlighting of employment contracts could become harmful. The current working conditions are data-driven, and the gig economy's moonlighting activities may pose a data security risk when employees work for two competing companies, according to the authors' report.

Bobby Jacob Mohsin Shaikh(2021): According to a study on the growth and difficulties faced by gig workers in India, pay equity, timely salary payments, and overtime compensation

According to Rajvihar Sinha (2021):The gig economy's employment opportunities tend to draw job seekers in the twenty to thirty age range who are oblivious to long-term effects because their earning potential in gig conditions encourages them to set aside their other plans and stick with the gig economy's jobs. This circumstance could result in widespread unemployment in the long run.

According to Schor (2020), gig work lowers barriers to employment, which benefits underserved groups including women, immigrants, and people living in rural areas. Gig platforms, such as TaskRabbit and Upwork, allow workers to access international labor marketplaces

Roy and Shrivastava 2020:Prior research examined the difficulties faced by digital workers in Southeast Asia and Sub-Saharan Africa, focusing on topics like bargaining power, economic and security policies, and a dearth of opportunities to advance their skills so they can contribute more successfully to the global gig economy supply chain.

According to Woodcock and Graham (2020), payment mechanisms in the gig economy are opaque, and workers have little control over their work and earnings.

Jarrahi et al., 2020 : According to a study on gigs that polled women, they may generate money while maintaining a flexible home environment, which makes their jobs more comfortable. Individuals who have retired from their normal jobs are also using this opportunity to supplement their income. Gig work lends to versatile and autonomous work, as the gig employees set their own working time, packages/remunerations, job-roles as well as their own social groups, business associates depending upon their individual cultural and sociological background

Madhusudan Kanna 2020: creation of economic cycles, which are typical of capitalistic economies in which the labor market performs poorly in comparison to the capital and product markets. However, these cyclical patterns are undesirable in nations like India since the labor market contributes fairly to the economic process. In his article, he also emphasized that if the state is heavily dependent on the gig economy and experiences a cascade impact on other parameters like spending power, then the duration of each trend in cyclical swings should be brief.

Brustein (2019) Employees in the gig economy will range from traditional independent contractors to independent contractors and temporary employees of staffing firms that work elite hours during certain times of the week. Gigs are often found on sites like Uber, Swiggy, Zomato, Eat Sure, Qmin, and others.

A survey summary report by Bhattacharya S. (2019) was published in the Economic Times. On June 20th, 2018, TimesJobs conducted a survey to examine the gig economy's rise in India. The study, which examined the replies of 2100 HR professionals from several verticals, shows that corporate operations have changed. Cost-saving viewpoints and competitive advantages are two perks of the gig economy. The conventional permanent employment model is being disrupted by the growing reliance on a "fluid workforce" across all sizes of organizations. The respondents stated that the media and communications, events, and IT and tech sectors are the biggest employers of freelancers.

According to a different study by De Ruyter and Brown (2019), there are little barriers to entry for the kinds of occupations that are available in this economy. The problems and difficulties related to "traditional labor markets" are discussed by the writers. The majority of gig workers seem to be young individuals who are either enrolled in school or actively looking for job. Therefore, until individuals have access to more standardized employment documents, gig work is more of a "temporary process."

India is the second-largest market for freelancers, according to a 2019 research by the Digital Future Society, and this app-based solution eliminates the middlemen. Allowing gig employment is also cost-effective from the recruiters' perspective. Gig workers typically do not receive the same benefits as full-time employees, such as paid time off and health insurance.

According to a different analysis by Salman and Varsha (2019) that was published in LiveMint, Delhi has surpassed Bangalore as the top destination for migrant workers joining the nation's tech-enabled gig economy. Together, the two app-based taxi services have hired about 1.3 million drivers in the past eight years.

According to Wood et al. (2019), platform-based "rating systems" are one of the characteristics that set gig labor apart. In contrast to the conventional Taylorist method, this management style can be viewed as a customer-based management technique. Relative freedom to do as they pleased was granted to the workers, and "control" would be established after the work was finished rather than while it was being done.

5. RESEARCH GAP

After reviewing it is observed that there is limited understanding of the policies introduced under India's *Code on Social Security, 2020* for gig workers. Insufficient exploration of government and platform-led skill development programs for gig workers in India.

6. OBJECTIVES OF THE STUDY

- To Identify factors driving the rise of gig employment

- To Identify opportunities and challenges Faced by Gig Workers

- To identify the government initiatives to support Gig workers

Hypothesis

H_0 :There is no significant relationship between driving factors and Gig workers satisfaction

H_0:There is no significant relationship between opportunities and Gig workers satisfaction

Methodology

The study is based on both primary and secondary data. Primary data is collected by survey and interviewing the workers and secondary data is collected by referring government reports, industry reports,think tanks, journals,books and articles.

A sample of 30 workers of each platforms Ola,Uber, Zomato,Swiggy were surveyed and interviewed and collected the data.

7. FINDINGS

Satisfaction Level of Gig workers

Satisfaction level	No of respondents	Percentage of respondents
Satisfied	55	58.33
Neutral	10	8.33
Not satisfied	50	33.33

Source:Primary data

From the above analysis it is observed that 58.33 respondents are satisfied as a gig worker,8.33% are neutral and 33.33 are not satisfied as a gig worker

Factors driving the rise of Gig employment

From the study it is observed that the following factors are driving the rise of Gig employment

TABLE1: Factors driving Gig workers

Factors	Agree	Neutral	Disagree
Technological	69	11	20
Economic factors	82	6	12
Policy and Regulatory	62	14	24

Source:primary data
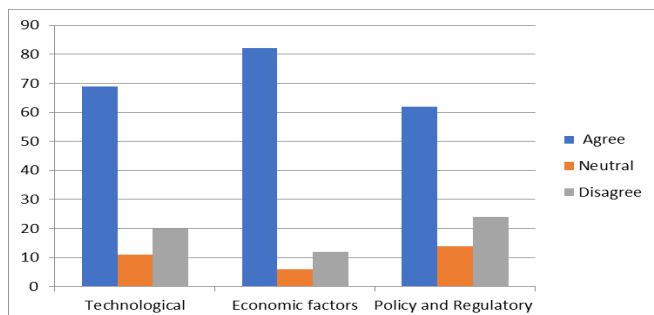
From the above analysis it is observed that Technological factors and Economic factors drive rise in Gig employment.From the interviews the following factors are identified.

Technological factors:

Digital platforms: Platforms like Uber and Swiggy have made it easier for workers and employers to connect. Widespread access to smartphones and affordable internet (e.g., Jio in India) enables gig workers to access platforms. Real-time tracking and route optimization powered by GPS and AI ensure faster deliveries.

Changing Work Preferences: Many workers prefer the autonomy of choosing when, where, and how much to work.

Economic Factors

Flexible gig roles in delivery services provide opportunities for low-skilled workers, often with minimal entry barriers.

Surge pricing during peak hours or festivals offers higher earning potential.

Growing cities have increased demand for services like ride-hailing, food delivery, and home services. Companies benefit from hiring gig workers to reduce overhead costs like salaries, benefits, and office spaces.

On-demand services like 10-minute grocery deliveries (Zepto) are driven by consumer impatience and convenience.

Policy and Regulatory Developments

Policies aimed at fostering startups and digital businesses indirectly boost gig platforms.

Initiatives like India's **Code on Social Security, 2020**, aim to formalize gig work and provide benefits.

Opportunities for Gig workers

Opportunities	Agree	Neutral	Disagree
Flexibility and Autonomy	52	31	37
Skill Development	34	30	56
Diverse Income	49	41	30

From the above analysis it is observed that most of the Gig workers opined that they have opportunities like flexibility,i.e workers can often choose when, where, and how much they work,Skill development opportunities and have diverse income streams.

By interviewing the workers it is also clear that Gig work provides opportunities for those struggling to find traditional full-time jobs. Rise of nuclear families and dual-income households increases reliance on grocery and food delivery platforms.

Platforms like Swiggy and Zomato provide accidental insurance and health benefits for delivery partners, aligning with the **Code on Social Security, 2020**.

Platforms like Ola, Uber, Swiggy, and Zomato allow workers to choose their working hours and locations, enabling them to align work with personal responsibilities.

Workers (e.g., private drivers, hotel staff) can use their existing skills to earn without needing significant reskilling.

Urban Company's group health insurance covers all active partners.

Urban Company's partnership with NSDC for upskilling carpenters and plumbers.

Companies partner with fintech startups to enable gig workers to save small amounts for emergencies or retirement.Example: Swiggy's tie-up with ICICI for flexible savings accounts.

Companies offer driving skill training and safety workshops in collaboration with **Skill India Mission.** Example: Amazon Flex trains delivery partners in customer engagement and traffic safety.

Gamification models encourage higher earnings during peak hours, ensuring stable income.

Challenges faced by gig workers

Challenges	Agree	Neutral	Disagree
Irregular income	70	30	20
Lack of benefits	80	12	8
Long working hours	76	8	16
Lack of job security	92	3	5
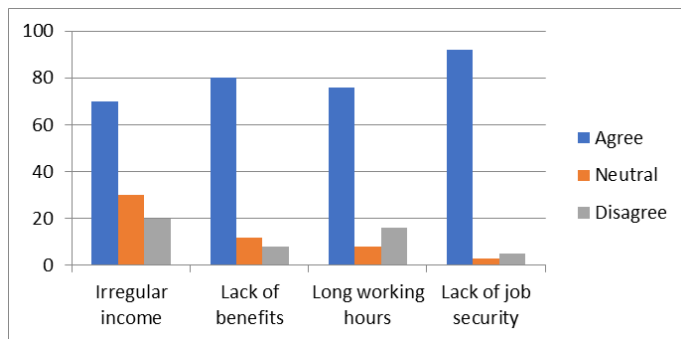
Source:primary data

From the analysis it is observed that irregular income,Lack of Benefits,long working hours lack of Job security are the challenges faced by Gig worker.Apart from these by interviewing the Gig workers it clear that gig workers have no proper grievance redress system. Sweltering heat or pouring rain, people need to rush off and complete as many deliveries as possible in a day. There are thousands who have no option but to work outdoors to feed their families.

Moreover, workers have to adapt to the schedules of customers based in:cities, which can lead to unsocial hours that negatively impact their pursuit of work-life balance.

While platform jobs offer income opportunities, earnings are often inconsistent and influenced by demand fluctuations (e.g., low ride requests during off-peak hours or competition among delivery partners).Gig workers for Ola, Uber, Swiggy, and Zomato lack formal employment benefits such as health insurance, paid leave, or retirement funds. This is particularly challenging for those relying solely on gig work as their primary income source

The physically demanding nature of gig work (e.g., long driving or delivery hours) leads to health risks.

According to Niti Ayog Report the following challenges are faced by the Gig workers

i.   The availability of digital technologies and internet connections may be a barrier to employment in the gig and platform economy.

ii.   Studies in the gig and platform business have identified a number of important issues, including irregular earnings, a lack of job security, and workers' ambiguous employment status. Employee stress and strain may rise as a result of the unpredictability of available employment and income.

iii.   The contractual arrangement between the platform owner and the employee is classified as non-employment. The word "independent contractors" refers to platform laborers. Platform employees are therefore unable to take advantage of many employment rights and safeguards.

Government initiatives to support Gig workers

Social Security Code, 2020: Mandatory contributions by aggregators (e.g., Swiggy, Uber) towards social security funds for gig workers. And Access to benefits like health insurance, maternity leave, and old-age protection.

e-Shram Portal: Registration provides workers with a unique ID and access to welfare schemes.

Insurance coverage under the Pradhan Mantri Suraksha Bima Yojana for accidental death and disability.

Startup India Initiative: Promotes entrepreneurship and startups, which often provide gig work opportunities.

Skill India Mission: Enhance employability of gig workers through skill training.

Partnerships with platforms like Urban Company to train gig workers in customer service, technical skills, and entrepreneurship.

Challenges in Implementation

Difficulty in identifying and registering gig workers.

Resistance from platforms regarding contributions to worker benefits.

Need for awareness among workers about government schemes.

Hypothesis 1

H$_o$:There is no significant relationship between driving factors and Gig workers satisfaction

Correlation analysis is used to test the hypothesis

	Technological	Economic	Policy &Regulatory	Saisfaction
Technological	1.000	0.997	0.999	0.696
Economic	0.997	1.000	0.992	0.641
Policy&Regulatory	0.999	0.992	1.000	0.734
Saisfaction	0.696	0.641	0.734	1.000

From the above analysis it is observed that

Policy and regulatory factors have has the **strongest correlation** with satisfaction levels (0.734). It suggests that satisfaction is more influenced by perceptions of policies and regulations.

A moderate positive correlation (0.696) with satisfaction, showing technological factors also influences satisfaction but less than policy factors.

The weakest correlation (0.641), though still positive, indicating a smaller impact on satisfaction.

Hypothesis 2

H$_o$:**There is no significant relationship between opportunities and Gig workers satisfaction**

opportunities	Satisfaction level coefficient
Flexibility and Autonomy	0.552
Skill Development	0.447
Diverse Income	0.515

From the above analysis it is observed that

Flexibility has the highest positive correlation with satisfaction levels, indicating that increasing flexibility and autonomy could most strongly enhance satisfaction.

Diverse income opportunities are moderately correlated with satisfaction, suggesting that financial variety also plays a role in influencing satisfaction.

While positively correlated, it has the weakest relationship among the three factors. However, improving skill development opportunities can still contribute to increased satisfaction.

Implications

Policy Development:

Research findings can guide governments and policymakers to create regulations or social security schemes that address gig workers' needs, such as fair wages, healthcare, or pensions.

Business Practices:

Platforms can use the insights to adjust their models, improve worker satisfaction, and ensure sustainability by addressing key challenges like income stability, safety, and workload demands.

Socioeconomic Impact:

The findings highlight the gig economy's role in providing employment, especially for those affected by layoffs or economic disruptions like COVID-19. This affects labor markets, family structures, and overall economic stability.

Worker Advocacy and Empowerment:

Research draws attention to gig workers' struggles, empowering them to negotiate better working conditions, wages, and benefits through collective action or policy intervention.

8. LIMITATIONS

- Limited Sample Size

- Confined to platforms like OLA, Uber, Swiggy and Zomato

- Respondents' answers might be influenced by personal biases, emotions, or misunderstandings of the survey questions.

9. FUTURE RESEARCH:

Expanding the sample size and including workers from diverse backgrounds and regions.The study can prompt further exploration into areas like algorithmic transparency, long-term impacts of gig work on workers' health and finances, or strategies to make gig work sustainable.

REFERENCES

[1.] Aditi Madan, Arjun Dubey (2024), "Heatwave vulnerability: The plight of gig workers in India"*observer research foundation*

[2.] Aggarwal, Suresh. (2023). "Gig workers in India: An Overview. 10.13140/RG.2.2.29650.32964.

[3.] Bhattacharya, S. (2019, August 13), How Gig Economy is Becoming a Key Part of India Inc's Strategy, Retrieved from

https://economictimes.indiatimes.com/news/company/corporate- trends/gig-projects-taking-over-corporates-and-professional-services-firms/articleshow

[4.] /70651920.cms

[5.] Bobby Jacob, Mohsin Shaikh(2021), Growth And Challenges Of Gig Employees In India, *Parikalpana KIIT Journal of Management* - Vol. 17(I)

[6.] De Ruyter, A., M. Brown and J. Burgess (2018), Gig Work and the Fourth Industrial Revolution: Conceptual and Regulatory Challenges, *Journal of International Affairs,* 72(1): 37-50, doi:10.2307/26588341

[7.] Digital Future Society (2019), The Future of Work in the Digital Era: The Rise of Labour Platforms, file:///C:/Users/nsing/Downloads/The_future_of_work_in_the_ digital_era.pdf

[8.] Dr. Rupa Biswas,Ms. Debdutta Dey(2023): The Plight of Gig Workers: A Study from Select Districts of West Bengal, *IJARIIE*, Vol-9 Issue-4

[9.] International Labour Organization (2018), "*Digital labour platforms and the future of work: Towards decent work in the online work*,"

[10.] International Labour Organization ((2021), "*World Employment and Social Outlook: The role of digital labour platforms in transforming the world of work*,"

[11.] Madhusudan Kanna(2020), Prospects of Freelancing Jobs in India, Astudy on Semi Skilled Workers in Hyderabad, Journal of Political Economy, Vol 1, issue 1 p121-125

[12.] Niels Beerepoot, Bart Lambregts (2014), "Competition in online job marketplaces: Towards a global labour market for outsourcing services?" *Global Networks*, 15(2), p. 236-255.

[13.] Niti Ayog Report(2022),India's Booming Gig and Platform Economy: Perspectives and Recommendations on the Future of Work

[14.] Prathima & Suraj (2022), Odds of Freelancing Jobs, the Thinker, vol11, issue 2, p 21-25

[15.] Rajvihar Sinha (2021) Factors Influencing the Growth of Gig Economy*, International Journal of Multi Desciplinary Journal of Social Sciences,* Vol 3, issue 1 p 50-56.

[16.] Sabrina Korreck (2021), Changing Geographies of Work: India's Online Gig Workers in a Digitalised Labour Market, *observer research foundation*

[17.] Salman, S.H. and B. Varsha (2019), *Delhi, and Not Bengaluru, is the Place to be for Gig Economy Workers*, https://www.livemint.com/companies/start-ups/delhi-and-not-bengaluru-is-the-place-to-be-for-gig-economy-workers-1555013405684.html

[18.] Saraswathi C (2023), "The Role And Challenges Of Gig Work Platforms In Indian Economic Development", *International journal of Research and analytical reviews*,vol(10),Issue-2

[19.] Suresh Nakka and Vani Chintha (2023) Role of Gig Economy in Generating Urban Employment- A Study on the City of Hyderabad. *KMICS Journal of Commerce and Management,* 1(1): 1-8. DOI: https://doi.org/10.62011/kmicsjcm.2023.1.1.1

[20.] Tejaswini Sugumaran, Abirami Vishwanathaan(2023), An Analysis of Gig Workers and the Challenges Surrounding Their Employment, *International Journal for Multidisciplinary Research (IJFMR),*Volume 5, Issue 6.

[21.] Wood, A.J., M. Graham, V. Lehdonvirta (2019), Good Gig, Bad Gig: Autonomy and Algorithmic Control in the Global Gig Economy, *Work, Employment and Society*, 33(1): 56-75.

[22.] https://www.orfonline.org/research/changing-geographies-of-work

[23.] https://community.nasscom.in/communities/talent/future-of-jobs/gig-economy-a-new-trend-in-employment.html

[24.] http://hdl.handle.net/10603/594931

[25.] https://www.thehindu.com/sci-tech/health/no-place-for-gig-workers-in-heat-action-plans/article68117675.ece

Empowering Employees through Green HRM: The Role of Organizational Support and Ownership in Fostering Engagement

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ABSTRACT

Purpose: This study examines how Green HRM affects Work Engagement (WE), focusing on the mediators Psychological Ownership (PO) and Perceived Green Organizational Support (PGOS). This increases understanding about the effect that sustainable HR practices have on employee engagement and the wellbeing of employees.

Methodology: A cross-sectional survey was used to collect data from 254 participants across industries. To analyze these relationships, direct, indirect and moderated effects were tested using Structural Equation Modeling (SEM). The study used the Job Demands-Resources (JD-R) model to develop a basis for the impact of GHRM practices on employee engagement and meaningful work.

Key Findings: The results indicate that GHRM uplifts WE through PGOS and PO, with no statistical influence on the former. Important mediators, PGOS and PO, imply that engagement and meaningful work are fostered by supportive environments and empowered people.

Originality: In this research, the JD-R model is extended into psychological and ecological dimensions, in which PO and PGOS play a mediating role in the GHRM–WE relationship. The research is unique in its treatment of the 'human side' of GHRM, on how sustainable practices may impact on deeper psychological outcomes.

Research Limitations/Implications: The cross-sectional design prevents causality with the sample predominantly from North America and Europe. Future research should include the use of longitudinal methods to test the entire model and to explore cultural differences as well as other psychological mechanisms (i.e., green identity) to enhance our current knowledge.

Practical Implications: Organizations need to enhance the psychosomatic perception of green support and enhance sense of ownership of environmental projects. The case for participative decision-making and green rewards suggests that motivation and sustainability objectives can be achieved.

Social Implications: When employee wellbeing and environmental sustainability are promoted within organizations through GHRM practices, the organization's growths and wellbeing of the natural environment become efficient.

Keywords: Green HRM, Work Engagement, Psychological Ownership, Perceived Green Organizational Support, Sustainable HR Practices.

1. INTRODUCTION

Green Human Resource Management (GHRM) has become an essential part in efforts for the organizational sustainability, with its scope beyond those of traditional Human Resource functions, to push for environmentally aware employee behaviour (Renwick et al., 2013). Today in the business world, organizations that adopt GHRM do not only go green, but also bring a good name to the company and give it competitive edge (Gyensare et al., 2024 ; AlKetbi & Rice, 2024). Integration of green approach service in HR systems popularizes the culture of environmental responsibility by facilitating the behaviour of employees in accordance with sustainability goals and promoting a healthy environment of work (Gupta & Jangra, 2024; Maheshwari et al., 2024). Though GHRM is gaining increasing attention, what these practices do to influence employee behaviors, perceptions, and engagement is not well understood by researchers or practitioners, and represents a challenge for both.

One of the focuses of current research shows how GHRM have a positive effect on employee performance, environmental behavior, and organizational outcomes (Jabbour & Santos, 2008; Longoni et al., 2018). Pham et al. (2019) have looked at the relationship between GHRM and outcomes – for example employee pro-environmental behaviour, satisfaction, and commitment. Nevertheless, there is still a lack of knowledge about how GHRM affects the deeper psychological factors, such as Work Meaningfulness (WM) and Work Engagement (WE), and how the latter is affected by other factors like Perceived Green Organizational Support (PGOS) and Psychological Ownership (PO) (Paille et al 2014, May et al 2004). Although there is empirical research on GHRM effects on organizational outcomes no study has explored the 'human side' of GHRM—meaning in work and emotional engagement in work roles. This gap has to be addressed before we develop effective HR strategies to promote both individual and organizational well-being.

This study attempts to fill this gap by investigating the impact of GHRM practices on Work Meaningfulness and Work Engagement, as mediated by PGOS and PO, being key moderating variables. In particular, the article extends the Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007) by specifically examining GHRM as a critical job resource capable of ensuing a positive psychological outcome in employees. This study analyzes the direct, indirect and reciprocal relationships between the constructs using the Structural Equation Modeling (SEM) on a sample of 254 participants from different industries where a cross sectional survey design is employed. By introducing PGOS and PO as moderators, however, our analyses show new ways in which organizational support and ownership influence employees' engagement in sustainability goals. This research also offers a sound and complete framework for examining the underlying psychological pathways through which GHRM practices shape employee experiences.

This research establishes that GHRM practices increase Work Engagement as mediated by Psychological Ownership and perceived green Organizational Support. Although Work Engagement which is closer to GHRM does not show a significant result, the mediating variables, namely, PGOS and PO bring out more details about how perceptions and ownership of the employees contribute to engagement. Thus, this study complements existing knowledge by incorporating WM, WE and GHRM within the JD-R framework and provides recommendations for organisations that aims at building sustainable HR practices. Moreover, there is a focus made on the bi-fold effect of GHRM in terms of organizational people and natural environment: environmentally correct practices improve individual and ecological well-being, as was demonstrated by Pierce et al., 2001, Eisenberger et al., 1986.

This paper carries out an initial theoretical review on GHRM with a view to appreciating how the concept can help advance sustainable organisational practices. It then provides the hypothesis and conceptual framework which are supported by theories reviewed in the literature. The method section outlines the cross-sectional survey approach that was used, the characteristics of the sample and the data analysis procedures. The results are provided in the results section, and the next section 'Discussion' relates these results to extant literature and theoretical contributions. Last, in the conclusion, the paper is summed up by introducing the application of the study, limitations and suggestions for future research.

2. HYPOTHESIS DEVELOPMENT

Green HRM Practices (GHRM) influence Perceived Green Organizational Support (PGOS)

According to the Social Exchange Theory (SET), employees are expected to respond with favourably with supporting their organisations in similar ways when the organisations have invested in them through organisation support provision (Blau, 1964). In the context of Green HRM (GHRM), it can be mentioned that organizations try to support sustainable principles through the policies of environmentally responsible action, and in turn, this increases the perception of support among employees (Eisenberger et al., 1986). PGOS is the perceptions that employees have about their organization recognizing and supporting their efforts towards going green (Dai et al., 2021).

Research evidence shows that GHRM processes like environmental training and green performance management create the belief that an organisation is doing its bit for sustainability (Renwick et al., 2013; Leidner et al., 2019). This perception that employees' values are in harmony with organizational behavior increases PGOS. GHRM culture supports green behavior by reminding the employees and making them understand that the organization is serious with green behavior (Jabbour & Santos, 2008; Ahmad & Sung, 2021a).

H1: Green HRM practices (GHRM) will positively influence Perceived Green Organizational Support (PGOS).

Green HRM Practices (GHRM) Influence Psychological Ownership (PO)

Psychological ownership (PO) is based on the premise that employees feel that they own what they do, and have a personal stake in it, when they are empowered and responsible (Pierce et al., 2001; Avey et al., 2009). To this end, GHRM promotes such ownership by involving employees in green practices, getting them to participate in environmental initiatives, and incorporating green concepts into their performance appraisal. With such practices in place, employees get to embrace their tasks and gained ownership of the activities in the organization.

Research has indicated that practices that are considered environmentally friendly, for example, participative decision making, help employees to feel as if they own the organization (Pierce et al., 2001; Masri & Jaaron, 2017). This is in support of SET, because employees have a favorable perception of companies that enable them to have meaningful participation. The sustainability culture within GHRM empowers employees to own and drive environmental objectives hence improving their PO (Paille et al., 2014; Marini et al., 2023).

H2: Green HRM practices (GHRM) will positively influence Psychological Ownership (PO).

Perceived Green Organizational Support (PGOS) will impact the relationship between GHRM and Work Engagement (WE)

According to the Job Demands-Resources (JD-R) model, PGOS can be motivational facilitating resources that affect

employee engagement (Bakker & Demerouti, 2007). It means PGOS generates work engagement by aligning employees' values to those of the organization (Rhoades & Eisenberger, 2002). Those employees who believe that they receive strong support from their organization are, as a result, more likely to reciprocate with higher levels of engagement.

As we've seen in our research, organizations with effective environmental support systems are able to create greater employee motivation and commitment to green practice (Pham et al., 2019). But if employees are supported in their environmental efforts, deeper connections to their work lead to greater engagement (Jackson et al. 2011). Trust in WE is created and emotional investment is encouraged through PGOS, which acts as a critical driver of WE (Saks, 2006).

That is, as Blau (1964) suggests, SET prescribes employees respond to perceived organizational investments with positive behaviors, such as engagement. The motivation comes from the GHRM in the sense that it helps employees begin to perceive green support, which will in turn inspire them to focus on their work. As employees encounter PGOS, a mediation mechanism takes place, whereby they feel encouraged to internalize environmental values of the organization's, raising their WE (Eisenberger et al., 1986).

According to empirical evidence, PGOS magnifies the WE impact of GHRM by inducing employees to reciprocate organizational support with higher engagement (Rhoades & Eisenberger, 2002). The mediation of the practice–perceptions–participation–engagement pathway in these analyses echoes other research that theorized that the influence of HR practices on engagement is exacerbated by employees' perceptions of organizational support (Marini et al., 2023).

H3: Perceived Green Organizational Support (PGOS) will mediate the relationship between Green HRM practices (GHRM) and Work Engagement (WE).

Psychological Ownership (PO) will impact the relationship Between GHRM and Work Engagement (WE)

Psychological ownership creates a feeling of responsible and sorbet affinity with the organization, hence, which results in strengthening of employee's engagement (Pierce et al., 2001). JD-R model shows that personal resources like PO serve as motivators to employees for active involvement in work (Bakker & Demerouti, 2007). The po impact makes employees become more involved with organizational goals, thus giving rise to higher work engagement (Van Dyne & Pierce, 2004).

Consequently, empirical studies proclaim that employees who are psychologically owned are more committed, productive, and enthusiastic at their workplace (Avey et al.,

2009). Modality power (PO) is an intrinsic motivator that promotes deeper engagement in and a commitment to the task (Mayhew et al., 2007). When this happens, employees feel as if they have some control and responsibility towards their work, thus resulting in them being more fully immersed in their job, and thereby becoming more engaged (Schaufeli et al., 2006).

Psychological ownership is an important psychological mechanism which links organizational practices to employee engagement (Pierce et al., 2001). According to Bakker and Demerouti (2007), the JD-R model can explain that personal resources like PO can simply strengthen the positive effects of job resources on engagement. The GHRM practices promote ownership by engaging employees in the sustainable programs and thus increase their intrinsic motivation and work involvement.

According to studies, employees who are witnessing psychological ownership would be more response to HR practices, so their engagement will be higher (Avey et al., 2009). PO utility is as mediation, transmitting the effect of GHRM practices to work engagement because it strengthens employees' emotional and cognitive involvement with their work roles (Van Dyne & Pierce, 2004).

H4: Psychological Ownership (PO) will mediate the relationship between Green HRM practices (GHRM) and Work Engagement (WE).

Green HRM Practices (GHRM) Will Have a Positive Indirect Effect on Work Engagement (WE) Through Both PGOS and PO

The purpose of this study is to propose a parallel mediation model whereby PGOS and PO independently mediate the relationship between GHRM and WE. Dual pathways build on SET and the JD-R model to capture how support and ownership can play complementary roles in promoting engagement. PGOS and PO that are developed via GHRM practices also contribute to work engagement.

Prior research shows that in working domain multiple psychological processes can influence latent and developed employee outcomes (Christian et al., 2011), and these trends align with the parallel mediation framework. The complementarity of the PGOS and PO in translating GHRM practices to engagement shows both the nuances by which employees respond to sustainable HRM practices (Bakker & Demerouti, 2007) and the difficulties inherent in translating such practices into a single quantifiable metric.

H7: Green HRM practices (GHRM) will have a positive indirect effect on Work Engagement (WE) through both

Perceived Green Organizational Support (PGOS) and Psychological Ownership (PO).

Figure II: Conceptual Model
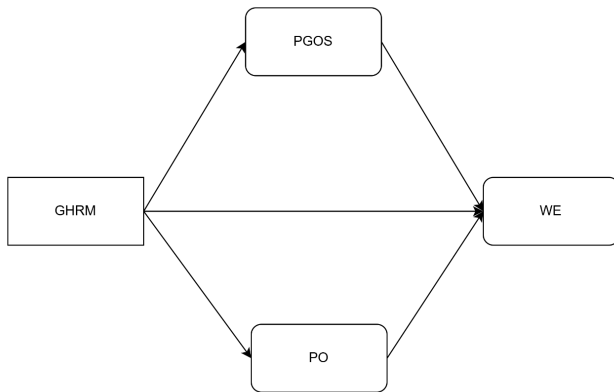
(Source: Author's own work)

3. METHOD

Study Design

The purpose of this study is to examine the role of Green Human Resource Management (GHRM) practices on Work Engagement (WE) through the role of parallel mediators of Perceived Green Organizational Support (PGOS) and Psychological Ownership (PO). These relationships and direct, indirect, and moderated effects were explored using a cross-sectional survey design. The theoretical framework for understanding how GHRM acts as a job resource that supports employees' psychological engagement and ownership was provided by the Social Exchange Theory & Job Demands-Resources (JD-R) model.

Participants and Sampling

A total of 254 people from different industries and regions were surveyed. Random and purposive snowball sampling was used to augment the number of responses in line with study objectives. Professional networks were used to invite initial participants with further respondents recruited through referrals. Additionally, breadth was achieved through this strategy of adding various participants, across different industries and organizational roles, to the dataset.

Sample Demographics

Gender: 181 males, 122 females, and 1 non-binary participant.

Age Distribution: 2% were aged 18–24, 28% were aged 25–34, 26% were aged 35–44, 28% were 45–54 years old, and 2% were 65+.

Job Tenure: 24 participants had less than one year of tenure, while 46 had more than 17 years of tenure in their current roles.

Total Work Experience: 34% reported 26+ years of experience, while 17% had between 21–25 years.

Education Levels: 47% held a bachelor's degree, 31% had a high school diploma, and 13% held a master's degree.

Employment Sector: 224 participants worked in the private sector, 59 in government, and 21 in other sectors.

Organizational Size: Participants worked in organizations ranging from fewer than 10 employees to over 500,000, with 77 participants employed in companies with 501–5,000 employees.

Geographical Distribution: 202 participants were based in Europe and 101 in North America, with the remaining participants from other regions.

4. DATA COLLECTION PROCEDURE

An online survey administered through Qualtrics was used in data collection between late January 2024 through mid-March 2024. Subjects were informed that their responses would remain anonymous and confidential, and they were guaranteed assured voluntary informed consent from all respondents. GHRM, WE, PGOS and PO were considered as the constructs of the survey and control variables such as gender, age, tenure and work experience.

Measures

Green HRM Practices (GHRM): Measured using a five-point Likert scale adapted from Dumont et al. (2017), with items such as "My company provides employees with green training to promote environmental values."

Work Engagement (WE): Measured using the Utrecht Work Engagement Scale (UWES-3), scored on a seven-point Likert scale ranging from 0 ("Never") to 6 ("Always"). Sample items included: "At my work, I feel bursting with energy."

Perceived Green Organizational Support (PGOS): Measured using a seven-point Likert scale adapted from Eisenberger et al. (1986), with items like "Our organization supports environmental initiatives."

Psychological Ownership (PO): Measured using the seven-item scale from Van Dyne and Pierce (2004), on a five-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). An example item is: "I feel a high degree of personal ownership for this organization."

Control Variables: Age, gender, tenure, total work experience, organizational size, and sector were controlled for to ensure robust analysis.

Data Analysis

Data were analyzed using Structural Equation Modeling (SEM) with Model 4 of Andrew Hayes' PROCESS macro in SPSS by which the direct and indirect effects through

parallel mediation could be estimated. Descriptive statistics and correlations were calculated in order to establish basic patterns of the interrelations between the variables. A bootstrapped mediation analysis with 5,000 resamples was employed to estimate confidence intervals for the indirect effects.

Descriptive Statistics: We have also reported mean, standard deviations, and correlation coefficients to establish the relationships between the constructs.

Mediation Analysis: Attempted to establish moderating effects of PGOS and PO on the relationship between GHRM and WE.

Multicollinearity Check: Variance Inflation Factor (VIF) values also established that there was no problem of multicollinearity among the variables.

Ethical Considerations

This research adhered to ethical principles in all the stages of the research. The subjects were told the nature of the study, that they could withdraw at any stage, and that their results would be kept anonymous. The study was approved by an institutional review board to conform to the principles of ethical practice.

5. RESULTS

Descriptive Statistics and Correlations

Table I presents the descriptive statistics and correlations between the study constructs. Green HRM (GHRM) was positively correlated with Psychological Ownership (PO) ($r = 0.509$, $p < 0.001$), Perceived Green Organizational Support (PGOS) ($r = 0.798$, $p < 0.001$), and Work Engagement (WE) ($r = 0.363$, $p < 0.001$). Similarly, both PO and PGOS were significantly correlated with WE, providing preliminary support for the hypothesized relationships.

TABLE I: Descriptive Statistics and Correlations

Variable	GHRM	PO	PGOS	WE
N	254	254	254	254
Mean	2.61	2.9	4.04	4.58
Median	2.5	2.86	4.07	4.67
Std. Dev.	1.09	1.09	1.56	1.22
Min	1	1	1	1
Max	5	5	7	7
GHRM	—	0.509***	0.798***	0.363***
PO	0.509***	—	0.638***	0.523***
PGOS	0.798***	0.638***	—	0.524***
WE	0.363***	0.523***	0.524***	—

Note: *p <.05, **p <.01, ***p <.001

(Source: Author's own work)

Reliability, Validity, and Discriminant Validity

Table II presents reliability and validity metrics. Cronbach's alpha values for all constructs exceeded 0.7, demonstrating good internal consistency. Composite reliability values were above 0.8, while the Average Variance Extracted (AVE) exceeded the threshold of 0.5 for all constructs, confirming convergent validity. Table III shows the Fornell-Larcker criterion results, where the square root of AVE for each construct was higher than its correlations with other constructs, establishing discriminant validity.

TABLE II: Reliability and Validity Metrics

Construct	Cronbach's Alpha	Composite Reliability (ρc)	AVE
GHRM	0.952	0.961	0.806
PGOS	0.949	0.962	0.792
PO	0.945	0.955	0.754
WE	0.895	0.935	0.827

(Source: Author's own work)

TABLE III: Fornell-Larcker Criterion

	GHRM	PGOS	PO	WE
GHRM	0.898			
PGOS	0.808	0.89		
PO	0.511	0.637	0.868	
WE	0.366	0.518	0.531	0.909

(Source: Author's own work)

Common Method Bias and Multicollinearity

To assess common method bias, Harman's single-factor test was conducted. The first factor explained 54.38% of the total variance, which is below the critical threshold of 50%, indicating no significant common method bias. The Variance Inflation Factor (VIF) values for all constructs were below 3.5, confirming the absence of multicollinearity issues (see Table IV).

TABLE IV: VIF Values

Path	VIF
GHRM $\rightarrow$ PGOS	1
GHRM $\rightarrow$ PO	1
GHRM $\rightarrow$ WE	2.881
PGOS $\rightarrow$ WE	3.3
PO $\rightarrow$ WE	1.682

(Source: Author's own work)

To ensure that common method bias (CMB) did not significantly influence the results, we implemented multiple procedural and statistical remedies, including the marker variable technique. Marker variables are theoretically unrelated to the key constructs under study and help identify if the observed relationships are artifacts of CMB (Lindell & Whitney, 2001). In our study, participants responded to three unrelated questions during data collection:

If you could travel to any of these places, where would you go? Which type of climate do you prefer? What is your preferred type of book to read for leisure?

These questions served as marker variables (MC1, MC2, and MC3) and were incorporated into the regression models to identify potential CMB effects. The correlation matrix (Table X) shows that the correlations between these marker variables and the primary constructs (GHRM, PO, PGOS, and WE) were low and mostly non-significant, except for a weak positive correlation between GHRM and MC3 ($r = 0.142$, $p < 0.05$). None of the other marker variables exhibited significant correlations with the main constructs, suggesting minimal overlap.

Regression analysis further confirmed the absence of significant bias. In the regression model predicting Work Engagement (WE), the marker variables were included as control variables along with GHRM, PGOS, and PO. As presented in the coefficients table, none of the marker variables (MC1, MC2, MC3) had significant effects on WE ($p > 0.05$), indicating that these unrelated variables did not distort the relationships among the primary variables.

The regression results ($F = 23.535$, $p < 0.001$) indicated that the model was statistically significant, but the inclusion of the marker variables did not alter the strength or significance of the relationships between the key constructs. Specifically, the direct effects of PO ($\beta = 0.315$, $p < 0.001$) and PGOS ($\beta = 0.442$, $p < 0.001$) on WE remained significant, while the effect of GHRM on WE ($\beta = -0.152$, $p = 0.078$) stayed consistent with prior results, underscoring the robustness of the findings.

The application of the marker variable technique, in combination with low inter-correlations among the constructs, supports the conclusion that common method bias does not significantly influence the results of this study. This comprehensive approach enhances the validity of our findings, ensuring that the observed relationships are not inflated by measurement artifacts.

Confirmatory Factor Analysis

The confirmatory factor analysis (CFA) results (Table IV) compare the fit indices for the one-factor, two-factor, three-factor, and four-factor models. The four-factor model, comprising GHRM, PO, PGOS, and WE, provided the best fit to the data ($\chi^2 = 579$, df = 224, CFI = 0.947, TLI = 0.940, RMSEA = 0.079, 90% CI [0.0711, 0.0870]). Factor loadings

were significant for all constructs ($p < 0.001$). GHRM indicators loaded between 0.860 and 1.135, PO indicators between 0.677 and 1.162, PGOS indicators between 0.617 and 1.755, and WE indicators between 1.038 and 1.307. These results confirm a strong measurement model for further hypothesis testing.

TABLE IV: Comparative Model Fit Indices

Model	df	χ^2 (p-value)	CFI	TLI	SRMR	RMSEA (90% CI)
One-Factor	230	2479***	0.662	0.629	0.196	0.189 (0.174-0.203)
Two-Factor	229	2124***	0.716	0.686	0.181	0.174 (0.157-0.188)
Three-Factor	227	1787***	0.766	0.739	0.164	0.157 (0.147-0.172)
Four-Factor	224	579***	0.947	0.94	0.079	0.079 (0.0711-0.0870)

(Source: Author's own work)

Structural Model and Hypothesis Testing

The structural model results (see Table V) provide insights into the hypothesized relationships. The direct effect of GHRM on WE was non-significant ($\beta = -0.1192$, $p = 0.2754$). However, GHRM had significant positive effects on PO ($\beta = 0.5039$, $p < 0.001$) and PGOS ($\beta = 1.1494$, $p < 0.001$). Both PO ($\beta = 0.3076$, $p = 0.0001$) and PGOS ($\beta = 0.3407$, $p < 0.001$) positively influenced WE, supporting Hypotheses 3 and 4.

TABLE V: Structural Model Results

Path	Coefficient (β)	SE	t-value	p-value
GHRM → PO	0.5039	0.0706	7.1403	< 0.001
GHRM → PGOS	1.1494	0.0736	15.6247	< 0.001
GHRM → WE	-0.1192	0.1091	-1.0932	0.2754
PO → WE	0.3076	0.0771	3.9898	0.0001
PGOS → WE	0.3407	0.074	4.6062	< 0.001

(Source: Author's own work)

Indirect Effects and Mediation Analysis

The indirect effects of GHRM on WE through both PO and PGOS were significant, confirming the parallel mediation model. The total indirect effect of GHRM on WE was significant (β = 0.5467, BootSE = 0.1002, 95% BootCI [0.3598, 0.7446]). Specifically, the indirect effect via PO was 0.1550 (95% BootCI [0.0624, 0.2625]), and the indirect effect via PGOS was 0.3916 (95% BootCI [0.2044, 0.5925]), supporting Hypotheses 5 and 6.

These findings confirm that GHRM significantly influences WE indirectly through PO and PGOS. However, the direct effect of GHRM on WE was non-significant, suggesting that the impact of GHRM practices on engagement occurs primarily through the mediating roles of PO and PGOS. The overall model highlights the importance of psychological ownership and green organizational support in fostering employee engagement through meaningful work.

Structural Model and Hypotheses Testing

The structural model was evaluated using SEM, and the results are presented in Table V. Figure II (below) outlines the path relationships among the constructs. The direct effect of GHRM on WE were found to be non-significant (β = -0.1192, p = 0.2754), suggesting that GHRM alone may not directly enhance work engagement, thereby rejecting Hypothesis 2. However, GHRM had a significant positive effect on both PO (β = 0.5039, p < 0.001) and PGOS (β = 1.1494, p < 0.001), supporting Hypotheses 1 and 3, respectively.

Both PO and PGOS were significant predictors of WE. Specifically, the effect of PO on WE were positive and significant (β = 0.3076, p < 0.001), supporting Hypothesis 4. Similarly, PGOS had a significant positive effect on WE (β = 0.3407, p < 0.001), providing support for Hypothesis 5.

TABLE V: Structural Model Results

Path	Coefficient (β)	SE	t-value	p-value	Hypothesis
GHRM → PO	0.5039	0.0706	7.1403	< 0.001	Supported
GHRM → PGOS	1.1494	0.0736	15.6247	< 0.001	Supported
GHRM → WE	-0.1192	0.1091	-1.0932	0.2754	Not Supported
PO → WE	0.3076	0.0771	3.9898	< 0.001	Supported
PGOS → WE	0.3407	0.074	4.6062	< 0.001	Supported

(Source: Author's own work)

Mediation and Indirect Effects Analysis

The indirect effects of GHRM on WE through both PO and PGOS were examined using bootstrapping with 5,000 resamples. The total indirect effect of GHRM on WE was significant (β = 0.5467, BootSE = 0.1002, 95% BootCI [0.3598, 0.7446]), confirming that the influence of GHRM on WE is fully mediated through these psychological pathways.

The specific indirect effect of GHRM on WE via PO was significant (β = 0.1550, BootSE = 0.0512, 95% BootCI [0.0624, 0.2625]), supporting Hypothesis 6. Similarly, the indirect effect via PGOS was also significant (β = 0.3916, BootSE = 0.0997, 95% BootCI [0.2044, 0.5925]), supporting Hypothesis 7.

Figure II: Structural Model
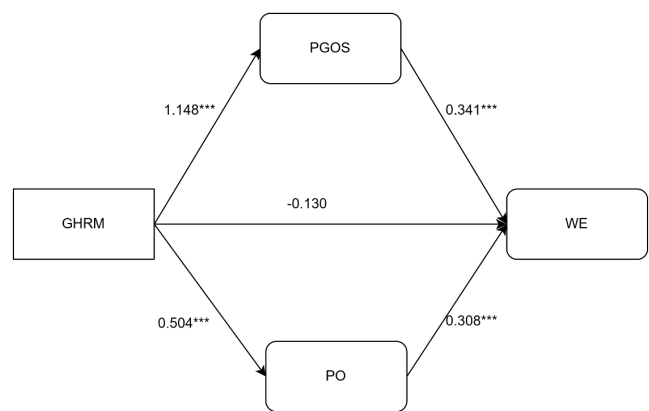
(Source: Author's own work)

These results suggest that while GHRM practices do not directly enhance engagement, they foster psychological ownership and green organizational support, which in turn drive engagement. The findings highlight the critical role of these mediators in translating GHRM efforts into meaningful employee outcomes.

Interpretation of Results

The findings underscore the role of two psychological constructs, PO, and PGOS, in the attainment of employee engagement. Although GHRM policies are not sufficient on their own to increase engagement they foster ownership and a perception of substantial organisational support which are vital for increased engagement.

The results of this study support the view that organisations which target sustainability in HRM have to work towards creating milieu that support the process as well as ensure that employees acquire ownership of the process. The non-significant direct effect of GHRM on WE indicates that, although such practices exhibit organizational sustainability,

these may not necessarily result in engagement without ownership and support.

This model gives a detailed perspective of how the enterprise practices influence employee perception of meaningful work and engagement. Also, it suggests that the organisations should manage for any possible conflict or stress arising from sustainability initiatives which may in some way harm the level of engagement, as indicated by the non-significant direct relationship between GHRM and WE.

6. DISCUSSION

Theoretical Implications

The contribution of this study to the literature is to extend Social Exchange Theory (SET) in the context of Green HRM (GHRM) practices to affect Work Engagement (WE), Perceived Green Organizational Support (PGOS), and Psychological Ownership (PO). The findings reinforce SET by verifying that GHRM practices are in fact organizational investments in employees, which in return elicit employees' reciprocal behaviors, including increased engagement and perceived support (Blau, 1964). H1: Positive effect of GHRM on PGOS (H1) suggests that GHRM represents the organization's sustainable engagement reflects perception of green support and emotional connections (Eisenberger et al., 1986).

H2 provides validation for Psychological Ownership to be a critical outcome of GHRM. Employees participation in green initiatives and perception of being a part of core contributors in organizational objectives builds personal investment and ownership (Pierce et al., 2001). This finding extends application of SET by showing how GHRM promotes personal attachment that then leads to enhanced employee engagement.

Additionally, the study supports the role of PGOS in stimulating employees to deepen their involvement with the work (H3) in light of the JD-R model emphasis on supportive resources (Bakker & Demerouti, 2007; Aboramadan et al., 2022). GHRMs enhance PGOS, further increasing the potential to empower employees with greater psychological engagement in responding to an unwritten GHRM script, elicited by PGOS and motivated sensors, which is aligned with and critical to the organizational value (Rhoades & Eisenberger, 2002). Just as the positive effect of PO on WE (H1) indicate that psychological resources contribute to the maintenance of employee motivation according to both the SET and the JD-R model.

Parallel mediation effects of PGOS and PO (H5 & H6) also show that support and ownership are complementary factors that underpin the GHRM engagement effect (Christian et al., 2011; Baykal & Bayraktar, 2022). This finding offers that employees respond favorable to both ownership opportunities and organizational support; each supports their

emotional and cognitive investment in work (Christian et al., 2011).

Practical Implications

The insights from this study offer important practical implications to organizations that are attempting to foster the use of GHRM practices to enhance the engagement of employees. In particular, the findings suggest that organizations should create strong green support perceptions by being clear about their credentials of environmental goals, and recognizing employees' contribution to sustainability initiatives. Feeling valued for your contributions more likely leads to increased engagement and commitment to environmental goals by your employees.

Also, organizations must launch the GHRM idea that will encourage employee ownership and participation. Meaningful opportunities to participate in decision making and sustainability initiatives really help employees to feel like the work they are doing belongs to them, and feeling ownership of the work contributes to employee engagement. The good news is that managers can increase this effect if they enable employees to take some responsibility for green projects and to speak their green goals from behind their personal values.

In addition, the study highlights the role of perceived organizational support (PGOS) as a moderator on the effects of GHRM on engagement. Organizations should aim to create an atmosphere that respects any extra work or efforts employees make to go green — not as an extra burden but as growing personally. Green training programs, environmental rewards, and participatory decision-making processes are one form of this support.

Limitations and Future Research

Nevertheless, this work has the following limitations. First, the study is cross-sectional in nature and therefore the authors cannot make causal conclusions. Subsequent research should use cross-sectional or longitudinal study design to establish the directionality of the relationships between GHRM, PO, PGOS, and WE. Second, the sample was mainly recruited from North America and Europe, and thus, the finding of the study may not be applicable to other cultures. Further studies should also look at the effects of culture on employees concerning the GHRM practices.

The last limitation pertains to the measurement of PGOS and PO in which some aspects of these constructs may not have been fully elicited in the context of environmental management. Further research could examine other psychological processes with the help of green identity or intrinsic motivation, to explain in detail how GHRM leads to engagement.

Finally, this research has concentrated on PGOS and PO as mediators, therefore the future research may examine how

the green transformational leadership influences the GHRM-WE relationship. The relationship between leadership and psychological processes can provide valuable information on how organisations can promote sustainable employee engagement.

7. CONCLUSION

As a result, this research establishes that GHRM practices positively affect employee engagement through the mediating variables of PGOS and PO. These findings advance the application of SET to the field of environmental management to explain how organizations can encourage mutualistic actions through positive and inclusive green activities (Ren et al., 2018; Vázquez-Brust et al., 2023). The study also finds that both PGOS and PO are important in promoting employee engagement in green initiatives, although PGOS and PO are not interchangeable and both support and ownership are necessary for maintaining motivation in green initiatives.

To this end, organisations interested in improving engagement through GHRM should pay attention to developing conducive cultures and encouraging employee ownership. These strategies can assist business to ensure that employees embrace sustainability values as the organization goals which in turn lead to high employee engagement and commitment. Future studies should build on the current work to identify other possible mediators and moderators of the GHRM practices effectiveness for the enhancement of sustainable HRM.

8. DECLARATION

I, Ujwal Shankar, hereby confirm that the manuscript titled " Empowering Employees through Green HRM: The Role of Organizational Support and Ownership in Fostering Engagement" authored by me, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspective Conference 2025 (IMPeC-25).

I declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Aboramadan, M., Kundi, Y. M., & Becker, A. (2022). Green human resource management in nonprofit organizations: Effects on employee green behavior and the role of perceived green organizational support. *Personnel Review, 51*(7), 1788–1806. https://doi.org/10.1108/PR-02-2021-0078

[2.] Ahmad, S. (2015). Green Human Resource Management: Policies and practices. *Cogent Business and Management, 2*(1). https://doi.org/10.1080/23311975.2015.1030817

[3.] Ahmad, S., Islam, T., Sadiq, M., & Kaleem, A. (2021). Promoting green behaviour through ethical leadership: A green human resource management model and environmental knowledge. *Leadership & Organization Development Journal, 42*(4), 531–547. https://doi.org/10.1108/lodj-01-2020-0024

[4.] AlKetbi, A., & Rice, J. (2024). The impact of green human resource management practices on employees, clients, and organizational performance: A literature review. *Administrative Sciences, 14*(4), Article 78. https://doi.org/10.3390/admsci14040078

[5.] Avey, J. B., Avolio, B. J., Crossley, C. D., & Luthans, F. (2009). Psychological ownership: Theoretical extensions, measurement, and relation to work outcomes. *Journal of Organizational Behavior, 30*(2), 173–191. https://doi.org/10.1002/job.583

[6.] Bakker, A. B., & Demerouti, E. (2007). The Job Demands-Resources model: State of the art. *Journal of Managerial Psychology, 22*(3), 309-328. https://doi.org/10.1108/02683940710733115

[7.] Baykal, E., & Bayraktar, O. (2022). Green human resources management: A novel tool to boost work engagement. *Frontiers in Psychology, 13*, Article 951963. https://doi.org/10.3389/fpsyg.2022.951963

[8.] Blau, P. (1964). *Exchange and power in social life.* John Wiley & Sons.

[9.] Christian, M. S., Garza, A. S., & Slaughter, J. E. (2011). Work engagement: A quantitative review and test of its relations with task and contextual performance. *Personnel Psychology, 64*(1), 89–136. https://doi.org/10.1111/j.1744-6570.2010.01203.x

[10.] Dai, Y. D., Zhuang, W. L., Lu, S. C., & Huan, T. C. (2021). Work engagement or job burnout? Psychological ownership amongst the employees of international tourist hotels. *Tourism Review, 76*(6), 1243–1259. https://doi.org/10.1108/TR-03-2020-0087

[11.] Eisenberger, R., Huntington, R., Hutchison, S., & Sowa, D. (1986). Perceived organizational support. *Journal of Applied Psychology, 71*(3), 500–507. https://doi.org/10.1037/0021-9010.71.3.500

[12.] Jabbour, C. J. C. & Santos, F. C. A. (2008). The central role of human resource management in the search for a sustainable organization. *The International Journal of Human Resource Management, 19*(12), 2133–2154. https://doi.org/10.1080/09585190802479389

[13.] Jackson, S. E., Renwick, D. W. S., Jabbour, C. J. C., & Muller-Camen, M. (2011). State-of-the-art and future directions for green human resource management. *German Journal of Human Resource Management, 25*(2), 99–116. https://doi.org/10.1177/239700221102500203

[14.] Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal, 33*(4), 692–724. https://doi.org/10.5465/256287

[15.] Leidner, S., Baden, D., & Ashleigh, M. J. (2019). Green (environmental) HRM: Aligning ideals with appropriate practices. *Personnel Review, 48*(5), 1169–1185. https://doi.org/10.1108/PR-12-2017-0382

[16.] Maheshwari, S., Kaur, A., & Renwick, D. W. S. (2024). Green human resource management and green culture: An integrative sustainable competing values framework and future research directions. *Organization & Environment.* https://doi.org/10.1177/10860266231217280

[17.] Marini, M., Handoyo, S., & Sukadiono, S. (2023). Green work

engagement: A literature review. *RSF Conference Series: Business, Management and Social Sciences, 3*(3), 179–185. https://doi.org/10.31098/bmss.v3i3.662

[18.]Mayhew, M. G., Ashkanasy, N. M., Bramble, T., & Gardner, J. (2007). A study of the antecedents and consequences of psychological ownership in organizational settings. *The Journal of Social Psychology, 147*(5), 477–500. https://doi.org/10.3200/SOCP.147.5.477-500

[19.]Paille, P., Boiral, O., & Chen, Y. (2013). Linking environmental management practices and organizational citizenship behaviour for the environment: A social exchange perspective. *International Journal of Human Resource Management, 24*(18), 3552-3575. https://doi.org/10.1080/09585192.2013.777934

[20.]Paille, P., Chen, Y., Boiral, O., & Jin, J. (2014). The impact of human resource management on environmental performance: An employee-level study. *Journal of Business Ethics, 121*(3), 451-466. https://doi.org/10.1007/s10551-013-1732-0

[21.]Pham, N. T., Tučková, Z., & Jabbour, C. J. C. (2019). Greening the hospitality industry: How do green human resource management practices influence organizational citizenship behavior in hotels? *Tourism Management, 72,* 386-399. https://doi.org/10.1016/j.tourman.2018.12.008

[22.]Pierce, J. L., Kostova, T., & Dirks, K. T. (2001). Toward a theory of psychological ownership in organizations. *Academy of Management Review, 26*(2), 298-310. https://doi.org/10.5465/amr.2001.4378028

[23.]Renwick, D. W. S., Redman, T., & Maguire, S. (2013). Green Human Resource Management: A review and research agenda. *International Journal of Management Reviews, 15*(1), 1–14. https://doi.org/10.1111/j.1468-2370.2011.00328.x

[24.]Rhoades, L., & Eisenberger, R. (2002). Perceived organization support: A review of the literature. *Journal of Applied Psychology, 87*(4), 698-714. https://doi.org/10.1037/0021-9010.87.4.698

[25.]Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. *Journal of Organizational Behavior, 25*(3), 293-315. https://doi.org/10.1002/job.248

[26.]Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement, 66*(4), 701-716. https://doi.org/10.1177/0013164405282471

[27.]Saks, A. M. (2006). Antecedents and consequences of employee engagement. *Journal of Managerial Psychology, 21*(7), 600–619. https://doi.org/10.1108/02683940610690169

[28.]Van Dyne, L., & Pierce, J. L. (2004). Psychological ownership and feelings of possession: Three field studies predicting employee attitudes and organizational citizenship behaviour. *Journal of Organizational Behavior, 25*(4), 439–459. https://doi.org/10.1002/job.249

[29.]Vázquez-Brust, D., Jabbour, C. J. C., Plaza-Úbeda, J. A., Perez-Valls, M., de Sousa Jabbour, A. B. L., & Renwick, D. W. S. (2023). The role of green human resource management in the translation of greening pressures into environmental protection practices. *Business Strategy and the Environment, 32*(6), 3628–3648. https://doi.org/10.1002/bse.3319

"Balancing Family, Career, and Stress: Analytics-Driven Work-Life Management for Sustainable Business Success"

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ABSTRACT

A rapid development in the technologies can be observed in the professional landscape. Work-life balance is essential in the professional field which helps in maintaining the satisfaction level. However, the inability of managing the stress level can cause burnout that decreases the effectiveness of the business. Work-life balance is an essential determinant that improves productivity along with the success rate of the business. This will help in managing the schedule according to their both personal as well as professional responsibilities. In the modern business landscape, stress is increasing in a rapid manner which affects the overall wellbeing as well as the productivity. The boundary theory helps in examining how people can negotiate and manage the level of boundaries between both professional as well as personal life. The methodology which is used in collecting data is a mixed method approach. In addition, a quantitative survey is also employed for understanding the current landscape. The mixed research combines both qualitative and quantitative data ensuring a comprehensive discussion.

Keywords: Work-life balance, employee well-being, career, stress, family.

1. INTRODUCTION

The professional landscape in the contemporary world is characterised by rapid technological development, heightened demands along with relentless pace of work pressure. In this case, maintaining a balance between career aspiration and family responsibility is a challenge for multiple individuals. As a result it increases the stress among people that profoundly cause a lot of consequences on professional productivity along with personal wellbeing. Determining the interrelationship between these dimensions requires a potential analytics driven work life management for the success of a business.

Work-life balance is not a personal goal but now it has become a strategic imperative for companies aiming to retain its position in the competitive market (Tahir, 2024). Workers who work achieve harmony between their personal and professional lives exhibit higher job satisfaction, engagement and creativity that results in developed organisational performance. On the other hand, the inability in managing stress as well as competing priorities can cause absenteeism and burnout that reduce the overall effectiveness of the business. As a result there is an importance to adopt innovative methods in order to handle these issues.

The analytics driven method offers a scope in work life balance. Through leveraging data in determining the patterns and predicting the outcomes, organisations can get the opportunity to create an environment which promotes the wellbeing of employees that enhance productivity. In this case, companies often track the workload distribution and work hours for assessing the level of stress and also gauging worker satisfaction (Dethier et al., 2024). The use of data analytics helps in making evidence based decisions which aligns the company goals with individual requirements.

The motive of this research is to identify the multifaceted relationship between stress, family and career through emphasising how analytics could serve as a catalyst in creating a sustainable work life management. Examining the industrial practices and theoretical frameworks provides the scope to highlight the actionable insights for individuals and businesses. Therefore, the article discusses the era of advocating the initiatives and constant changes which balances individual's needs along with organisational ambitions. Furthermore, accurate qualitative and quantitative data will be collected in discovering multiple factors that are impactful on the work life balance of individuals in modern days.

2. REVIEW OF LITERATURE

Effect of work life balance on employee productivity

Work life balance is a crucial determinant of worker productivity as well as organisational success. It represents an equilibrium between professional and personal life. According to the reviews of Verma et al., (2024) allocating energy and time effectively in personal and professional life of an individual helps to manage the activities. Employees need to achieve the balance for becoming motivated, engaged as well as focused. As a result the productivity of employees is expected to be increased by maintaining a work life balance appropriately.

A balanced work life dynamics minimises the stress as well as boredom that are the major barriers to productivity. Stress streaming from on resolved personal issues or work overload

can negatively affect cognitive functioning. The creativity and decision making ability of an individual is also influenced by the personal issues or overloading work pressure. Some researchers have found that employees who have flexible schedules and manageable workloads exhibit a higher efficiency as they are able to focus on the task without any kind of distraction due to personal challenges. On the other hand Brough et al., (2020) explained that poor work life balance can cause chronic stress as well as absenteeism. The job satisfaction level of employees is reduced due to the poor work life balance. Hence the employees who are experiencing burnout generally struggle with low energy levels that impacts the quality of their work. Companies that have a rigid working environment generally see high employee turnover rates as employees prioritise workplaces which support them.

Flexible working arrangements like compressed work weeks, better communication and flexible time helps in developing the work life balance. It allows the employees to manage their schedules accordingly to handle their personal and professional responsibilities in an accurate manner. The time management methods are followed effectively by them that helps in boosting their overall productivity (Waworuntu et al., 2022). Companies that are investing in work life balance initiatives have the ability to increase the retention rate of employees and also improve the job satisfaction level. Addressing all these diverse requirements of the word force is crucial for creating a healthy working environment and also achieving sustainable growth.

Technology for work life management

Technology plays a crucial role for work life management. It creates some boundaries between the personal and professional life of an individual. The advancement of modern technology in industry 4.0 provided the opportunity to connect the people from different regions of the world (Yang & Gu, 2021). It also helps all the organisations in making all the employees available beyond their working hours. Conversely the development of advanced technology provides a solution to companies to manage their workload and also streamline communication methods (Rožman et al., 2023). As a result a better work life integration method is being followed by a lot of organisations from different industries. The major challenge in technology for maintaining work life balance is the increased expectations to get timely responses from all the employees. Employees face issues to be "always on" that leads to stress and overwork in some companies.

The advancement of technology is providing the opportunity to organisations in determining the location of employees and expect work from them all the time. As a result the employees failed in completing dear personal works which is the stressful thing for them. In that case the job satisfaction level of individuals is reduced due to the overload of work pressure on them. Moreover technology is used as a powerful

tool for promoting the work life balance if used in a strategic way. Scheduling applications as well as project management methods are helpful for organising the tasks of individuals (Zasa et al., 2020). It helps in setting the priorities accurately and enhance collaboration between the team members. All these tools are essential for increasing the productivity of employees during the working hours and leave more time for them to complete their personal commitments. The advancement of technology also provides the opportunity to track the sleep patterns and physical activities records of individuals working in modern days (Park et al., 2023). As a result the employees get the opportunity to follow a healthy lifestyle that is crucial for their physical and mental health. The remote work technology in modern days is also used by a lot of companies and the video conferencing tools like Google Meet and Zoom allows the employees to communicate with their teammates whenever they want. Technology can be a powerful tool for achieving work life balance but if not used in an appropriate way it can be a major trouble for the workers. Hence it is crucial to use the technology in a suitable way for developing the interpersonal relationship between the employees and managers in an organisation.

Analytics driven strategies in reducing stress

In modern organisations stress is increasing rapidly that impacts the overall productivity and wellbeing of employees. Due to the increasing stress among the employees of an organisation their productivity is reducing rapidly. The analytics' driven strategies are adopted in determining monitoring as well as mitigating distress among the workers. Therefore actionable insights for companies to improve the working environment and creative foster culture of wellbeing is crucial. In the opinion of Pantović et al., (2024) the advanced analytics tools are able in processing a huge amount of data of employees that determines the stress triggers accurately. Some key metrics are important to be determined like the email response time, work hours, absenteeism patterns and the task completion rate. These are the crucial factors that are important to be revealed to identify the potential stressors. Moreover predictive analytics are essential for determining the reason for stress among the individual employees working in different organisations (Giermindl et al., 2022). The excessive overtime may indicate the workload related stress among individuals. Analytics are essential for developing a stressed reduction program through identifying the preferences and behaviour of individual employees working in an organisation.

Companies can effectively design wellness initiatives which resonate with the behaviour of employees. Collecting the data of employees is crucial for creating flexible working hours for them which is essential for managing the stress level (Canavesi & Minelli, 2022). Employee engagement surveys as well as real time feedback can be collected for getting qualitative data. Companies can track the walk place

wellbeing accurately by creating some dashboards that provide a clear picture of the stress level across multiple departments in an organisation. The technology driven stress management solutions are crucial for recommending some relaxation techniques to individuals and provide them motivational insights to handle their work accurately. While using the data driven strategies for managing the stress level of individual workers it is crucial to highlight the motivational insights and also maintain data privacy. The ethical considerations are crucial for transparent communication and building trust among all the employees in the organisation.

Theoretical foundation on work life balance

The boundary theory examined how people can negotiate and manage the boundaries between their personal and professional life. It provides an appropriate framework which is crucial for understanding the demands and expectations of individuals. This theory suggests that individuals can categorise what they are as well as personal lies like two distinct domains but experience multiple degrees of permeability between them (Adisa et al., 2022). Hence in this case there are two boundaries that are important to be considered by the individuals. Segmented and integrated boundaries are the two boundaries that are important to be carefully handled by individuals in managing the stress level and work life balance. While the personal and professional life of individuals are kept strictly separated then it can be called as the segmented boundary. On the other hand a fluid boundary between the personal and professional life is called the integrated one that allows for flexibility and overlap. However individuals with the segmented boundaries can create strict demarcations between the home and the work life. Hence in that case individuals need to avoid bringing work home or check the professional emails in their home.

This strategy reduces stress and chances of conflicts. On the other hand the integrators blend the personal and professional responsibilities (Tahir, 2024). They often do their office work in their home and also manage their family tasks in their office. However if flexibility is not provided to them then it can cause stress among them. Companies need to analyse the basic concept of the boundary theory for designing the policies according to the preferences of the employees. In this case providing a remote work option for all the integrators can help in motivating them to stay connected with work while managing their household activities. On the other hand, there should be fixed office hours for the "segmenters" in order to inspire them to work peacefully in their office hours and enjoy their personal life at their homes (Khateeb, 2021). This theory is a vital foundation to determine the importance of work life balance. Hence identifying the preferences of individuals for integration of segmentation is crucial for companies in order to develop personalised approaches that can foster the productivity and wellbeing of employees.

3.   RESEARCH GAP IDENTIFICATION

All the existing literature regarding employee productivity and work life balance provided a valuable insight about the interconnected and individual dynamics. Moreover there is limited integration regarding analytics in work life balance research. Previous studies lacked statistical knowledge and failed in discussing how data analytics can be used for personalised interventions. Predictive analytics as well as AI driven tools are important for discussing the underexplored areas of the topic. The role of technology for work life management is also not addressed in a detailed manner. A lot of studies seldom discuss the fine balance needed in leveraging technologies without excess stress or conflicts. Addressing all these gaps is crucial for discussing a novel insight regarding the interplay between stress, family and career. Hence the analytics' driven strategies are crucial in determining the sustainable business success methods. Identifying all the data are crucial in meeting the aim of the study and discussing all the areas where researchers limitedly provided knowledge.

4.   METHODOLOGY

Data collection

The data has been collected by following a mixed method approach which is suitable in meeting the objectives of the study. HR leaders as well as line managers from different industries are consulted to conduct a qualitative interview. Additionally, a quantitative survey of employees has been done for understanding the current state of work life integration methods that have a huge impact on the stresses. Hence, in both of the two cases primary data has been collected in this study. The use of primary data in a research provides the scope to include first hand data to a research. Primary research includes some methods like surveys and qualitative interview helps in gathering first hand data from groups or individuals. This strategy ensures specificity as well as relevance to the research goal. The major benefits of this type of research include customised insights, rich content and real time information.

Gathering data directly allows the researchers to tailor questions and highlight some specific areas of interest. Primary research also allows in determining the current situation of an area for making actionable decisions. Considering all these factors, in this research primary data are collected in two forms that are qualitative and quantitative. An online interview session was organised with 2 HR leaders and 3 line managers from different industries. Close ended questionnaire was prepared for the interview session to get the responses of the interviewees.

Conversely, the survey was organised with 53 people working in different industries. Open ended questionnaire was prepared to get the responses of the survey participants.

Data analysis

Online survey was organised to complete the study in a short time. Moreover, the primary qualitative data was analysed by using thematic method while the quantitative data was analysed by following statistical analysis method. IBM SPSS was used for performing multiple types of analysis that helped in meeting the key goals of the study.

The mixed research that combines qualitative and quantitative data ensures more comprehensive discussion about the research issue (Fetters et al., 2021). Integration of the diverse perspective of people regarding the research topic can be found through the use of a mixed approach in a research paper. It helps in increasing reliability and validity to a research. Hence the use of IBM SPSS software to interpret the primary quantitative data in this study allows one to draw a conclusion according to the responses given by the population. It also helps to provide some graphs and charts that indicate the results of the study in a more effective and clear manner. The relationship between multiple variables of the study are explained effectively by performing regression and descriptive statistics analysis methods. The statistical findings of this research supports the evidence based statistics in achieving work life balance in organisation and personal context. Therefore the methodology that has been selected for this research helped in providing actionable and meaningful findings to the study.

5. FINDINGS

Quantitative analysis

The findings of the primary data has been analysed by using IBM SPSS software. Regression analysis has suggested that the R square value is.942 that indicates that 94.2% of the variability in the dependent variable is clearly explained by the independent variable in the model. Therefore, the independent variables and dependent variables in this study are good fit.Only 5.8% of the variance is because of the other factors which are not captured by the model and may include randomness.

Figure 1: Regression Analysis

(Source: SPSS)

The findings of the regression analysis suggested that stress level of employees is impacted by the flexibility and other factors that are considered as the independent variables. Moreover, the R square value of 0.942 highlights that the

survey model is effective for explaining the variability in the outcome of the interest.

Figure 2: ANOVA Analysis

(Source: SPSS)

The F value in the ANOVA analysis is 169.981that indicates a strong likelihood which helps in identifying the differences between the groups in the survey. It suggests a strong likelihood for a group that significantly differs from others.

Figure 3: Descriptive statistics

(Source: SPSS)

According to the above image, the age mean value of the last variable is 2.53. Thus, the data analytics tools are crucial for achieving growth in business. Work life balance can be maintained by following data driven tools that can increase productivity in business.
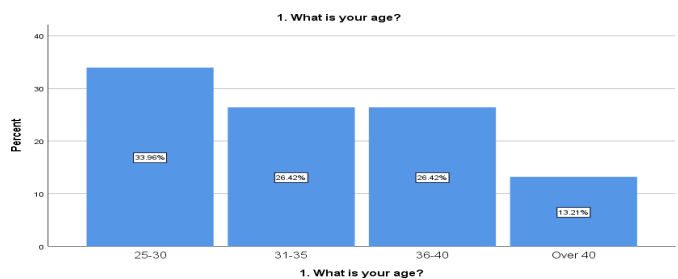
Figure 4: Age of the participants

(Source: SPSS)

Most of the people from the age group of 25 to 30 participated in the survey. Around 33.96% of the people from 25 to 30 years age group joined the survey while 26.42% of people from the age group of 31 to 35 years joined the survey. Lastly, 26.42% of the people from 36 to 40 years and 13.21 % of people were above the 40 years age group.
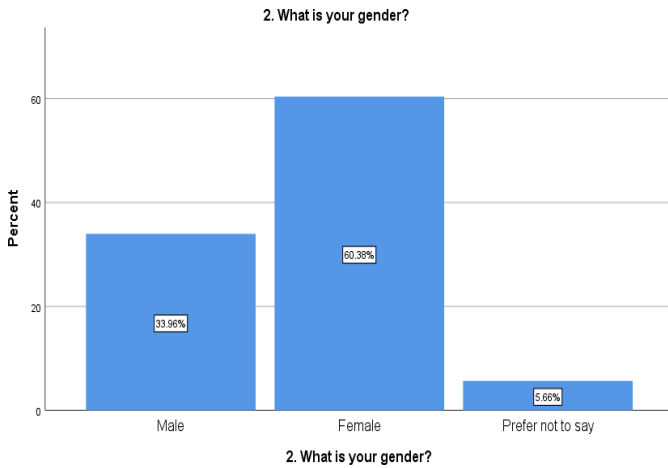
Figure 5: Gender of the participants

(Source: SPSS)

Around 60.38% of female and 33.96% male candidates joined the survey. Only 5.66% of people preferred not to reveal their gender.
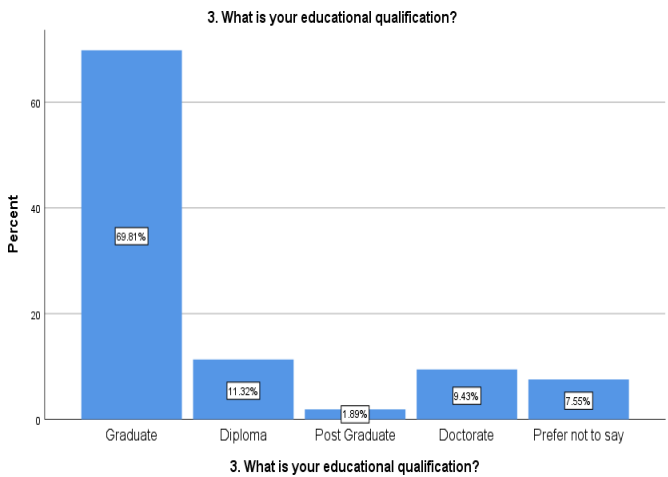
Figure 6: Educational qualification of the participants

(Source: SPSS)

69.81% of people in the survey are graduates while 11.32% of them are having diploma degrees. Additionally, 9.43% of the population were doctors who joined the survey and 1.89% of the survey population were post graduates. Thus, all the people who joined the survey were highly educated who showed an interest in the survey topic.
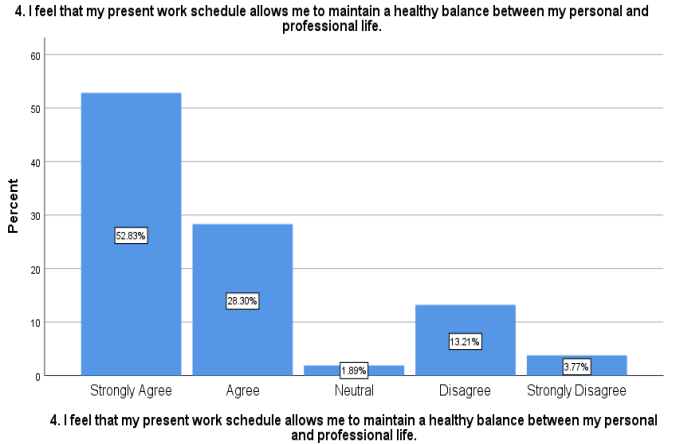
Figure 7: Work schedule for maintaining the healthy balance

(Source: SPSS)

About 52.83% of the survey participants stated that they feel their present work schedule allows them to maintain a healthy balance between professional and personal life. Additionally, 28.30% of the population agreed to the statement. Only 13.21% of the population disagreed with the statement. Thus, 13.21% of the population disagreed that their work schedule is not appropriate for their personal and professional life.

Figure 8: Professional responsibilities

(Source: SPSS)

50.38% of the participants have agreed and 20.75% of the participants have strongly agreed that their professional duties interfere in their personal life. These participants have clearly agreed that their ability to meet family obligations is being hampered due to their professional life. This is a major issue that is being faced by these individuals and highlights the impact of work pressure on these people.

Figure 9: Professional goals aligned with personal priorities

(Source: SPSS)

There is a need to highlight that the majority of the participants have agreed that their professional life aligns with their personal life. More than 60% of the participants have agreed and another 20.70% have strongly agreed to it. These individuals indicate that they have been able to align their professional goals with personal priorities.

Figure 10: Stressed due to workload

(Source: SPSS)

45.28% have strongly agreed and another 35.85% have agreed that stress is a major factor in their life. This stress is largely due to the workload that these individuals are facing in the current times. The high workload has led to stress among individuals, which is impacting their overall personal life in an immense manner.
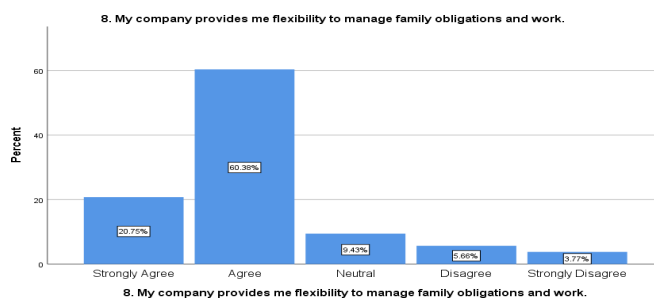
Figure 11: Flexibility offered by company

(Source: SPSS)

Despite the immense workload, respondents have also indicated that the companies that they work in are providing them with flexibility. 60.38% of the participants have agreed that companies are offering them flexibility. This forms more than half of the number of participants of the survey that has been conducted.
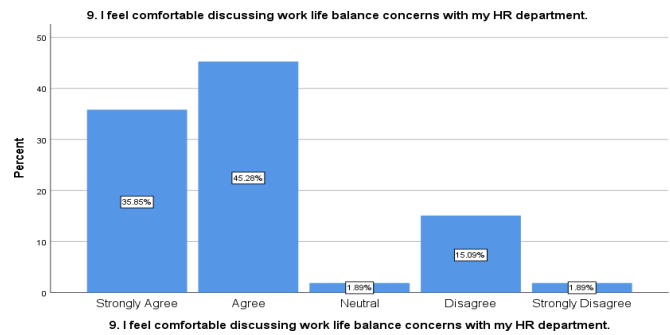
Figure 12: Comfort in discussion

(Source: SPSS)

45.28% and 35.85% of the respondents have agreed and strongly agreed that they feel comfortable with the HR department. These respondents have highlighted that they are comfortable in discussing their concerns with the HR department of their company. These discussions regarding work life balance help in ensuring better stress relief to the individuals.
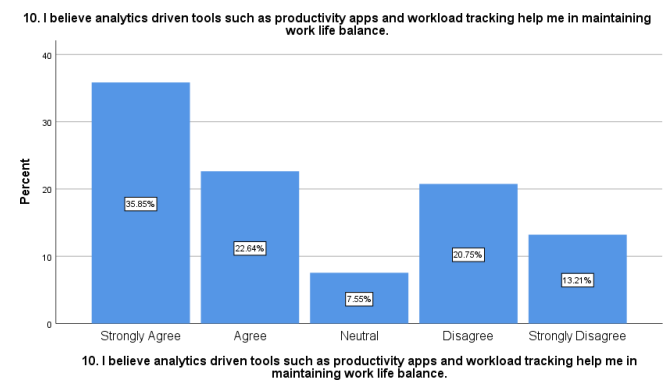
Figure 13: Maintenance of work life balance

(Source: SPSS)

The use of the correct data-driven analytics tools and productivity apps can be beneficial. Besides, workload tracking tools can help in better managing work life balance. This has been indicated in the results of the survey as more than 50% of the respondents have either strongly agreed or agreed to it. These areas can be beneficial in the long run and can help in the betterment of employees as a whole.

6. QUALITATIVE ANALYSIS

For the purpose of the qualitative data collection an interview was conducted between five individuals. A total of three

questions were asked and the data that was generated has been analysed here using the thematic analysis technique.

Theme 1: Stress at workplace and its reasons

Stress is a common outcome in extremely competitive workplace environments across the globe. When asked whether they feel stressed at the workplace, the participants in the interview have clarified that stress is a common aspect in the workplace. As per the ideas of Kriakous et al., (2021), stress is a major aspect that is generally seen among working professionals. It is an outcome of a number of factors and the most common one is workload. High workload in an organisation tends to have a deeper impact on the levels of stress that an individual faces. The level of stress in an individual is extremely high if the workload is high at the workplace. The participants have indicated that at the workplace, there is a greater stress due to the complex professional duties. These duties often lead to major problems of stress and can hamper their work-life balance as well.

On the other hand, it has also been noted that organisations with a good HR department are able to minimise the stress of their employees. The interview has indicated that HR plays an important role in allowing individuals to maintain a balance between personal and professional aspects. This helps in minimising the levels of stress that can be associated with an individual. As Thesing, Feldmann & Burchardt (2021) suggests, the use of the correct schedule at work is also important. Individuals often face a higher level of stress due to inappropriate schedules. The schedule at the workplace hampers the ability of individuals to maintain a balance in life and leads to stress at the workplace.

Theme 2: Impacts of stress at workplace on personal affairs

The interview respondents have all said that stress at the workplace hampers their personal life significantly. It was asked whether these issues hamper the personal affairs of an employee and they responded with a "Yes." These individuals have further indicated that owing to immense stress at the workplace they fail to focus on personal commitments in an appropriate manner. In the ideas of Jermsittiparsert et al., (2021), employees working in organisations that have a high workload often are at a greater risk of stress. This stress leads to unwanted problems for these individuals, who fail to fulfil their personal obligations most of the time. This often leads to unwanted problems and can cause severe mental health issues for individuals as well.

Further, the employees who feel a higher level of stress often fail to fulfil commitments to their family. In the results of the interview one common aspect indicated by all five employees is their inability to fulfil family commitments. These individuals have clarified that they face difficulties in balancing their personal and professional life. However, as indicated by Bhende et al., (2020), better work-life balance can be generated by maintaining proper schedules. These

schedules are also dependent on the workload and the company. The HR department can play an important role in ensuring better work-life balance as well. Stress has significant negative impacts on the productivity of an individual as well. Higher levels of stress can mean that the creative thinking and problem solving capabilities of individuals are being hampered. This can cause concerns in the productivity of the employees (Tschang & Almirall, 2021). These issues are a direct impact of stress that is generated at the workplace, which hampers both personal and professional life of an individual.

Theme 3: Ways of balancing family, career and stress

The most significant developments in the domain of technology have enabled the use of data analytics in driving stress control. As the participants of the interview have indicated, analytics driven productivity apps have been beneficial. These applications allow better understanding of the workload patterns of an individual. Besides, it offers insights regarding the schedules and activities of employees as well (Becker et al., 2022). These areas of analytics driven approach can help companies understand the ways of mitigating stress from the lives of their employees. Organisations can also appropriately gauge the levels of stress and productivity in the case of an employee. The use of data analytics offers trends in employee productivity as well. The implementation of technology in stress control and management have been found to be beneficial. This allows better outcomes for the businesses and enhances the work-life balance of individual employees as well.

Tracking workload using such productivity applications can be helpful as well. In the ideas of Austin & Gregory (2021), the main need for an individual is to understand and manage workload better. The implementation of the correct tracking tools that are driven by data analytics and relevant technology have been helpful as indicated in the interview results. These results have also indicated that the use of the correct applications that are adequately equipped with the latest technologies can be helpful. It offers valuable insights into critical areas like the reasons for stress and ways of managing workload better as well. These insights are beneficial and can underpin the scheduling needs better. These areas are critical and can help in generating betterment as well. The implementation of the correct analytics can help in measuring stress and can ensure better strategies that can help employees reduce it. This has been identified in the results of the interview of the five respondents.

7. DISCUSSION

The key area that must be noted in the case of work-life balance is the problems faced by employees due to workload. In the ideas of Subramaniam et al., (2024), workload is one of the major concerns that has led to unwanted issues for employees in the long run. These employees are unable to manage the workload due to the immense pressure that is

exerted by the organisations. The higher workload in an organisation means that the employees are largely being impacted in a negative manner. A higher level of stress is being generated in the case of such employees, which leads to mental health issues in the long run. Such employees fail to maintain a balance between work, career and family. Besides, it has been indicated here that such employees fail to meet the obligations they have towards their families as well. This is a major impact of stress at the workplace in the case of any employee.

The study here was conducted with the use of both qualitative and quantitative data. Primary qualitative and quantitative data have been employed here to create a better understanding of major aspects. The use of the correct methods have helped in getting both statistical and factual insights regarding key areas. In the ideas of Ahmad, Gul & Kashif (2024), the understanding of the major problems that are faced by employees has indicated immense workplace pressure as a key one. There is immense pressure at the workplace due to high workload, which is the key factor that impacts the outcomes of an individual employee. Besides, these employees also face significant challenges in facilitating appropriate commitments towards their families. They are not able to fulfil their obligations towards their family in the correct manner. This leads to an unwanted issue between individuals and their families, further increasing stress.

In such scenarios, it has been clarified here that an analytics driven approach can play a major role. In the ideas of Chigeda, Ndofirepi & Steyn (2022), data analytics driven tools and applications can play an important role in reducing work-life stress in individuals. These applications have major use cases in the case of workplaces. The use of such analytics driven tools can help individuals to come up with better results and enhance their productivity. The tools are designed to track the stress patterns of an employee and ensure better tracking of stress levels. Besides, it helps in understanding the workload that is being exerted on an employee. The stress that is generated due to the same is also being indicated using such analytics tools. These are clearly the most important areas that can be considered here. These recommendations can allow enhancements in the overall productivity of individual employees and can foster better performance as well. The HR department of an organisation can also play an important role in this regard.

8.   CONCLUSION

Balancing family, career and stress can be a major problem in the case of individuals. Employees are at a greater risk of not being able to manage career and stress and balance families as well. The main reason for such issues faced by employees is the higher workload that is being exerted by individuals. These individuals are extremely vulnerable to stress generation as there is an increased level of workload. Besides, inappropriate policies at the workplace can also lead

to major issues as well. The HR department of an organisation has a critical role to play in generating better outcomes here.

The use of the correct tracking apps and productivity apps using data analytics can be helpful for employees. These employees can be largely benefited by the application of such apps that are data-driven. The data-driven nature of these tools can be helpful in better tracking of the productivity and stress patterns of employees. It can also assist employees in developing appropriate schedules as well. This helps in relieving the unwanted stress that is generally faced by these employees in the long run. Therefore, data analytics can be helpful in ensuring better balance between family, career and stress.

REFERENCES

[1.] Adisa, T. A., Antonacopoulou, E., Beauregard, T. A., Dickmann, M., & Adekoya, O. D. (2022). Exploring the impact of COVID-19 on employees' boundary management and work–life balance. *British Journal of Management*, *33*(4), 1694-1709. https://doi.org/10.1111/1467-8551.12643

[2.] Ahmad, I., Gul, R., & Kashif, M. (2024). A qualitative study of workplace factors causing stress among university teachers and coping strategies a qualitative study of workplace factors. *Human Arenas*, *7*(4), 812-834.

[3.] https://www.researchgate.net/profile/Rani-Gul-3/publication/362592363_A_Qualitative_Stud y_of_Workplace_Factors_Causing_Stress_Among_University _Teachers_and_Coping_Strate gies_A_Qualitative_Study_of_Workplace_Factors/links/6308f e0b5eed5e4bd11f9690/A-Qual   itative-Study-of-Workplace-Factors-Causing-Stress-Among-University-Teachers-and-Coping

[4.] -Strategies-A-Qualitative-Study-of-Workplace-Factors.pdf?_sg%5B0%5D=started_experime nt_milestone&_sg%5B1%5D=started_experiment_milestone& origin=journalDetail

[5.] Austin, Z., & Gregory, P. (2021). Resilience in the time of pandemic: the experience of community pharmacists during COVID-19. *Research in Social and Administrative Pharmacy*, *17*(1), 1867-1875. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7260564/ Becker, W. J., Belkin, L. Y., Tuskey, S. E., & Conroy, S. A. (2022). Surviving remotely: How job control and loneliness during a forced shift to remote work impacted employee work behaviors and well-being. *Human Resource Management*, *61*(4), 449-464.

[6.] https://onlinelibrary.wiley.com/doi/pdfdirect/10.1002/hrm.221 02

[7.] Bhende, P., Mekoth, N., Ingalhalli, V., & Reddy, Y. V. (2020). Quality of work life and work–life balance. *Journal of Human Values*, *26*(3), 256-265.

[8.] https://www.researchgate.net/profile/Yv-Reddy-2/publication/343360162_Quality_of_Work_ Life_and_Work-Life_Balance/links/64d25cfdb684851d3d928c9d/Quality-of-Work-Life-and- Work-Life-Balance.pdf

[9.] Brough, P., Timms, C., Chan, X. W., Hawkes, A., & Rasmussen, L. (2020). Work–life balance: Definitions, causes, and consequences. *Handbook of socioeconomic determinants of*

[10.] *occupational health: From macro-level to micro-level evidence,* 473-487. https://www.academia.edu/download/100782538/Brough4317 72Accepted.pdf

[11.] Canavesi, A., & Minelli, E. (2022). Servant leadership and employee engagement: A qualitative study. *Employee responsibilities and rights journal*, *34*(4), 413-435. https://doi.org/10.1007/s10672-021-09389-9

[12.] Chigeda, F., Ndofirepi, T. M., & Steyn, R. (2022). Continuance in organizational commitment: The role of emotional intelligence, work-life balance support, and work-related stress. *Global Business and Organizational Excellence*, *42*(1), 22-38.

[13.] https://onlinelibrary.wiley.com/doi/pdf/10.1002/joe.22172

[14.] Dethier, E., Stevens, G., & Boden, A. (2024). The Burden of Administrative Household Labor—Measuring Temporal Workload, Mental Workload, and Satisfaction. *Social Sciences*, *13*(8), 404. https://doi.org/10.3390/socsci13080404

[15.] Fetters, M. D., Curry, L. A., & Creswell, J. W. (2021). Achieving integration in mixed methods designs-principles and practices. *Health Services Research*, *48*(6), 2134–2156. https://doi.org/10.1111/1475-6773.12117

[16.] Giermindl, L. M., Strich, F., Christ, O., Leicht-Deobald, U., & Redzepi, A. (2022). The dark sides of people analytics: reviewing the perils for organisations and employees. *European Journal of Information Systems*, *31*(3), 410-435. https://doi.org/10.1108/PR-12-2019-0680

[17.] Jermsittiparsert, K., Petchchedchoo, P., Kumsuprom, S., & Panmanee, P. (2021). The impact of the workload on the job satisfaction: Does the job stress matter?. *Academy of Strategic Management Journal*, *20*, 1-13.

[18.] https://www.academia.edu/download/108551641/The-impact- of-the-workload-on-the-job-sati sfaction-does-the-job-stress- matter-1939-6104-20-S5-079.pdf

[19.] Khateeb, F. R. (2021). Work life balance-A review of theories, definitions and policies.

[20.] *Cross-Cultural Management Journal*, *23*(1), 27-55. https://www.researchgate.net/profile/Fatima- Khateeb/publication/376520334_WORK_LIFE_ BALANCE- _A_REVIEW_OF_THEORIES_DEFINITIONS_AND_POLI CIES/links/657be8

[21.] 0bcbd2c535ea292b94/WORK-LIFE-BALANCE-A-REVIEW- OF-THEORIES-DEFINITION S-AND-POLICIES.pdf

[22.] Kriakous, S. A., Elliott, K. A., Lamers, C., & Owen, R. (2021). The effectiveness of mindfulness-based stress reduction on the psychological functioning of healthcare professionals: A systematic review. *Mindfulness*, *12*, 1-28.

[23.] https://link.springer.com/content/pdf/10.1007/s12671-020- 01500-9.pdf

[24.] Pantović, V., Vidojević, D., Vujičić, S., Sofijanić, S., & Jovanović-Milenković, M. (2024). Data-Driven Decision Making for Sustainable IT Project Management Excellence. *Sustainability*, *16*(7), 3014. https://doi.org/10.3390/su16073014

[25.] Park, S., Zhunis, A., Constantinides, M., Aiello, L. M., Quercia, D., & Cha, M. (2023). Social dimensions impact individual sleep quantity and quality. *Scientific Reports*, *13*(1), 9681. https://doi.org/10.1038/s41598-023-36762-5

[26.] Rožman, M., Oreški, D., & Tominc, P. (2023). Artificial- intelligence-supported reduction of employees' workload to increase the company's performance in today's VUCA Environment. *Sustainability*, *15*(6), 5019. https://doi.org/10.3390/su15065019

[27.] Subramaniam, S. H., Wider, W., Tanucan, J. C. M., Yew Lim, K., Jiang, L., & Prompanyo, M. (2024). Key factors influencing long-term retention among Contact Centre employee in Malaysia: a Delphi method study. *Cogent Business & Management*, *11*(1), 2370444.

[28.] https://www.tandfonline.com/doi/pdf/10.1080/23311975.2024. 2370444

[29.] Tahir, R. (2024). Work–life balance: is an entrepreneurial career the solution?. *Journal of Entrepreneurship in Emerging Economies*, *16*(4), 845-867.

[30.] https://doi.org/10.1108/JEEE-03-2022-0077

[31.] Thesing, T., Feldmann, C., & Burchardt, M. (2021). Agile versus waterfall project management: decision model for selecting the appropriate approach to a project. *Procedia Computer Science*, *181*, 746-756.

[32.] https://www.sciencedirect.com/science/article/pii/S187705092 1002702/pdf?md5=dc8af90274 c3cd59f94f4055c64519bd&pid=1-s2.0-S1877050921002702- main.pdf

[33.] Tschang, F. T., & Almirall, E. (2021). Artificial intelligence as augmenting automation: Implications for employment. *Academy of Management Perspectives*, *35*(4), 642-659. https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=7668 &context=lkcsb_research

[34.] Verma, N., Verma, N., Verma, N., Verma, N., Verma, N., & Verma, N. (2024). Exploring the global landscape of work-life balance research: A bibliometric and thematic analysis. *Heliyon*, *10*(11), e31662–e31662. https://doi.org/10.1016/j.heliyon.2024.e31662

[35.] Waworuntu, E. C., Kainde, S. J., & Mandagi, D. W. (2022). Work-life balance, job satisfaction and performance among millennial and Gen Z employees: a systematic review. *Society*, *10*(2), 384-398. https://doi.org/10.33019/society.v10i2.464

[36.] Yang, F., & Gu, S. (2021). Industry 4.0, a revolution that requires technology and national strategies. *Complex & Intelligent Systems*, *7*, 1311-1325.

[37.] https://doi.org/10.1007/s40747-020-00267-9

[38.] Zasa, F. P., Patrucco, A., & Pellizzoni, E. (2020). Managing the hybrid organization: How can agile and traditional project management coexist?. *Research-Technology Management*, *64*(1), 54-63. https://doi.org/10.1080/08956308.2021.1843331

Application of Gestalt Therapy and Transactional Analysis on Organizational Development

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ABSTRACT

This dissertation examines the methodologies evolved from Gestalt Therapy and Transactional Analysis, in attempting to develop unique interventions into Organizational Development meant to improve emotional intelligence, teamwork, and leadership. Gestalt Therapy works in present-moment awareness, and TA builds upon identifying communication structure and ego states toward improving interpersonal relationships. With the help of detailed HR interviews and survey results, practical therapeutic applications are planned to enhance personal and leadership development along with organizational sustainability.

These interventions nonetheless enable the organisation to address interpersonal conflicts, build healthier communication habits, and enhance working together. Another topic discussed is the lack of aptitude analysis and achievement tracking, usually rooted in traditional OD methodologies, along with suggestions for amalgamating these aspects in future models. The study focuses on the tremendous background of coping strategies whereby these approaches can help the organizations to be involved in post-plan career maps that provide a road to growth and change.

In this respect, Gestalt Therapy and TA are explanatory with respect to presenting themselves as strategies to nurture workplace dynamics, enhance personal and professional development and support an organizational culture of growth. Ultimately, this research presents Gestalt therapy and TA as comprehensive strategies for improving workplace dynamics, fostering personal and professional development, and promoting a thriving organizational culture.

Keywords: Gestalt Therapy, Transactional Analysis, Organizational Development, Psychotherapy, Workplace Dynamics

Keywords: Gestalt Therapy, Transactional Analysis, Organizational Development, Emotional Intelligence, Leadership

1. INTRODUCTION

Gestalt Therapy and Transactional Analysis (TA), have emerged as key figures in psychotherapy. Their synergy has made a significant impact on modern psychology. They were developed by the most impactful Fritz Perls, Laura Perls, and Paul Goodman in the mid-20th century. Gestalt therapy emphasizes personal responsibility by focusing on personal experiences and emotions in the present. This article is propounded as our experiential findings as an organizational practitioner of OD and change practices for decades and explains how our engagement with certain theories and practices of psychotherapy has significantly transformed and impacted our lens on OD. The very adoption of Gestalt theory and TA practice has marked a major qualitative increase in their presence and gave them the creative lenses through which to build organizational capacity, effects of change, and allied developments in a more relational rather than objectivist manner. Both therapies help the clients to become aware of their thoughts, emotions, actions and develop self-awareness as a result of their connections with the world around them. Transactional Analysis was founded in the 1950s by Eric Berne, discussing what kinds of behavior and communication can be best understood through

the dynamics of social exchange. This framework not only encourages personal self-knowledge but improves interpersonal relationships by exploring the communication styles and emotional reactions of the clients. Gestalt therapy and Transactional Analysis provide wonderful tools and activities for self-reflection and personal growth, making them an important part of modern therapeutic practice in organization. This introduction aims to explore these two paradigms, putting them in their perspective and incisively displaying their role on the one hand as a manageability tonus and on the other hand as a relational tool for the flourishing of psychological health. The objective of this research will show how Gestalt Therapy and Transactional Analysis can improve teamwork at work, enhance leadership, and resolve organizational conflicts. This can be achieved by emphasizing self-awareness, communication, and accountability, and aims to show the future possibilities that these therapies have in terms of organizational growth and employee well-being.

2. EVOLUTION

As Gestalt therapy evolves, its principles are being applied outside of traditional therapy settings into education and organisational development, due to the fact that self-

awareness and interpersonal dynamics have been recognized as crucial in all areas of life. For example, workshops using Gestalt techniques can enhance teamwork and improve communication skills in the workplace, creating healthier and better work environments. The focus in Gestalt therapy is mostly on experiential learning that means participants are actively engaging with their feelings and perceptions, resulting in continuous personal growth. This shows how flexible Gestalt is; not only it addresses the individual psychological and emotional needs but also social interactions and relationships with others.

Transactional analysis (TA) has moved on, it's been creeping into areas outside of conventional therapy, into organisational leadership and education. In these areas, the principles of TA improve interpersonal communication and conflict resolution by getting individuals to identify their own ego states and how these impact their interactions with others. Plus, this method supports personal growth and collective growth in teams, so healthier relationships and higher productivity. As it continues to spread, understanding the implications of transactional analysis on individual and group dynamics is key for those working in any professional field.

3. INTERLINKAGES BETWEEN THESE TWO THERAPIES

Another important point of linkage between Gestalt therapy and transactional theory is their similar emphases on awareness and personal responsibility in the therapy processes. Both modalities advocate the clients' inward exploration of their thoughts, motives, and behaviors with respect to their relationships and past experiences. Most times, the self-exploration develops into more considerable do-self-constancy life-scripts that might account for how a client interacts with themselves and everyone else- a concept of both approaches (James & Jongeward, 1971). At this point, this amalgamation can confer greater significance to the psychosomatic disorders, fostering an understanding of how emotional quarrels manifest in the terms of physical state inducing one to holistic healing (Kertesz, 1973). As the clinicians draw on both of these frameworks, they put an upright relationship-building process into play and deepen the ability of the clients to regain autonomy over their lives, which is instrumental in effecting precipitative changes in a synergistic way. There is more of a customized touch to the therapeutic inn that addresses an individual unique point and facilitates building resilience and personal growth.

4. LITERATURE REVIEWS

A thorough analysis of Gestalt therapy's use in OD shows that in addition to its therapeutic advantages, it may also improve group dynamics and the efficacy of leadership. Leaders can create an atmosphere that encourages development and cooperation by using the Gestalt cycle as a framework to better understand the emotional processes and

requirements of their teams (Matthew & Sayers, 1999). Organisations, as explained, are accompanied by the "self-structures" of "id", "ego" and "personality" (Perls et al., 1994) states. Furthermore, studies suggest that integrating Gestalt principles into team-building exercises may lead to improved interpersonal relationships and reduced conflict among members, thereby addressing common workplace challenges such as aggression related to deadlines (Shumar, 2024). These literature reviews potentially offer lessons for more holistic approaches in management and employee engagement, recognizing the increasingly pervasive stance for psychological safety and well-being within organizations. This transition into an empathetic leadership style would ignite productivity and give a sense of belonging to the members of a team, ultimately driving innovative brains and resilience toward changes. In an environment where people feel appreciated and heard, commitment enhances productivity, leading to sustainable success and a conducive workplace culture.

Any transformation of this culture will require ongoing training in order for our leaders to hone the skill set they need to deal with the complex interpersonal relationships and effectively support their teams. The commitment to strengthening relationships among team members and increasing the overall organizational agility to allow the company to respond quickly to market demands and the emerging challenges is continuous improvement.

In exploring Transactional Analysis (TA) applications in OD, one must bear in mind its broader implications for team dynamics and leadership styles. It aims at empowering personnel to take responsibility for their actions and to encourage leaders to adopt adaptive management techniques aligned with TA principles, rendering the whole company able to achieve better organizational development outcomes (McCann & McCann, 1976). Such workshops around these concepts can also provide foundational TA training, after which participants will acquire the skills needed to deal with complex personal relationships (Dhume et al., 2022) and widen personal insight into how their own behaviors affect group dynamics.

In addition, the sessions could pave the way towards some activities like role-play or mock situations whereby participants would practice their emotional reactions and learn how to use TA in real situations. Aside from that, feedback loops also help create a perpetual learning environment in such workshops. Here, the opinions of the employee are able to come forward as strong and valued. Consequently, this will increase collaboration and trust among the members of different teams. Through this kind of approach, individuals have a better chance of improving themselves while also growing a culture of openness, innovation and acceptance of challenges. Teams then can become even better at utilizing the same techniques for

understanding and solving any conflicts, hence uplifting both individual morale and collective productivity.

5. PSYCHOTHERAPIES AND ORGANIZATIONAL DEVELOPMENT

Fig 1 (Old Woman or Young Woman?)

Source: Gestalt Therapy, Perls F.S. et al.

OD constitutes a highly diverse domain that endeavors to comprehend the human aspects of predominantly business organizations to perform (Denison, 1990; Kotter and Heskett, 1992; Truskie, 1999), Alvesson (2002). Selection of these new instruments was prompted by our intrigue regarding the motivations behind human actions while simultaneously desiring to avoid immersion in OD dilemmas throughout many professional pursuits.

Through cognitive addressing, the psychological aspects of stress and social dynamics allow firms to tackle burnout and turnover that mostly arise due to conflicts of the inner emotional turmoil of teams. Proactive monitoring employs these psychodynamic psychotherapy principles with established conclusions that variation in this school of therapy has been used to achieve considerable reductions in health care usage and expenditures over time that will bountifully bless the employees and the employer financially, as supported by Yonatan-Leus et al." Also it is imperative to see how culture affects personality development-in terms of those companies better placed to develop working conditions that provide supportive environments for the perspectives of these divergent personalities for the increased productivity of the whole organization" (Whitaker 1993).

6. COMMONALITIES BETWEEN GESTALT THERAPY & PSYCHOLOGY

This correlation is, however, underscored by the reliance on holistic perception where an individual focuses on experiencing the here and now. It is noted with common yet fundamental principles of both approaches demanding that thoughts, feelings, and that environment be perceived with compound and dualistic perspectives.

Integration of these perspectives has been claimed to bring better therapeutic outcomes as it trains the Gestalt-theory mechanism with cognitive therapy by identifying with clients during therapy sessions and bringing enhanced self-awareness and contextual understanding to treatments. These integrative practices diversify the therapeutic process and provide a manifestation for sustained mindfulness within both frameworks to stir deeper emotional processing and personal growth. These approaches foster synergy leading to a more holistic view to mental health so that the clients go through experience with greater clarity and resilience.

7. GESTALT THERAPY – FIGURES & RELATIONSHIPS

The initial secret to Gestalt lies in the concept of figure and ground. Essentially, researchers instinctively differentiate objects from their surroundings by creating boundaries around them to set them apart from the background. This principle holds true even for flat objects, such as various designs. Printed text serves as a splendid illustration of this concept.

When one gazes upon a word, whether it's on paper or illuminated on a screen, the focus is drawn to the darkness of the letters, overshadowing the white space surrounding them, despite both being entirely valid focal points. The brain instinctively distinguishes the figures (the letters) from the ground.

At times, the dynamics of figure and ground can transform as you delve into their intricacies. In these iconic examples, your perception hinges on which elements you identify as the figure and which ones you regard as the ground.

In the realm of well-being, the dynamic dance between figure and backdrop is a continuous yet significant ebb and flow. Consequently, this intricate relationship between foreground and background emerges as the cornerstone of the concepts explored in this volume: engagement, focus, enthusiasm, care, thrill, and elegance symbolize a flourishing figure-ground interaction, whereas chaos, monotony, obsessions, fixations, unease, forgetfulness, inertia, and self-awareness reflect a disrupted figure-ground connection.

The term configuration, structure, theme, and structural relationship (as per Korzybski) or a meaningful organized whole closely aligns with the original German word Gestalt, which lacks a precise English counterpart. For instance, linguistically, the words pal and lap share the same components, yet their meanings rely on the arrangement of the letters within their Gestalt. Similarly, the word bridge can refer to either a card game or a structure that connects two riverbanks. In this case, the interpretation is contingent upon the context in which "bridge" is utilized. The hue of lilac
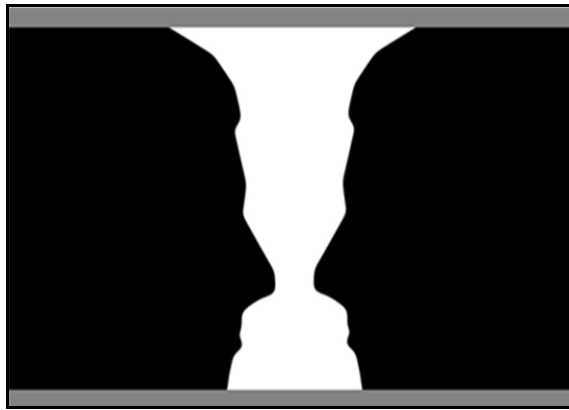
Fig 2 (Figure Ground Phenomenon)
Source: Gestalt Therapy, Perls F.S. et al.

appears bluish when set against a red background, and red looks different against a blue backdrop. The context in which an element is situated is referred to in Gestalt psychology as the "ground," contrasting with the "figure" that emerges from it.

8. TRANSACTIONAL ANALYSIS – FIGURES & EXAMPLES

Transactional analysis is an enchanting subject that we explore in our 'Management Training and Leadership Development Training' programs. You might not have pondered this deeply before, but in every exchange with another individual, the speaker can be seen as providing the 'stimuli' for the transaction, while the listener offers the 'response.'

Then the recipient receives the dialogue and tweaks it until they perceive that it is their turn to initiate the dialogue, opening their discourse while at the same time 'allowing' the next party to follow. The framework of transactional analysis is actually employed to dissect the dance of exchanges in this intricate interplay that takes place among communications with others. It gives credence to self-awareness: it makes one aware of his or her own feelings, thoughts, and behaviors in interaction with the world. It takes into cognizance the fact that different 'ego states,' an idea first put forward by Sigmund Freud, influence our personalities. They are the frameworks we use to interact with those around us.

Eric Berne was the original architect of this model; he was born in 1910 in Montreal, Canada; he was an M.D. and C.M. from McGill University Medical School in 1935. In contrast to the other two, his educational career was different from Freddy's; it provided him with a solid starting block to construct his theory of the "Parent, Adult, and Child" states.

These life scripts have a considerable degree of control over our thoughts, feelings, and actions. We learn to behave in a specific way based on what we have learned from or experienced as the effects of previous behaviors. If a person is 'conflict-averse,' it may be for the reasons they went through growing up. Conversely, if someone possesses a short temper and responds with fury to the most trivial of situations, it's likely that their early experiences moulded them in such a way. Thus, the creation of the 'script' that dictates our behavior. Transforming this script is the objective of transactional analysis psychotherapy. Traditional or experiential scripts can be supplanted with cooperative, collaborative behaviors through dialogues centred around the analysis of TA. This is precisely why Team Leader Apprenticeships, among the diverse array of courses we provide, have surged in popularity! Through these apprenticeships and training sessions, leaders can embark on a journey to comprehend and value their behavioral patterns, which in turn illuminates the reasons behind the actions of their teams and individuals.
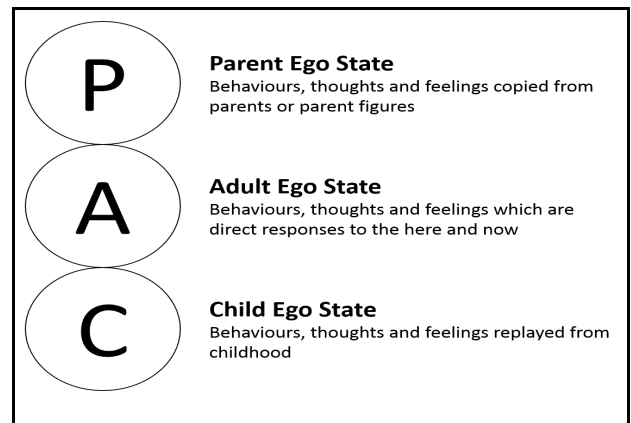
Fig 3 (Ego States Models-Transactional Analysis)
Source: Kelly, K. (2017), Counselling Tutor

The Child State

In the realm of transactional analysis, two intriguing facets of the child state emerge: the adapted child and the free child. This ego state flourishes on the affirmations we received during our formative years. Were you showered with praise frequently? Did your guardians scold you for specific actions? Was your early life a tapestry woven with joy or a mosaic of shadows? Depending on the nurturing environment you experienced, the echoes of those moments continue to resonate in our interactions today. The adapted child seeks to win the approval of others and thrives on being cherished, often conforming to the desires of those around them. They may appear meek or hesitant, permitting others to dictate their emotions, occasionally at the expense of their own voice.

The Parent State

The parent represents an ego state shaped by the influence of significant parental figures during one's upbringing. If a

formidable figure like a grandparent or teacher played a pivotal role, their impact may profoundly shape how an adult perceives appropriate responses to various situations. Once more, we can identify two dimensions of the adult state: critical/ controlling, and nurturing.

Eric Berne posited that our understanding of the parent state is largely sculpted in the early years of life. One perspective on the parent state revolves around the judgements we cast on others and the circumstances we encounter. The expectations we have for how others should conduct themselves often spring from the examples set by those who raised us.

The Adult State

This state encompasses a singular dimension or aspect. While the child and parent states may be influenced by yesterday's experiences and conditioning, the adult state focuses on the immediate context. The adult state is characterized by an openness to dialogue, a curiosity about the emotions of others, an ability to sift through data and insights, respect for diverse opinions, a readiness to collaborate and find common ground, and a preference for nurturing deep, healthy relationships.

We often observe the adult state at play when making impactful decisions or resolving dilemmas in professional settings.

Complementary Transactions

This occurs when the ego states of conversing individuals align harmoniously, as illustrated above. Envision this as the sender operating in one state while the receiver mirrors that same state, harmonizing with the ego states rather than confronting them.
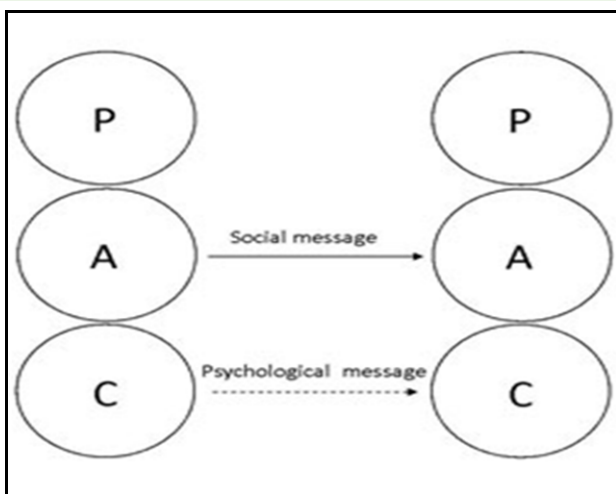
Fig 5 (Ulterior TA)

Source: Berne, E. (2016)

Ulterior Transactions

You may be familiar with the terms 'ulterior motives' or 'hidden agendas'. This concept arises when a person's actions or words convey one message while subtly or subconsciously implying something entirely different. This encapsulates the essence of an ulterior transaction, where a nuanced, underlying message from one state may be perceived as another by the recipient.
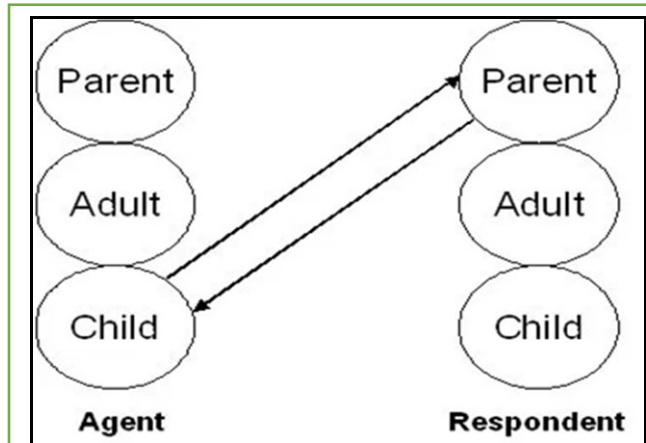
Fig 4 (Contemporary TA)

Source: Berne, E. (2016)

Crossed Transactions

Crossed Transaction occurs when the ego states fail to resonate with each other, leading to potential discord in various forms. A crossed transaction necessitates that one or both parties adjust their perspectives, enabling communication to progress at a reasonable level.
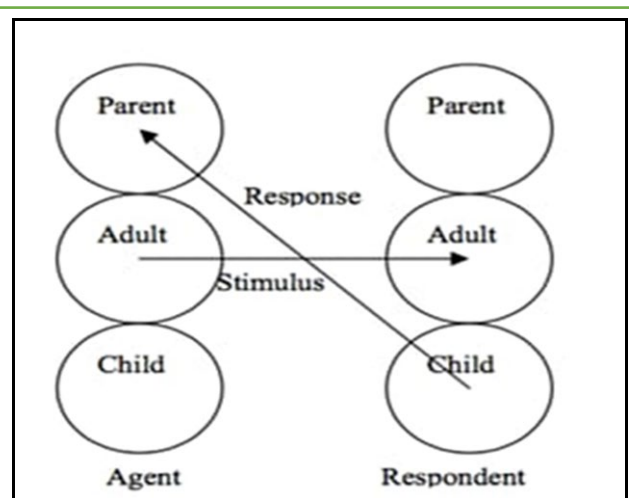
Fig 6 (Crossed TA)

Source: Berne, E. (2016)

9. RESEARCH GAPS

Despite the growing recognition of mental health's impact on workplace dynamics and a few previous studies linked to clinical and organizational psychology and development, there remains a paucity of empirical studies examining the direct correlation between psychotherapeutic interventions and organizational effectiveness. Areas such as the integration of psychotherapeutic principles into leadership awareness and training, the effects of individual therapy on team performance, and the long-term benefits of mental health initiatives within organizations require comprehensive analysis. Addressing these gaps could not only enhance the theoretical understanding of organizational behavior but also provide practical frameworks for improving workplace culture and productivity. Future research endeavors should aim to bridge these gaps, thereby contributing to a more holistic approach to organizational development that prioritizes psychological well-being alongside traditional business strategies.

10. RESEARCH DESIGN

During carefully crafting the research has been designed for both 'Qualitative' and 'Empirical' study. While the various applications, interpretations, models and outcomes are explored and analysed with both the therapeutic tools. Building on the theoretical model, we conducted the qualitative study in three phases where the first phase started with an 'Ethnographic' study followed by interviews (as multiple case study approach; Eisenhardt, 1989; Yin 2017) of 30 Human Resource Practitioners from SMEs (with a manpower strength of 500-2000 and a turnover up to 1000 Cr.) and Learning & Development Professionals (handling multiple SME clients) of the 'Eastern Region' through specific open-style questioners to record their feedback with rankings on a Likert scale and open-ended answers. At the same time, observed various exhibits in support of the Organizational needs to imbibe various such interventions for establishing a favourable environment.

The emphasis of these studies was to collectively gather information to assess and find out the relationship between select therapies and OD in an organization. Once the data gathered was codified, into 6 areas as mentioned in the Table 1. Cronbach alpha resulted a high internal consistency and reliability as its around 0.8.

The Questionnaires are as follows –

1. Do you feel that Psychology has a strong influence on the OD frameworks?
2. What kind of OD aspects are observed and practiced in your organizations?
3. What are the major pain areas?
4. Are these interventions including both Individual, Team and Large-Group frameworks?
5. Are you currently undergoing a 'Change Management' journey?
6. What kind of change do you seek to happen? Are they short, mid or long term?
7. Do you prefer internal or consultant based, externally influenced interventions for achievement of outcomes?
8. Are the Management and the Managers open to new learning and psychotherapy as a proven OD tool?
9. Do you believe that individual ego states act as influencers to collective developments and interventions?
10. Do you think that your organization measure progress of the Change process and ROI of the measures applied on a periodic basis?

11. DISCUSSIONS AND FINDINGS

TABLE 1: HR Response on the Questionnaire-Gestalt Therapy & TA

Sl. No.	Findings	% of Respondents
1	With a belief that Psychology as mode of OD process	75
2	Referred more than 3 pain areas for OD	60
3	Undergoing a change management journey	55
4	Searching for long term changes	40
5	Are the managers open to further learning?	60
6	Understanding of Ego state as an influencer?	45

Source: Author's Compilation

We further transcribed the recorded interviews of all 30 HR persons manually and thereafter, analysed the qualitative data through thematic and text analysis with NVivo 15 software to get connections, comparison, perceptions, and variance for exploration. Accordingly, the responses, previous studies and analysis of existing potentials unveil the following instruments, extracted from both Gestalt Psychotherapy and Transactional Analysis, to address the OD at different level to leverage towards excellence. Although, we have described the specific conceptions about the tools in details afterwards, the overall findings suggest a positive acceptance of Gestalt Therapy and Transactional Analysis for OD processes, individual and team interventions along with emotional well-being and interpersonal relationships.

While interviewing with OD heads of most of the select organizations, the **Hot Seat Gestalt therapy** was specifically discussed in the realm of organizational development. Hot

Seat not only promotes personal evolution but also enriches group dynamics by nurturing a space of transparent dialogue and constructive feedback. By empowering individuals to confront their obstacles within a nurturing atmosphere, organizations can cultivate a culture that cherishes vulnerability and authenticity, both of which are vital for sparking innovation and fostering collaboration. Furthermore, the interviewees agree that as teams' journey through this transformative experience, they become increasingly sensitive to shared emotions and behaviors, crafting a vibrant synergy between individual input and collective identity. Ultimately, such initiatives not only strengthen employees but also nurture a resilient organizational culture that is adept at embracing change. By promoting open dialogue and inviting feedback, organizations can further amplify this atmosphere, ensuring that every voice is acknowledged and cherished, which in turn fuels engagement and dedication among team members.

Dreams are a treasure trove of information for these therapies. By dissecting the feelings, ideas, and symbols that surface in our dreams, we can better understand them and maybe even decipher them. A trained therapist can help us make sense of the dream, identify hidden issues, and find ways to incorporate the dream into our waking lives so that we may learn more about ourselves.

Mr. M. Joseph, the VP (Human Resources) of an Inc. shared his experience that the **empty chair** is required for this method to work. The empty chair approach is a fascinating strategy that allows individuals to delve into their emotions and reflections by engaging in a dialogue with an unoccupied seat. The individual envisions that the chair is filled by another person or a different facet of their own being. This technique can empower individuals to untangle disputes and enhance their self-assurance in social exchanges. The next step is for us to express our emotions, ideas, and disagreements through a conversation or performance. The employee can better traverse our unresolved sentiments, emotional states, and past challenges with the help of this method.

Through the use of **awareness exercises**, we are able to strengthen our connection to the here and now and our knowledge of ourselves in these treatments. Among these pursuits are investigations of sensory perception, mindfulness training, and the identification and elaboration of specific body experiences.

To increase our **comprehension and vigilance**, these techniques include ratcheting up particular feelings, ideas, or deeds. While reversal involves temporarily adopting an opposing attitude or behaviour to find fresh options and ideas, exaggeration helps us become more aware of our tendencies.

The **two-chair** method is similar to the empty chair method in that it uses two chairs to represent different aspects of ourselves or different points of view. To show how the two chairs' positions evoke different feelings or points of view, we'll have to switch between them. We are able to reconcile our conflicting selves through introspection and this practice.

Like the two-chair and empty chair techniques, **role-playing** puts us in the shoes of important people in our lives and allows us to have conversations with them, allowing us to express feelings that might otherwise go unspoken, ease tensions, and obtain new perspectives. Improving our communication abilities, trying out new behaviours, and delving into the complexities of interpersonal interactions are all made easier by this.

The Transactional Analysis and its practitioner model is known as the **OK Modes** of life positions in the TA. This innovative OK Modes in various references emerged and presents us a more lucid and relevant depiction of the classic PAC (TA) framework. This concept and its accompanying diagram serve as invaluable resources for grasping the dynamics of human interactions—primarily on a one-to-one basis—and discerning the elements that render these exchanges either constructive or destructive; efficient or inefficient.

In the realm of Transactional Analysis, we refer to compliments and various forms of acknowledgement as **emotional strokes**. This term emerged from studies showing that infants need physical contact to thrive and develop. Interestingly, it seems that whether the touch results in discomfort or joy holds little significance - it's still vital. Generally, we tend to favor receiving negative strokes over the absence of strokes entirely, as this way we affirm our existence and allow others to recognize our presence.

Moreover, practices that foster body awareness, such as body scans, are frequently utilized to assist us in tuning into our physical existence, identifying tensions and emotions within our bodies, and unveiling revelations about the mind-body connection by carefully tuning into our physical sensations.

The fusion of Gestalt therapy and Transactional Analysis offers a wealth of benefits for those on a journey of personal growth, deeper self-awareness, and enriched well-being. These benefits can lead to a greater sense of fulfilment, authenticity, and improved quality of both personal and interpersonal interactions. Below are several advantages associated with the processes:

Gestalt Therapy underscores the importance of the "here and now," encouraging spiritual growth in individuals to fully engage with the present moment to experience life more completely, connect with immediate experiences, and gradually release past pain and future worries without any adverse ego. This mindfulness-centered approach in Gestalt Therapy further enriches the experience of a profound sense of vitality and connection to the present.

Fig 7 (Life Positions)
Source: Ok Corral, Ernst (1971)

With the guidance of a qualified therapist, 50% of the HR persons have witnessed that the individuals are given the chance to explore and apply practical coping strategies within the realm of Gestalt Therapy to tackle life's hurdles. They learn to acknowledge and understand their effective personal coping techniques, examine alternative responses to dilemmas, and gradually develop healthier ways to manage emotions, conflicts, and stress. These refined coping skills significantly contribute to the cultivation of emotional resilience and enhance overall well-being.

Gestalt Therapy champions the unification of the myriad facets of our identity. By recognizing and celebrating the varied elements of ourselves, we can aspire toward a richer sense of completeness. This journey fosters a connection with our genuine selves as we explore our emotions, thoughts, and actions in tandem with a skilled therapist. The harmonization and embrace of our deepest feelings and thoughts enhance self-acceptance and invigorate personal development. Ms. S. Ganguly, CHRO of a progressive organization in the Jewellery segment in the eastern region opined that the Gestalt Therapy provides a platform for individuals to face lingering emotions and conflicts from the past, often dubbed "unfinished business." With the support of a therapist, individuals can gradually revisit and unpack these unresolved issues, easing emotional burdens, seeking resolution, and embarking on a journey of healing, thus moving forward with newfound freedom from past constraints and attaining greater clarity.

A comprehensive understanding of the ego states and transactional patterns exhibited by team members may significantly augment communication and mitigate misunderstandings within the professional environment. Removal of child ego states by converting them to the appropriate adult and parent ego states found essential in reaching this objective.

Gestalt Therapy and Transactional Analysis (TA) have emerged as influential frameworks in both psychotherapy and Organizational Development (OD). Developed by Fritz Perls and Eric Berne, respectively, these approaches offer unique insights into personal responsibility and communication dynamics. Gestalt emphasizes living in the 'here and now,' while TA analyzes human behavior through three ego states—Parent, Adult, and Child. This study investigates how applying these frameworks in organizations can foster emotional awareness, improve team dynamics, and drive leadership development.

HR leaders agree that they may leverage the principles of Transactional Analysis to cultivate superior leadership styles and nurture a constructive organizational culture by promoting Adult-to-Adult interactions while eschewing harmful Parent-to-Child dynamics.

By acknowledging and confronting constraining life scripts, employees are afforded the opportunity to undergo personal development and enhance their effectiveness within the workplace. Transactional Analysis provides invaluable insights into human interactions and communication, particularly within the realm of organizational behavior.

12. CONCLUSION

In conclusion, the synergy of gestalt therapy with transactional analysis is understood through the lens of development in the workplace, and both interventions seek to improve workplace dynamics and enhance individual growth among the employees. The theoretical interests of gestalt psychotherapy allow organizations to become sensitive to feelings that an individual or individuals experience in themselves and others, resulting in an insight into interpersonal relationships and team dynamics. Simultaneously, transaction the end, though, combined gestalt therapy and transactional analysis represent a complex target of OD process aiming at workplace dynamics with personal development of employees within. Utilizing the foundational components of gestalt therapy, organizations are wrapped in a blanket of increased awareness of both individual and collective experiences that beget full comprehension of personal relationships and team dynamics. At the same time, transactional analysis offers insights on communication patterns and relational transactions that reveal dysfunctional behaviors that undermine productivity and cooperation. Working together, these psychotherapeutic frameworks provide for a strong foundation for designing interventions that will help meet both immediate organizational demands, as well as entrenching psychological well-being and work-related effectiveness of the workgroup. These methodologies would, therefore, play a very important role in developing adaptive, resilient, and thriving organizational cultures, while organizations continue their tough journey within the contemporary world of work. Transactional analysis furnishes valuable perspectives regarding communication patterns and relational transactions, which enable organizations to discern and rectify dysfunctional behaviors that impede productivity and collaboration. These

overarching psychotherapeutic frameworks serve as an important basis for developing interventions that would not only address the immediate organizational issues but also support the long-lasting mental health and efficiency of the workforce. As there continues to be no respite for organizations in learning the intricacies of modern-day work environments, the from within would require building these selections around adaptive, resilient, and flourishing organizational cultures.

13. LIMITATIONS

This is mostly a qualitative study that involves focused group and interview-based understanding of situations, beliefs and ideas. While designed to establish the impact of these therapies towards the nitty-gritty of the OD processes both at micro and collective levels, these is a clear limitation in drawing dependency among one or multiple variables statistically. The study also depends on the already acquired knowledge of the HR & L&D professionals about the specifics of the therapies. It is also clear from the study that the positive outcome of the tools depends on their holistic acceptance at the macro level. Further, in absence of enough literature against these therapeutic applications on OD, the research scopes are neither in conjunction with earlier findings, nor supported by adequate practical/ research references.

14. FUTURE SCOPE OF RESEARCH

As the future scope of research on psychotherapy applications in organizational development (OD) interventions unfolds, it becomes crucial to consider

- How to integrating evidence-based psychosocial frameworks can enhance focus on the change management, collective outcome, teamwork and mental well-being. Earlier researchers emphasizes that psychosocial interventions are not only effective but also significantly underutilized within various sectors, including corporate and plant environments.
- How the methodologies from both psychotherapy and OD leverage organizations to foster a deeper understanding of employee interactions and relative perceptions, leading to more tailored and impactful OD strategies.
- How the barriers identified in existing literature—such as inadequate standardization and lack of incentives for implementation—will be essential in creating sustainable change that benefits both employees and employers alike, as this holistic approach not only promotes resilience but also cultivates a culture of openness and support.
- Influence of Transactional Analysis on the regular and most accepted change management models.
- Possible application of AI in automating the therapeutic tools in analysis of ego states, perception and most importantly self-awareness?

- Creation of awareness and imbibing therapeutic mind-set in the dynamic Organizations to ensure holistic mental well-being.
- How Gestalt Therapy refers to Spiritual awareness and Mindfulness by addressing the adverse ego states?

DECLARATION

I, **Dr. A. Chatterjee**, hereby confirm that the manuscript titled *"Application of Gestalt Therapy and Transactional Analysis on Organizational Development"* is original and has not been submitted elsewhere. All authors have approved this submission.

REFERENCES

[1.] Michon, P. (2019). Gestalt therapy and its contribution to the understanding of the link between health and the environment.
[2.] Perls, F. S., Hefferline, R., & Goodman, P. (1951). Gestalt therapy: *Excitement and growth in the human personality.*
[3.] James, M., & Jongeward, D. (1971). Born to win: *Transactional analysis with Gestalt experiments.*
[4.] Kertesz, R. (1973). Gestalt therapy and transactional analysis as new methods for the treatment of psychosomatic ailments. *Psychotherapy and Psychosomatics*, 22(5), 307-314.
[5.] Matthew, B., & Sayers, P. (1999). The application of Gestalt to organizational development interventions in universities. *International Journal for Academic Development*, 4(2), 162-176.
[6.] Shumar, A. (2024). The impact of Gestalt psychotherapy approach on leadership intervention perspectives in organizations.
[7.] McCann, F. M., & McCann, M. W. (1976). The results of an experimental study of organizational transactional analysis. *Transactional Analysis Journal,* 6(3), 259-265.
[8.] Chidiac, M. (2013). An organizational change approach based on Gestalt psychotherapy theory and practice. *Journal of Organizational Change Management*, 26(3), 458-474.
[9.] Hay, J. (2000). Organizational transactional analysis: Some opinions and ideas. *Transactional Analysis Journal,* 30(1), 49-58.
[10.] Woldt, A. L., & Toman, S. M. (Eds.). (2005). Gestalt therapy: History, theory, and practice. *Sage Publications, Inc.*
[11.] Dhume, R., Deshpande, M. A., Shah, P., Roy, S., & Sinha, N. (2022). Transactional analysis: A toolkit for the workshop of life. *Indian Journal of Psychiatry,* 64(2), 192-195.
[12.] Berne, E. (2016). Transactional analysis in psychotherapy: A systematic individual and social psychiatry. Pickle Partners Publishing.
[13.] Berne, E. (1968). Games people play: The psychology of human relationships (Vol. 2768). Penguin Uk.
[14.] Yashodhara, L. (2023). Whatever! – Using transactional analysis to communicate better with my teen. *https://www.navgati.in/whatever-using-transactional-analysis-to-communicate-better-with-my-teen/*
[15.] Kelly, K. (2017). *Basic Counselling Skills: A Student Guide.* Warrington: Counselling Tutor
[16.] Ernst, F. H. (1971). The OK Corral: The Grid for Get-on-With. *Transactional Analysis Bulletin*, 1(4), 33-42. https://doi.org/10.1177/036215377100100409

Systematic Literature Review Sustainable Human Resource Management (SHRM)

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Abstract

Exploring the relationship between sustainable HRM and people, organizations, and society is the aim of this systematic literature review. 110 research papers released between June 2012 and June 2024 were examined. Several studies reveal the relationship between sustainable HRM and a company's and its employees' well-being at work. Its overall societal influence, however, has not received much empirical attention. Future studies should examine the interaction between people and SHRM from the perspective of the individual and examine the overall effects of SHRM practices using in-depth models and theoretical connections.

Keywords: "Sustainable Human Resource Management", "Sustainable HRM" "SHRM"

1. INTRODUCTION

Today, companies and businesses are evaluated upon a wider spectrum apart from their financial performance. Hence an organisation needs to take care about the society and environment (Matthew, 1995). For all organizations, human resources are regarded as their most precious asset. Therefore, it must be in line with the organization's sustainability goals, since sustainable HR practices provide value for potential and encourage investment in employees' long-term availability and viability, ensuring a top-notch workforce for the future.

HRM practices can be viewed as sustainable if they support long-term economic growth, environmental preservation, and social well-being, according to Stahl et al. (2020). On the other hand, if the behaviours negatively impact the economy, society, or the environment, they are not sustainable. It is crucial to comprehend the implementation of HRM strategies and practices that facilitate the attainment of financial, social, and ecological objectives, as they will eventually effect both internal and external stakeholders of the organization.

IFRS Foundation is a worldwide not-for-profit public interest organization founded to create high-quality, intelligible, legally binding, and internationally recognized accounting and sustainability disclosure standards. The Integrated Reporting Framework of IFRS states that many forms of capital are necessary for all businesses to succeed. which, in accordance with the "Integrated Reporting Framework" of the IFRS foundation Framework, include financial, manufactured, intellectual, human, social and relational, and natural. People's abilities, aptitudes, experiences, and desire to create make up their human capital. This includes their capacity to comprehend and apply strategy, their drive to improve, and their alignment with organizational values.

The sustainability of HRM practices (Mariappanadar, 2003; Ehnert, 2009b; Cohen et al., 2012) and HRM's contribution to organizational sustainability (Cohen et al., 2012; Ehnert et al., 2013; Guerci and Pedrini, 2014) are the fundamental assumptions that underpin the relationship between sustainability and human resources management.

The existing researches have different goals which are based on different assumptions about the role of HRM in sustainability (**Ehnert and Harry, 2012; Järlström et al., 2016**).

In order to give a comprehensive overview of sustainable human resource management's contribution to the achievement of organizational goals, the current study examines the breadth of the field's literature. This literature review attempts to answer are the following research questions:

RQ1. What has been understood about sustainable human resource management currently?

RQ2. Where does SHRM intend to take its research going forward?

Earlier researchers have used several theories to explore sustainable Human Resource Management. Following Table gives a list of the theories and its focus.

Author	Year of Publication	Theoretical Underpinning
Khan M. et al	2024	"Stakeholder Theory"
Yong J.Y. et al	2022	"Stakeholder Theory:
Macini N. et al	2022	"Stakeholder Theory"
Diaz-Carrion et al	2018	"Stakeholder

Author	Year of Publication	Theoretical Underpinning
		Theory"
Gim G.C.W et al	2022	"Attribution Theory"
Ali M. et al	2022	"Social Identity Theory"
Tandon A. et al	2023	"Social Identity Theory"
Parida S.et al	2021	"Social Identity Theory"
Su W. et al	2023	"AMO Theory"
Al-Alawneh R. et al	2024	"AMO Theory"
Khan M.H. et al	2024	"AMO Theory"
Mehrajunnisa M. et al	2022	"AMO Theory"
Anlesinya A. et al	2020	"AMO Theory"
Jerónimo H.M. et al	2020	"AMO Theory"
Yong J.Y. et al	2020	"AMO Theory"
Islam T. et al	2024	"Supply Value Fit Theory"
Poon T.S. et al	2022	Cognitive Theory and Practice Theory"
Podgorodnichenko N. et al	2020	"Paradox Theory"
Guerci M. et al	2016	"Paradox Theory"
Darvishmotevali M. et al	2022	"Social Exchange Theory"
Gupta R. et al	2024	"Social Cognitive Theory"
Anlesinya A. et al	2023	"Social Learning theory"
Suleman A.-R. et al	2024	"Research Based View"
Tanveer M.I. et al	2023	"Research Based View"
Ghosh A. et al	2024	"Research Based View"
Chiappetta Jabbour C.J et al	2024	RBV("Middle Range Theory")

The recent definition of SHRM (Mariappanadar, 2019) is about bundles of HRM practices that engages employees to synthesize increased organisational performance outcome while simultaneously reducing the unsustainable impacts on environment as well as on employees and stakeholders.

However academic views of what SHRM means is diverse and the effectiveness of sustainable HRM is not certain. The purpose of SHRM has transformed recently with focus on triple bottom line involving people, planet and profit and also towards the collective need through common good HRM.

Previous studies on the relationship between sustainability and HRM-related issues may be found in the literature on corporate social responsibility, strategic HRM, sustainable work systems, and sustainable HRM (mazur, 2013). Four distinct approaches to the concept— sociological, psychological, strategic human resource management, and green—are distinguished by De Prins and are demonstrated in actual policy. It was clear from the literature review that socially responsible HRM and green HRM comprise the majority of the studies. Nevertheless, integrated approaches like the triple bottom line and common good HRM are rarely the subject of papers.

The emergence of Sustainable HRM is a novel approach to HRM that aims to connect sustainability with HRM which is covered through various model

"Respect Openness Continuity (ROC)" is a model which presents framework to reconcile SHRM theory with practice. The premise of the model is based on the fact that sustainable HRM represents a step up from the conventional HRM way of thinking ((De Prins, P, 2014)

- Respect: Promotes treating stakeholders, workers, and the environment fairly and with respect for others.

- Openness: Encourages cooperation, communication, and transparency inside the company.

- Continuity: Places a strong emphasis on long-term planning and makes sure HR procedures support long-term objectives.

Balance Score Card (BSC), Tabatabaei, S. A. N., et all (2017) method is a strategic management framework that financial and non-financial perspectives

The factors that are key from perspective are enlisted below:

- Value Creation: Align HR practices with financial sustainability.

- Stakeholder: Enhance employee satisfaction and well-being.

- Internal Processes: Optimize HR processes for sustainability.

- Learning & Growth: Invest in employee development and knowledge.

- This model emphasizes long-term organizational success within a complex business context.

In **Triple Bottom Line (TBL)** model (Westerman et al., 2020) three dimensions are highlighted by sustainable HRM

In accordance with the TBL framework:

- Profit (Economic): Businesses need to continue making a profit.

- People (Social): Diversity, inclusivity, and worker well-being are important.

- Planet (Environmental): It's critical to reduce negative impact on environment.

2.1 Source selection

When compared to other online databases, Scopus offers the largest index of abstracts from scholarly articles (Kaur et al., 2022). The query used in internet databases:

TITLE-ABS-KEY (sustainable AND hrm)

941 results in total were returned as an initial sample by our search procedure. Articles published in scholarly management and social science journals were included in the search criteria. Nevertheless, integrated approaches like the triple bottom line and common good HRM are rarely the subject of papers.

Table 1:

Source : Moher et al 2009

2.2 Search Scope

Only empirical papers from peer-reviewed journals were chosen, leaving out book reviews, editorial comments, conference proceedings, and other unrelated pieces, in order to ensure that the data passed a rigorous peer-review process. It was restricted to the fields of social science, economics, and management. For this work, full-length, peer-reviewed articles published in the English language were taken into consideration. During this screening process, the titles, abstracts, and keywords of each paper were assessed to determine their applicability to the subject of this review. After evaluating the titles and abstracts of the literature separately, 110 articles were ultimately chosen for content analysis. It was discovered that the literature used a variety of methods and included quantitative, qualitative, and mixed

method approaches. The two most often utilized techniques were semi-structured interviews and SEM.

3.1 CONTEXT AND METHODOLOGY:

3.1 Year-wise distribution of articles

From the pool of data that was available for this analysis from the Scopus database, 115 research publications in total were chosen initially. There has been a notable increase in research on the subject of this study over the past four years, with 2020 marking a turning point.

The final study conducted a systematic literature review using the Scopus database, analysing 58 scientific articles from 2012 to 2024(June).

3.2 Most cited papers

The top paper, with 477 citations, is "Beyond strategic human resource management: Is sustainable human resource management the next approach?" by Kramar R, published in 2014. The main characteristics of SHRM, various interpretations of sustainability, and the connection between sustainability and HRM were all covered in the study. After that, it listed the essential traits of sustainable HRM.

There is another article with similar number of citations which focuses on Green HRM. In this article titled "Green Human Resource Management and Green Supply Chain Management: Linking two emerging agendas" the authors proposed a synergistic and integrative framework for the GHRM-GSCM relationship.

Sr. No	Title	Cited by
1	"Green Human Resource Management and Green Supply Chain Management: Linking two emerging agendas"	477
2	"Beyond strategic human resource management: Is sustainable human resource management the next approach?"	477
3	"Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development"	448

3.2 Territory wise distribution of articles

Compare the document counts for up to 15 countries/territories.

Documents
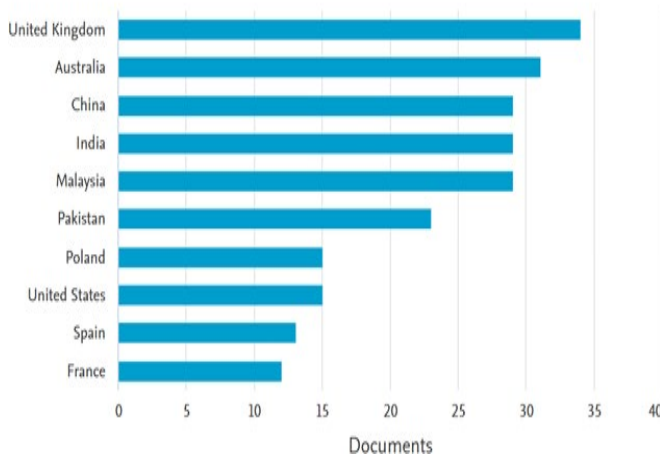
United Kingdom contributes to most number of research paper followed by Australia. India, China and Malysia have contributed equally by covering different industries including IT, Textile, Automobile etc. Tourism industry has maximum number of papers followed by hospitality industry.

TABLE 2: Research Approches

Research Approaches	No. of papers	Percentage
Quantitative	32	55.17
Qualitative	13	22.41
Mixed	7	12.07
Conceptual	6	10.34
Review	2	3.45

TABLE 3: Research Methods

Research Approaches	No. of papers	Percentage
Structural equation modeling	18	31.03
Factor Analysis	15	25.86
Correlation Analysis	14	24.14
Survey	7	12.07
Literature Review	2	3.45
Delphi Method	1	1.72
Network Model	1	1.72

Characteristics:

The concepts of Soft HRM (Beer, Spector, Lawrence, Mills, & Walton, 1984) and Hard HRM (Fombrun, Tichy, & Devanna, 1984) had a significant impact on the early discourse of human resource management.

Hard HRM focused on Quantitative aspects of HR, such as cost reduction, efficiency, and productivity while treating Treats employees as resources, similar to any other input in the production process.

It adopts a task-driven approach, emphasizing control and short-term goals. On the other side Soft HRM focused on employee well-being, development, and long- term success. While recognizing individuals' needs for self-actualization. It adopts an approach that treats professionals as individuals

The goal of human resource management is currently changing (Ehnert, 2014), and a multifaceted sustainable HRM model is beginning to emerge that considers factors other than just market-driven, short-term financial concerns and quarterly returns, such as workforce demographics and long-term impacts like biodiversity, urbanization, and climate change.

- Contradictory Outcomes: Sustainable HRM aims for positive outcomes in multiple areas (economic, social, environmental) simultaneously.

- Time span: This goal might be contradictory to organisation's short-term goals which causes a tension.

- Capability Development: Focuses on enhancing employees' skills and abilities.

- Positive and Negative Outcomes: Recognizes both potential and actual impacts of HR practices.

- HRM Activities: Attention to the development and implementation of HR practices.

- Values: Explicitly states values informing Sustainable HRM.

- Metrics: Designs metrics to promote sustainability

2. DISCUSSION

The sustainability-human resource management (S-HRM) literature can be categorized into four themes: economic orientation, social orientation, environmental orientation, and employee orientation. These themes are related to the common understanding that sustainability refers to long-term results.
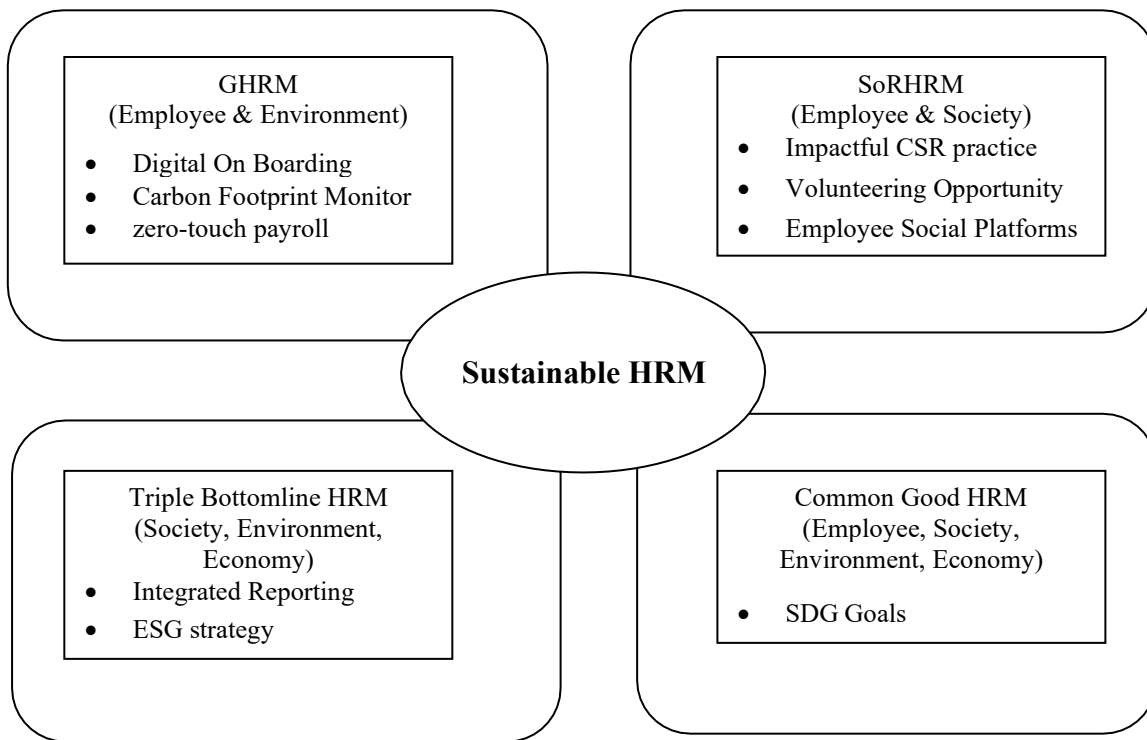
Comparison between GHRM, SoRHRM, TBL HRM and CGHRM

Green HRM(GHRM): Green HRM encompasses all facets and methods of HRM that aim to achieve environmental sustainability. It comprises implementing eco-friendly projects that increase productivity, cut expenses, and improve staff engagement and retention—all of which assist organizations in lowering their carbon footprints.

Socially Responsible HRM (SoRHRM): Human resource management that takes into account the needs of both the company and the employee is known as socially responsible HRM, or SoRHRM. This is making an effort to proactively improve employees' job experiences and to fulfil their personal and societal expectations in an ethical and socially responsible manner.

Triple Bottomline HRM: this kind of HRM concentrates on the social, economic, and environmental goals of HRM at the same time. Triple Bottom Line HRM may assist achieve financial gains by setting up systems and policies that impact social responsibility and sustainability of the environment. This is because it acknowledges that people, profits, and the planet are all closely interconnected.

Common Good HRM: This type of HRM looks from the outside in, putting the demands of the business or organization on par with the collective needs of the environment and society. This entails elevating the community it supports and having a positive impact on its surrounding as a company's fundamental responsibility.

TABLE 4: Antecedent- Practice- Outcome

Limitation and future research scope :

Systematic reviews can be affected by bias introduced during the review process. Methodological choices, study selection, and data extraction may inadvertently introduce inaccuracies. Only Scopus data was used for the study with subject Area – Business Management and Social Science Very few papers were available on CG HRM and TBL HRM and majority of the papers were from GHRM.

The present study unfolded multiple opportunities for the future scholars. The framework may provide practitioners an understanding of the factors impacting Sustainable HRM and enable organisations capture the same in reporting and design strategy to improve accordingly.

3. CONCLUSION

Sustainable human resource management (SHRM) goes beyond conventional HR procedures. It seeks to provide favourable results in the short- and long-term in the areas of profit, society, human welfare, and environment. It largely concerns personnel management that is consistent with sustainable objectives of the firm.

Impact, as defined by the GRI Standards, is the effect that an organization's operations or commercial partnerships have or may have on the environment, the economy, and people—including repercussions on their human rights. Actual or potential, negative or positive, short- or long-term, planned or unplanned, and reversible or irreversible are all possible outcomes. Therefore, more empirical study is required to fully examine the influence of SHRM in this field and create reliable models.

Healthy lifestyles, job satisfaction, and work-life balance are all enhanced by sustainable HRM practices. Performance and creativity inside a business are largely positively impacted by sustainable HR. Sustainable HRM promotes happiness, propels business success, and fits in with larger social objectives.

Studies that experimentally evaluate association are few, of the importance of workplace interventions causing an impact on Employee Sustainable Behaviour. (Paillé et al., 2014; Raineri & Paillé, 2016) will set the tone for future research.

REFERENCES

[1.] De Prins, P., Van Beirendonck, L., De Vos, A., & Segers, J. (2014). Sustainable HRM: Bridging theory and practice through the Respect Openness Continuity (ROC)

[2.] model. Management Revue, 25(4), 263–284. doi:10.1688/mrev-2014-04-Prins Doi

[3.] GRI. (2013b). Sustainability Topics for Sectors: What do stakeholders want to know?. Amsterdam. Retrieved from https://www.globalreporting.org/resourcelibrary/sustainability-topics.pdf

[4.] Macke, J., & Genari, D. (2019). Systematic literature review on sustainable human resource management. *Journal of Cleaner Production*, *208*, 806–815.

[5.] Alcaraz, J. M., Susaeta, L., Suarez, E., Colón, C., Gutiérrez-Martínez, I., Cunha, R.,

[6.] Leguizamón, F., Idrovo, S., Weisz, N., Correia, M. F., & Pin, J. R. (2017). The human resources management contribution to social responsibility and environmental sustainability: explorations from Ibero-America. *International Journal of Human Resource Management*, *30*(22), 3166–3189. https://doi.org/10.1080/09585192.2017.1350732

[7.] Ehnert, I., & Harry, W. (2012). Recent Developments and Future Prospects on Sustainable Human Resource Management: Introduction to the Special Issue. *Management-Revue*, *23*(3), 221–238. https://doi.org/10.5771/0935-9915-2012-3-221

[8.] Tabatabaei, S. a. N., Omran, E. S., Hashemi, S., & Sedaghat, M. (2017). Presenting Sustainable HRM Model Based on Balanced Scorecard in Knowledge-based ICT Companies (The Case of Iran). *Economics & Sociology*, *10*(2), 107–124. https://doi.org/10.14254/2071-

[9.] 789x.2017/10-2/8

[10.] Decrinis, L., Freibichler, W., Kaiser, M., Sunstein, C. R., & Reisch, L. A. (2023). Sustainable behaviour at work: How message framing encourages employees to choose electric

[11.] vehicles. *Business Strategy and the Environment*, *32*(8), 5650–5668. https://doi.org/10.1002/bse.3441

[12.] Kramar, R. (2014). Beyond strategic human resource management: Is sustainable human resource management the next approach? *International Journal of Human Resource Management*, 25(8), 1069–1089.

Building Theoretical Foundations and Practical Applications of Green HRM for Carbon Footprint Reduction

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ABSTRACT

This paper offers a thorough examination of Green Human Resource Management (Green HRM) and its effectiveness in minimizing organizational carbon footprints. The paper explores the essential elements of theory construction, including conceptualization, construct development, and hypothesis formulation, within the context of Green HRM practices. The evaluation of these theories is rigorously assessed through criteria such as validity, reliability, falsifiability, and generalizability, ensuring that the theoretical framework is sound and applicable. Additionally, the practical implementation of these theories is discussed, focusing on how they guide research design, empirical testing, and the enhancement of existing models. Through case studies of both successful applications and theoretical challenges, the paper provides valuable insights into the practical implications of Green HRM. The paper concludes by identifying future research opportunities, particularly the need for deeper investigation into the long-term impacts of Green HRM on sustainability and its potential integration with new technologies.

Keywords: Green HRM, Carbon Footprint Reduction, Theory Construction, Construct Development, Theory Evaluation, Empirical Validation, Sustainability, Organizational Impact

JEL Code

- **M14**: Corporate Culture; Diversity; Social Responsibility
- **Q56**: Environment and Development; Environment and Trade; Sustainability; Environmental Accounts and Accounting; Environmental Equity; Population Growth
- **O32**: Management of Technological Innovation and R&D

1. INTRODUCTION

The growing concern over climate change and its detrimental impact on the planet has driven both public and private sectors to seek innovative solutions to reduce greenhouse gas emissions and mitigate global warming. Among various organizational strategies aimed at promoting sustainability, Green Human Resource Management (Green HRM) has emerged as a critical approach that integrates environmental objectives into the traditional human resource management (HRM) framework. Green HRM encompasses a wide range of practices aimed at fostering an eco- friendly culture within organizations by aligning HRM policies with environmental sustainability goals. These practices include green recruitment, training and development, performance management, employee engagement, and reward systems, all designed to encourage environmentally responsible behavior among employees (Renwick, Redman, & Maguire, 2013).

The concept of Green HRM is grounded in the idea that human resource practices can play a pivotal role in promoting environmental sustainability within organizations. Traditionally, HRM has focused on optimizing the use of human capital to achieve organizational goals, with little attention paid to environmental concerns. However, with the increasing recognition of the importance of sustainability, HRM is now being redefined to include environmental considerations. This shift is driven by the understanding that employees are central to the successful implementation of environmental management initiatives and that their attitudes, behaviors, and actions can significantly influence an organization's environmental performance (Jabbour & Santos, 2008). One of the key drivers behind the adoption of Green HRM is the growing pressure on organizations to reduce their carbon footprint. The carbon footprint of an organization refers to the total amount of greenhouse gases (GHGs) emitted directly or indirectly by the organization's activities. Reducing the carbon footprint has become a critical objective for organizations seeking to comply with environmental regulations, enhance their corporate social responsibility (CSR) profile, and respond to stakeholder demands for greater environmental accountability. Green HRM practices can contribute to this goal by promoting energy efficiency, waste reduction, and sustainable resource use, all of which are essential for minimizing carbon emissions (Jackson, Renwick, Jabbour, & Muller-Camen, 2011).

2. THE ROLE OF GREEN RECRUITMENT AND SELECTION

Green recruitment and selection practices involve attracting and selecting candidates who are not only qualified for the job but also share the organization's commitment to environmental sustainability. This can be achieved by incorporating environmental criteria into job descriptions, interview questions, and selection processes. For example, organizations may prioritize candidates with experience in environmental management or a demonstrated commitment to sustainability in their previous roles. By hiring individuals with a strong environmental ethic, organizations can enhance their capacity to implement green initiatives effectively (Renwick et al., 2013).

Moreover, green recruitment can serve as a signaling mechanism to potential employees, indicating the organization's commitment to sustainability. This, in turn, can attract environmentally conscious candidates who are likely to be more motivated to engage in pro-environmental behaviors at work. The alignment between personal and organizational values is crucial for fostering a culture of sustainability, as it enhances employee engagement and commitment to environmental goals (Renwick et al., 2013).

3. GREEN TRAINING AND DEVELOPMENT

Green training and development programs are essential for equipping employees with the knowledge and skills needed to adopt sustainable practices in their daily work activities. These programs can cover a wide range of topics, including energy conservation, waste reduction, sustainable resource use, and the environmental impact of organizational activities. By raising awareness and building competencies in these areas, green training can empower employees to contribute to the organization's sustainability goals more effectively (Daily, Bishop, & Massoud, 2012).

In addition to formal training programs, organizations can also promote informal learning opportunities, such as workshops, seminars, and peer-to-peer learning, to reinforce green behaviors. For instance, employees can be encouraged to share best practices for reducing energy consumption or minimizing waste in the workplace. Such initiatives not only enhance employees' environmental knowledge but also foster a sense of collective responsibility for the organization's environmental performance (Jackson et al., 2011).

4. GREEN PERFORMANCE MANAGEMENT

Green performance management involves integrating environmental goals into the employee performance evaluation process. This can be achieved by setting specific, measurable, achievable, relevant, and time-bound (SMART) environmental objectives for employees and linking these objectives to performance appraisals and reward systems. By holding employees accountable for their environmental

impact, organizations can incentivize behaviors that contribute to reducing the carbon footprint (Milliman & Clair, 2017).

For example, an organization might set targets for reducing energy consumption, minimizing waste, or increasing the use of renewable resources. Employees who meet or exceed these targets can be recognized and rewarded through bonuses, promotions, or other incentives. This approach not only motivates employees to engage in pro-environmental behaviors but also aligns individual performance with the organization's broader sustainability objectives (Renwick et al., 2013).

5. BUILDING A THEORY ON THE IMPACT OF GREEN HRM ON CARBON FOOTPRINT REDUCTION

1. Conceptualization: Identifying and Defining Key Concepts and Constructs

Conceptualization involves identifying and defining the core concepts and constructs that form the foundation of a theory. In the context of Green Human Resource Management (Green HRM) and its impact on reducing the carbon footprint, three primary constructs are central to the theory: Green HRM, Carbon Footprint, and Environmental Sustainability.

- **Green Human Resource Management (Green HRM):** Green HRM refers to the systematic incorporation of environmental management practices into human resource management processes. It encompasses a variety of HR activities aimed at promoting environmental sustainability, such as green recruitment, training, performance management, and employee engagement. Green HRM seeks to align employee behaviors with the organization's environmental objectives, thereby fostering a culture of sustainability (Renwick, Redman, & Maguire, 2013).

- **Carbon Footprint:** The carbon footprint of an organization is a quantifiable measure of the total greenhouse gases (GHGs) emitted directly or indirectly by the organization's activities, usually expressed in carbon dioxide equivalents (CO_2e). These emissions stem from various sources, including energy consumption, transportation, waste management, and operational processes. Reducing an organization's carbon footprint is a critical aspect of its environmental responsibility and a key driver of Green HRM initiatives (Wiedmann & Minx, 2008).

- **Environmental Sustainability:** Environmental sustainability refers to practices that ensure the preservation of the natural environment for future generations. It includes the efficient use of resources, minimization of waste and pollution, and protection of ecosystems. In the context of Green HRM,

environmental sustainability is achieved by promoting eco-friendly practices and behaviors within the organization, thereby contributing to the reduction of its carbon footprint (Dyllick & Hockerts, 2002).

These constructs provide a conceptual framework for understanding the relationship between Green HRM practices and the reduction of an organization's carbon footprint. By integrating these concepts, the theory aims to explain how specific HR practices can influence an organization's environmental performance.

Here's a simplified diagram illustrating the **Conceptualization** process for identifying and defining key concepts and constructs related to Green HRM and Carbon Footprint Reduction:

- This simplified figure and process help in clarifying the key components involved in conceptualizing a theory, setting the foundation for further research and analysis
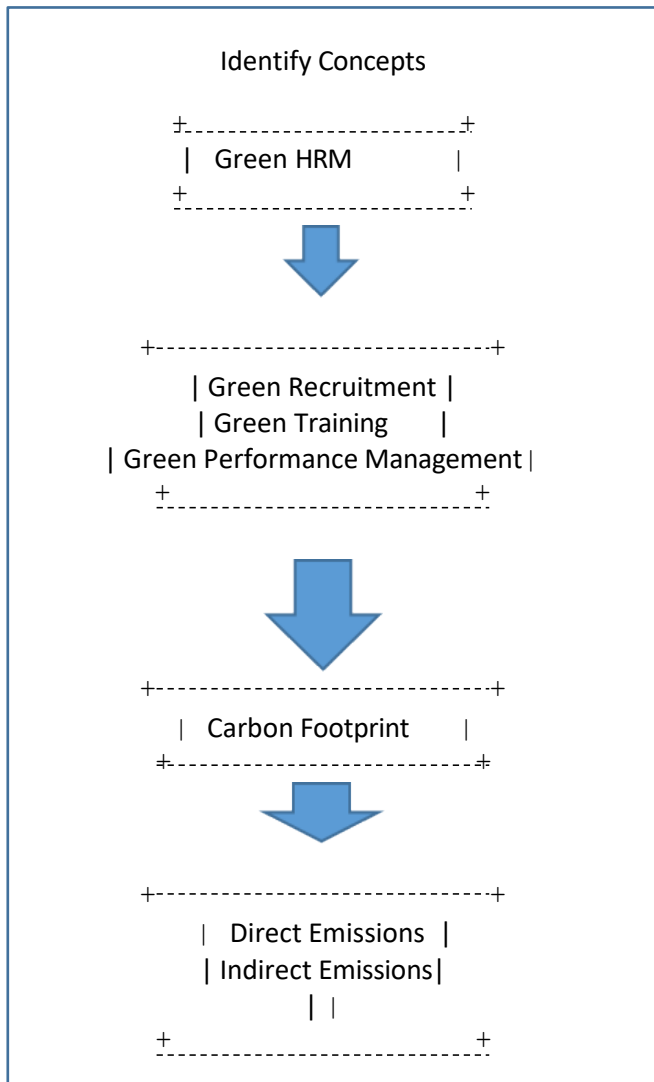
6. EXPLANATION

1. Identify Concepts:

- The first step involves identifying the main concepts, such as **Green HRM** and **Carbon Footprint.**

2. Define Constructs:

- Each concept is then broken down into specific constructs, like **Green Recruitment**, **Green Training**, and **Green Performance** for Green HRM, and **Direct Emissions**, **Indirect Emissions**, and **Supply Chain** for Carbon Footprint.

2. Construct Development: Operationalizing Constructs

Construct development is the process of defining the dimensions and variables associated with the identified constructs, making them measurable and testable.

- **Operationalizing Green HRM:** Green HRM can be operationalized by identifying specific HR practices that contribute to environmental sustainability. Key dimensions include:

  o **Green Recruitment and Selection:** This dimension involves attracting and selecting candidates who demonstrate a commitment to sustainability. Variables might include the use of environmental criteria in job descriptions, green interview questions, and the recruitment of candidates with experience in environmental management (Renwick et al., 2013).

  o **Green Training and Development:** This involves providing employees with the necessary knowledge and skills to engage in sustainable practices. Variables include the availability of environmental training programs, frequency of sustainability workshops, and the integration of green topics into employee development plans (Daily, Bishop, & Massoud, 2012).

  o **Green Performance Management:** This dimension includes the setting of environmental objectives for employees, integrating these into performance evaluations, and linking them to reward systems. Variables could include the presence of green performance indicators and the use of incentives to promote environmentally friendly behaviors (Milliman & Clair, 2017).

- **Operationalizing Carbon Footprint:** The carbon footprint can be operationalized by measuring the GHG emissions associated with an organization's activities. Key dimensions include:

  o **Energy Consumption:** Variables include total energy use, the proportion of energy from

renewable sources, and energy efficiency improvements (Wiedmann & Minx, 2008).

- o **Waste Management:** Variables might include the amount of waste generated, recycling rates, and waste reduction initiatives (Jackson, Renwick, Jabbour, & Muller-Camen, 2011).

- o **Transportation:** Variables include the total distance traveled for work purposes, transportation emissions, and the use of eco-friendly transportation options (Renwick et al., 2013).

- **Operationalizing Environmental Sustainability:** Environmental sustainability can be operationalized through indicators of environmental performance, such as:

- o **Resource Efficiency:** Variables include resource use per unit of output and improvements in resource efficiency (Dyllick & Hockerts, 2002).

- o **Pollution Reduction:** Variables could include reductions in pollutants like CO2 and NOx emissions, and the adoption of cleaner technologies (Jackson et al., 2011).

- o **Biodiversity Protection:** Variables might include initiatives to protect local ecosystems and biodiversity (Wiedmann & Minx, 2008).

These operationalized constructs enable empirical testing of the relationships between Green HRM practices, carbon footprint reduction, and environmental sustainability.

3. HYPOTHESIS FORMULATION: CREATING TESTABLE PROPOSITIONS

Hypothesis formulation involves developing testable propositions that link the constructs, allowing for empirical investigation.

Based on the conceptualization and construct development, the following hypotheses can be formulated:

- **H1: Green recruitment and selection practices are positively associated with a reduction in the organization's carbon footprint.** This hypothesis suggests that organizations that prioritize environmental criteria in their recruitment processes are more likely to reduce their carbon emissions through the alignment of employee behaviors with environmental goals (Renwick et al., 2013).

- **H2: Green training and development programs have a positive impact on employees' adoption of eco-friendly practices, leading to a lower carbon footprint.** This hypothesis posits that providing employees with sustainability-focused training enhances

their ability to engage in practices that reduce the organization's environmental impact (Daily et al., 2012).

- **H3: The integration of environmental objectives into performance management systems is positively correlated with the reduction of the organization's carbon footprint.** This hypothesis proposes that when employees are held accountable for their environmental performance, they are more likely to engage in behaviors that contribute to sustainability goals (Milliman & Clair, 2017).

- **H4: The overall adoption of Green HRM practices is positively associated with enhanced environmental sustainability within the organization.** This hypothesis suggests that organizations that systematically implement Green HRM practices are more likely to achieve broader sustainability outcomes, including reduced resource use, lower pollution levels, and enhanced biodiversity protection (Dyllick & Hockerts, 2002).

These hypotheses provide a framework for empirical testing, allowing researchers to examine the impact of Green HRM practices on carbon footprint reduction and overall environmental sustainability.

4. CONTEXTUAL RELEVANCE: ENSURING THE THEORY IS RELEVANT TO THE SPECIFIC CONTEXT

Contextual relevance is crucial for ensuring that the theory developed is applicable to the specific field of study. In this case, the relevance of the theory to organizations seeking to reduce their carbon footprint and enhance sustainability is paramount.

- **Industry Relevance:** The theory is particularly relevant to industries with significant environmental impacts, such as manufacturing, energy, and transportation. In these sectors, reducing the carbon footprint is a critical component of corporate social responsibility (CSR) and regulatory compliance. Green HRM practices can play a pivotal role in helping these organizations meet environmental regulations and achieve sustainability goals (Jackson et al., 2011).

- **Geographical Relevance:** The theory is also relevant in regions where environmental regulations are stringent and where there is strong public and governmental pressure on organizations to adopt sustainable practices. For example, in the European Union, where carbon reduction targets are legally binding, the adoption of Green HRM can be a key strategy for organizations to comply with these requirements (Renwick et al., 2013).

- **Organizational Relevance:** The theory is applicable to organizations of all sizes, although its impact may vary depending on the organization's resources and

capabilities. Large organizations with significant HR resources may be able to implement comprehensive Green HRM strategies, while smaller organizations may focus on specific aspects, such as green recruitment or training. The theory provides a flexible framework that can be adapted to different organizational contexts (Dyllick & Hockerts, 2002).

By ensuring contextual relevance, the theory on Green HRM and carbon footprint reduction can be effectively applied across various industries, regions, and organizational types, making it a valuable tool for advancing environmental sustainability.

7. EVALUATING A THEORY

The evaluation of a theory is a critical phase in the theoretical development process. It ensures that the theory is not only logically sound but also applicable, testable, and reliable in various contexts.

This section discusses the key criteria for evaluating a theory: validity and reliability, falsifiability, and generalizability.

8. VALIDITY AND RELIABILITY

Validity refers to the accuracy of a theory in measuring what it is intended to measure, while **reliability** concerns the consistency of the results obtained from the theory across different studies and applications.

- **Construct Validity:** Construct validity involves ensuring that the theoretical constructs are well-defined and accurately represent the concepts they intend to measure. For a theory on the impact of Green HRM on carbon footprint, construct validity would require that the constructs of Green HRM practices and carbon footprint are operationalized in a manner that truly reflects their underlying meanings (Cronbach & Meehl, 1955). This could involve the use of validated scales for measuring Green HRM practices and well-established methodologies for calculating carbon footprints.

- **Internal Consistency:** Internal consistency refers to the extent to which different components of the theory yield consistent results. A theory with high internal consistency ensures that the relationships between its constructs, such as Green HRM practices and carbon footprint reduction, hold true across different samples and settings (Nunnally & Bernstein, 1994). For example, if green training consistently leads to lower carbon emissions across multiple studies, the theory would be considered reliable.

- **Empirical Support:** The robustness of a theory is also evaluated based on empirical evidence. A theory gains credibility if it is consistently supported by data from multiple studies conducted in various contexts (Shadish,

Cook, & Campbell, 2002). In the case of Green HRM, empirical studies showing a significant reduction in carbon footprints as a result of implementing green HRM practices would provide strong support for the theory.

2. Falsifiability

Falsifiability is a fundamental criterion for evaluating a theory, as posited by philosopher Karl Popper (1959). A theory must be structured in a way that allows it to be tested and potentially

disproven. If a theory cannot be falsified, it lacks scientific rigor and cannot be empirically validated.

- **Importance of Falsifiability:** For the theory on Green HRM and carbon footprint reduction, falsifiability is crucial. Researchers should be able to test whether specific Green HRM practices, such as green recruitment or green performance management, actually lead to measurable reductions in carbon emissions. If the theory is falsifiable, it allows for the possibility that certain Green HRM practices may not have the expected impact, thereby refining the theory and improving its accuracy (Popper, 1959).

- **Testing Hypotheses:** The hypotheses derived from the theory should be formulated in a way that they can be empirically tested and potentially refuted. For example, the hypothesis that "Green recruitment and selection practices are positively associated with a reduction in the organization's carbon footprint" should be testable through data collection and analysis. If empirical results do not support this hypothesis, the theory may need to be revised or rejected.

3. Generalizability

Generalizability refers to the extent to which the findings and principles of a theory can be applied to different contexts, populations, and settings beyond the original study.

- **Contextual Application:** For a theory to be useful, it should be applicable across various industries, geographical regions, and organizational types. The theory on Green HRM and carbon footprint reduction should be generalizable to different sectors, including manufacturing, services, and technology, and should hold true in diverse cultural and regulatory environments (Yin, 2014). For instance, while the theory may have been developed in the context of large corporations in developed countries, it should also be relevant to small and medium enterprises (SMEs) in developing countries.

- **Limitations of Generalizability:** It is also important to recognize the limitations of a theory's generalizability. Not all theories can be universally applied, and certain contextual factors may limit the applicability of the

Green HRM theory. For example, in regions with limited regulatory pressure for sustainability, the adoption of Green HRM practices may not have the same impact on carbon footprint reduction as in regions with stringent environmental regulations. Acknowledging these limitations allows for a more nuanced application of the theory (Lee & Baskerville, 2003).

9. APPLYING THEORY IN RESEARCH

The application of theory in research is crucial for designing robust studies, testing hypotheses, and refining or extending theoretical frameworks. This section discusses how theory guides research design, supports theory testing, and facilitates the refinement and extension of theories based on empirical findings.

1. Research Design

Theoretical frameworks play a fundamental role in shaping the research design, including the selection of methodology, data collection techniques, and analysis strategies.

- **Guiding Methodology:** A well-defined theory helps in choosing an appropriate research methodology that aligns with the objectives of the study. For instance, in investigating the impact of Green HRM on carbon footprint, the theory might suggest using quantitative methods such as surveys or experimental designs to measure the relationship between Green HRM practices and carbon emissions (Creswell, 2013). The chosen methodology should be capable of capturing the constructs and their relationships as posited by the theory.

- **Data Collection:** Theory informs the operationalization of constructs, guiding the development of instruments for data collection. If the theory posits that green training leads to reduced carbon footprints, then the data collection process should include metrics for both green training initiatives and carbon footprint measurements (Eisenhardt, 1989). This ensures that the data collected is directly relevant to the theoretical constructs being studied.

- **Data Analysis:** The theory also directs the analytical approach. For example, structural equation modeling (SEM) could be employed to test the relationships between multiple Green HRM practices and carbon footprint outcomes simultaneously, providing a comprehensive assessment of the theory's predictions (Hair et al., 2010).

2. Theory Testing

Empirical research plays a critical role in testing the relationships proposed by a theory. Theory testing involves the application of empirical methods to validate or refute the hypotheses derived from the theory.

- **Empirical Validation:** The process of theory testing begins with formulating testable hypotheses based on the theoretical framework. These hypotheses are then subjected to empirical investigation using statistical techniques such as regression analysis, SEM, or other appropriate methods (Cohen et al., 2003). For example, a hypothesis stating that "Green performance management is negatively associated with carbon emissions" can be tested by analyzing data collected from organizations that have implemented such practices.

- **Confirming or Refuting Hypotheses:** The results of empirical tests either confirm the theory's predictions, thereby supporting the theory, or they refute the hypotheses, indicating that the theory may need revision (Shadish, Cook, & Campbell, 2002). A significant negative relationship between Green HRM practices and carbon footprint would validate the theory, while a non-significant or positive relationship might suggest the need for reevaluation.

3. Theory Extension and Refinement

Research findings often lead to the refinement, extension, or even rejection of existing theories, contributing to the evolution of knowledge in the field.

- **Refinement:** If empirical evidence only partially supports the theory, researchers may refine the theory by adjusting the constructs, variables, or relationships. For instance, if Green HRM practices are found to reduce carbon footprints only in specific industries, the theory may be refined to include industry as a moderating variable (Whetten, 1989).

- **Extension:** When research uncovers new variables or relationships not previously considered, the theory may be extended to include these elements. For example, the discovery that organizational culture significantly influences the effectiveness of Green HRM practices could lead to the extension of the theory to incorporate cultural factors (Dubin, 1978).

- **Rejection:** In cases where empirical evidence consistently contradicts the theory's predictions, the theory may need to be rejected or fundamentally restructured. This process is essential for scientific progress, as it encourages the development of more accurate and comprehensive theories (Lakatos, 1970).

Theoretical Contributions

The development of a robust theory extends beyond its academic significance; it also involves making meaningful contributions that advance knowledge, inform practice, and

adhere to ethical standards. This section discusses the key aspects of theoretical contributions: novelty, practical implications, and ethical considerations.

1. Novelty

Novelty in theoretical contributions refers to the introduction of new insights, perspectives, or frameworks that enhance the understanding of a particular phenomenon. The uniqueness of a theory is a key determinant of its value and relevance in the academic community.

- **Contributing New Insights:** A theory that offers novel perspectives can challenge existing paradigms and encourage new lines of inquiry. For instance, the development of a theory that connects Green HRM practices to the reduction of carbon footprints introduces a fresh perspective on how human resource management can play a crucial role in sustainability efforts. This contribution is particularly valuable in the context of the growing emphasis on corporate social responsibility and environmental stewardship (Corley & Gioia, 2011).

- **Expanding Existing Frameworks:** Novelty can also be achieved by extending existing theoretical frameworks to include new variables, relationships, or contexts. For example, integrating organizational culture as a moderating variable in the Green HRM-carbon footprint theory expands the existing framework, providing a more comprehensive understanding of how various factors interact to influence sustainability outcomes (Whetten, 1989). Such contributions help bridge gaps in current knowledge and open avenues for further research.

2. Practical Implications

The **practical implications** of a theory refer to its potential impact on management practices and decision-making processes. A theory that is grounded in real-world applications can guide managers in implementing effective strategies and policies.

- **Informing Management Practice:** Theories that offer actionable insights are particularly valuable in the business world. The theory of Green HRM and its impact on carbon footprint reduction can inform organizational leaders on how to implement HRM practices that not only improve employee engagement but also contribute to environmental sustainability. For instance, by adopting green training programs, organizations can foster a culture of sustainability that leads to tangible reductions in carbon emissions (Mintzberg, 2005).

- **Decision-Making:** Theoretical contributions that enhance decision-making processes are crucial for the practical application of knowledge. A well-developed theory can provide managers with a framework for evaluating the potential outcomes of various HRM practices on their organization's environmental performance. This can lead to more informed, strategic decisions that align with both business goals and sustainability objectives (Eisenhardt & Zbaracki, 1992).

3. Ethical Considerations

Ethical considerations are integral to the development and application of any theory. Ensuring that theoretical frameworks adhere to ethical standards is essential for maintaining the integrity and credibility of research.

- **Ethical Research Practices:** The development of a theory should be based on ethical research practices, including honesty, transparency, and respect for the rights of participants. In the context of Green HRM, researchers must ensure that their studies do not exploit workers or misrepresent the environmental impact of HRM practices. Ethical considerations also extend to the responsible use of data, ensuring that findings are reported accurately and without bias (Resnik, 2015).

- **Application of Theory:** The application of a theory should also be guided by ethical principles. For example, organizations implementing Green HRM practices based on theoretical recommendations should do so in a way that genuinely promotes sustainability rather than engaging in "greenwashing" to enhance their public image. Ethical theories and practices ensure that the benefits of Green HRM extend to all stakeholders, including employees, customers, and the broader community (Donaldson & Preston, 1995).

10. CASE STUDIES AND EXAMPLES

The development and application of theories in management research can be better understood through illustrative case studies and examples. These examples highlight successful theory development, provide insights into practical applications, and offer lessons from instances where theories did not withstand empirical testing.

1. Illustrative Examples

Illustrative examples serve as powerful tools for demonstrating the real-world application of theoretical frameworks. They provide concrete evidence of how theories can guide management practices and inform strategic decision-making.

- **Green HRM and Organizational Sustainability:** One notable example is the development and application of Green HRM practices in multinational corporations like Unilever. Unilever has integrated sustainability into its HR practices by promoting green training, performance management, and employee engagement initiatives focused on reducing the company's carbon footprint (Buller & McEvoy, 2016). This application of Green

HRM theory has resulted in measurable improvements in environmental performance, demonstrating the theory's practical relevance and effectiveness in driving sustainability outcomes. Unilever's success in reducing its carbon emissions while maintaining profitability serves as an illustrative case of how theoretical insights can be operationalized to achieve real-world results.

- **Resource-Based View (RBV) in Strategic Management:** The Resource-Based View (RBV) of the firm is another example of successful theory development and application. The RBV, which posits that a firm's competitive advantage is derived from its unique resources and capabilities, has been widely adopted in strategic management research (Barney, 1991). Companies like Apple have successfully applied this theory by leveraging their unique resources, such as brand reputation and innovation capabilities, to maintain a competitive edge in the technology industry. This case illustrates how a well-developed theory can provide a strong foundation for both academic research and practical application.

2. Learning from Failures

Learning from failures in theory development and application is equally important, as it offers valuable lessons that can lead to the refinement of existing theories or the development of new ones.

- **Theories on Corporate Governance Post-Enron:** The collapse of Enron is a case where existing theories on corporate governance were tested and found lacking. Before Enron's bankruptcy in 2001, theories on corporate governance emphasized the importance of board structure and the role of independent directors in preventing corporate malfeasance (Clarke, 2005). However, Enron's failure exposed significant gaps in these theories, particularly regarding the effectiveness of governance mechanisms in the face of complex financial manipulations. The lessons learned from this failure led to the development of more robust governance theories that incorporate broader considerations, such as ethical leadership and organizational culture, and have informed regulatory changes like the Sarbanes-Oxley Act of 2002.

- **The Downfall of Nokia:** Another example of theory failure is Nokia's decline in the smartphone market. Theories on dynamic capabilities suggested that firms could maintain competitive advantage by continuously adapting to technological changes (Teece, Pisano, & Shuen, 1997). However, Nokia's inability to transition quickly to the smartphone era, despite its strong market position and resources, challenged the universality of this theory. Nokia's failure highlighted the limitations of dynamic capabilities when faced with disruptive innovation and emphasized the need to consider additional factors, such as organizational inertia and the speed of market changes, in theoretical models.

11. CONCLUSION

The development, evaluation, and application of theories in management research are foundational to advancing both academic knowledge and practical management practices. This paper has explored critical aspects of theory building, including conceptualization, construct development, hypothesis formulation, and ensuring contextual relevance. Additionally, the evaluation of theories has been discussed through the lenses of validity, reliability, falsifiability, and generalizability. Moreover, the application of theories in research was examined, focusing on research design, theory testing, and the refinement or extension of existing theories. Finally, theoretical contributions, illustrative examples, and case studies provided insights into the impact and importance of robust theory development.

1. Synthesis of Key Points

Theory Building begins with conceptualization, where key concepts and constructs are identified and defined. This is followed by construct development, which involves operationalizing these constructs into measurable variables and dimensions. Hypothesis formulation is the next critical step, where testable propositions linking these constructs are created. Ensuring that a theory is contextually relevant to its field of study is crucial for its acceptance and applicability.

Theory Evaluation is vital to ascertain the robustness and applicability of the developed theory. Validity and reliability ensure that the constructs accurately represent the concepts they intend to measure, and that the theory is consistent across different scenarios. Falsifiability is a necessary criterion, allowing the theory to be tested and potentially disproven, thereby contributing to scientific rigor. Generalizability is also essential, as it determines the extent to which the theory can be applied across different contexts and settings.

Theory Application involves using the theory to guide research design, including the selection of methodology, data collection, and analysis. Empirical testing of the theory is crucial for validating the proposed relationships between constructs. The findings from such research can lead to the refinement, extension, or even rejection of existing theories, contributing to the evolution of knowledge in the field.

2. Future Directions

Looking forward, several areas warrant further exploration. Future research could focus on refining the operationalization of constructs in Green HRM to better capture its impact on carbon footprint reduction. There is also a need to explore the interplay between organizational culture and Green HRM practices in different industries and cultural contexts. Additionally, research should investigate

the long-term effects of Green HRM on both environmental sustainability and organizational performance, providing a more comprehensive understanding of its benefits and limitations.

Moreover, the integration of new technologies, such as artificial intelligence and big data analytics, into Green HRM practices presents a promising area for future research. These technologies could offer innovative ways to measure and manage the environmental impact of HR practices, thereby enhancing the accuracy and effectiveness of Green HRM strategies.

Finally, there is a need for more empirical studies that test and refine the theories discussed in this paper across diverse organizational settings. Such studies will not only validate the theories but also contribute to their generalizability and practical relevance.

REFERENCES

[1.] Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

[2.] Buller, P. F., & McEvoy, G. M. (2016). A model for implementing a sustainable business strategy: The theory of the firm as the foundation for progressive corporate sustainability. *Journal of Leadership & Organizational Studies, 23*(3), 243-259.

[3.] Clarke, T. (2005). Accounting for Enron: Shareholder value and stakeholder interests. *Corporate Governance: An International Review, 13*(5), 598-612.

[4.] Corley, K. G., & Gioia, D. A. (2011). Building theory about theory building: What constitutes a theoretical contribution? *Academy of Management Review, 36*(1), 12-32.

[5.] Daily, B. F., Bishop, J. W., & Massoud, J. A. (2012). The role of training and empowerment in environmental performance: A study of the Mexican maquiladora industry. *International Journal of Operations & Production Management, 32*(5), 631-647.

[6.] Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review, 20*(1), 65-91.

[7.] Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment, 11*(2), 130-14

[8.] Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin, 52*(4), 281-302.

[9.] cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences (3rd ed.). Lawrence Erlbaum Associates.

[10.] Creswell, J. W. (2013). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (4th ed.). Sage Publications.

[11.] Dubin, R. (1978). Theory Building. Free Press.

[12.] Eisenhardt, K. M., & Zbaracki, M. J. (1992). Strategic decision making. *Strategic Management Journal, 13*(S2), 17-37.

[13.] Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532-550.

[14.] Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2010). *Multivariate Data Analysis* (7th ed.). Pearson.

[15.] Jabbour, C. J. C. (2011). How green are HRM practices, organizational culture, learning, and teamwork? A Brazilian study. *Industrial and Commercial Training, 43*(2), 98-105.

[16.] Jabbour, C. J. C., Santos, F. C. A., & Nagano, M. S. (2010). Contributions of HRM throughout the stages of environmental management: Methodological triangulation applied to companies in Brazil. *The International Journal of Human Resource Management, 21*(7), 1049-1089.

[17.] Jackson, S. E., Renwick, D. W., Jabbour, C. J. C., & Muller-Camen, M. (2011). State-of- the-art and future directions for green human resource management: Introduction to the special issue. *Zeitschrift für Personalforschung, 25*(2), 99-116.

[18.] Lakatos, I. (1970). *Criticism and the Growth of Knowledge*. Cambridge University Press.

[19.] Lee, A. S., & Baskerville, R. L. (2003). Generalizing generalizability in information systems research.

[20.] *Information Systems Research, 14*(3), 221-243.

[21.] Mintzberg, H. (2005). *Strategy Bites Back: It Is Far More, and Less, than You Ever Imagined*. Pearson Education.

[22.] Milliman, J., & Clair, J. (2017). Best environmental HRM practices in the US. In S. E. Jackson, D. W. Renwick, C. J. C. Jabbour, & M. Muller-Camen (Eds.), *Green Human Resource Management: A Global Perspective* (pp. 100-116). Routledge.

[23.] Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

[24.] Popper, K. (1959). *The Logic of Scientific Discovery*. Hutchinson.

[25.] Resnik, D. B. (2015). What is ethics in research & why is it important? *National Institute of Environmental Health Sciences*. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm

[26.] Renwick, D. W. S., Redman, T., & Maguire, S. (2013). Green human resource management: A review and research agenda. *International Journal of Management Reviews, 15*(1), 1-14.

[27.] Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Houghton Mifflin.

[28.] Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management.

[29.] *Strategic Management Journal, 18*(7), 509-533.

[30.] Whetten, D. A. (1989). What constitutes a theoretical contribution? *Academy of Management Review, 14*(4), 490-495.

[31.] Wiedmann, T., & Minx, J. (2008). A definition of 'carbon footprint'. *Ecological Economics Research Trends, 1*, 1-11.

[32.] Yin, R. K. (2014). *Case Study Research: Design and Methods* (5th ed.). Sage Publications.

Sustainable Business – A Study on Employee Mindfulness in the Healthcare Sector

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ABSTRACT

The growing need for the healthcare sector due to prevailing diseases demands efficient healthcare employees. They play a pivotal role in ensuring quality deliverables enabling the sustainability of healthcare organisations. Amidst the challenges in the job performance, mindfulness and emotional intelligence have gained attention as a potential intervention to enhance employee performance. This research paper investigates the relationship between mindfulness, organizational culture, ethical practices and employee job performance with the support of the Self Determination Theory. This research paper has adopted a quantitative approach. Primary data was gathered from 409 allopathic doctors working in private hospitals. The data has been analysed and the hypotheses have been tested using PLS-SEM. The goodness of fit values are acceptable with GFI value of 0.97 and SRMR of 0.1. By tackling the existing gaps in research concerning mindfulness, the model clarifies the complex interconnections among organization culture, emotional intelligence, ethical practices, and employee performance factors. It demonstrates that mindfulness can influence employee performance both directly and indirectly, with ethical practices serving as a vital mediating factor in this relationship. It also demonstrates that organization culture and emotional intelligence can influence employee performance indirectly, with ethical practices as a significant mediating factor. This comprehensive insight not only enriches the existing literature but also offers valuable guidance for healthcare sector leaders and human resource professionals aiming to provide work-life balance, reduce stress and improve employee performance. Through mindfulness, healthcare employees can improve their cognitive abilities, manage their emotions more effectively, and develop better interpersonal skills.

Keywords: Mindfulness, Organization Culture, Ethical Practices, Self Determination Theory, Emotional Intelligence, Healthcare, Employee Performance

1. INTRODUCTION

Ongoing development within the workplace demands continuous investigation into the dynamics of employee behaviour within the organization. Factors influencing employee performance have been identified within a comprehensive organizational framework (Al- kharabsheh et al., 2023), examined in relation to leadership characteristics (Arifuddin et al., 2023), human resource management strategies, and employee attitudes in the corporate environment. Recent studies have focused on aspects such as mindfulness (Fitzhugh et al., 2023; He et al., 2023; Young et al., 2023) and employee performance (S. Zada et al., 2023). Although these factors have consistently been linked to employee performance, there is a pressing need for an updated model in this field. Efforts were made to review literature that elucidates the causal relationships among these three employee variables in academic databases. Amidst this backdrop, the practice of mindfulness has emerged as a potential solution, offering individuals the tools to cultivate self-awareness, reduce stress, and enhance their overall well-being (Kumprang & Suriyankietkaew, 2024).

In the high-pressure and highly demanding healthcare industry, fostering mindfulness among healthcare professionals is absolutely essential (Dsouza et al., 2023).

Mindfulness is not merely a luxury but rather a fundamental necessity in this field, given that the health and well-being of patients depend heavily on the competency and emotional resilience of these dedicated individuals. The emphasis on mindfulness within the healthcare workforce is firmly grounded in the belief that it not only enhances clinical practice but also serves as a powerful antidote to burnout while promoting a culture of compassionate patient care. Through comprehensive mindfulness training programs, the overarching goal is to equip healthcare staff with valuable tools to effectively manage the stress that often accompanies their roles, enhance their capacity to maintain unwavering focus, and ultimately cultivate a deeper sense of empathy in their interactions with patients, thereby elevating the overall quality of healthcare delivery. A number of sources such as Dell USA (2020), How Mindfulness Can Shape Company Culture (2019), and How to cultivate mindfulness in the workplace by Culture Amp (2023) have emphasized the significance of mindfulness in organizational culture. Mindfulness has been integrated into company culture with a view of enhancing employee emotional intelligence, productivity, creativity and performance. Establishing a mindful culture entails setting intentions, reflecting, avoiding multitasking, and following best practices for bringing mindfulness to work.

The literature suggests that promotion of prosocial behavior among employees through fostering mindfulness will not only improve their emotional quotient but also enhance their productivity at work and performance. Further research is needed to understand how mindfulness influences organizational culture and to replicate these findings in different workplace settings. The ability to be mindful is related to higher levels of emotional intelligence, which in turn lead to greater positive feelings, lesser negative feelings, and enhanced life satisfaction (Li et al., 2022). This holds a crucial implication for medical practitioners since (Jiménez-Picón et al., 2021) highlights how mindfulness and emotional intelligence serve as a buffer against imbalance in emotions by promoting balance, awareness, and control among others. Furthermore, (Kaplunenko & Kuchyna, 2023) has found out that previous meditation counts towards emotional intelligence and awareness which are key components of mindfulness.

Most research on organizational culture and ethical practices focuses on general organizational settings rather than the specific context of hospitals. Hospitals present unique ethical dilemmas and cultural challenges that differ significantly from other workplaces. Therefore, there is a need for context-specific studies that explore how organizational culture and ethical practices specifically affect hospital employees' performance. The potential moderating or mediating effects of organizational culture and ethical practices on the relationship between these psychological factors and work performance remain largely unexplored. These research gaps have been addressed to develop a comprehensive understanding of how mindfulness, emotional intelligence, organizational culture, and ethical practices collectively influence the work performance of hospital employees. This understanding leads to more effective, integrated interventions and policies tailored to the unique demands of the healthcare sector, ultimately improving employee well-being and patient care.

2. REVIEW OF LITERATURE

Emergency care nurses recognized that the awareness and transformations resulting from mindfulness training positively impacted themselves, their colleagues, and the patients they serve. The findings also shed light on the difficulties of practicing mindfulness in a fast-paced emergency care environment and the practical considerations of utilizing a smartphone application for mindfulness training (Trygg Lycke et al., 2023). Poor health practices, particularly inadequate sleep, also play a role in the escalation of burnout. To address these challenges, three types of interventions can be implemented. Modifications to the workplace environment can mitigate compassion fatigue among nurses. Incorporating yoga with mindfulness practices is essential for reducing stress levels, which in turn can alleviate burnout. Furthermore, enhancing resilience through self-care techniques and healthy lifestyle choices, such as adequate sleep and guided imagery, can combat burnout effectively (Balaoing, 2023). Several studies across various industries have suggested that mindfulness practices can lead to reduced burnout, increased job satisfaction, and improved decision-making skills. These benefits are particularly relevant to healthcare professionals who face high levels of stress and emotional demands. Mindfulness appears to hold promise as a tool for enhancing employee performance in the health sector, given its potential to reduce stress and improve emotional regulation. While existing studies provide valuable insights, more rigorous research is needed to establish causality, explore diverse healthcare roles, and consider contextual factors. Understanding the impact of mindfulness on employee performance in the health sector is crucial for improving the quality of healthcare delivery and the well-being of healthcare professionals (Sunardi & Tatariyanto, 2023)

In todays paced and demanding work environment companies are increasingly exploring ways to improve employee well-being and job performance. Mindfulness, described as the awareness of experiences has garnered attention as a potential method to enhance employee outcomes (Gajda & Zbierowski, 2023). The practice of mindfulness has been linked to decreased stress levels, improved focus, better emotional control and enhanced cognitive skills (Khari & Bali, 2024). Mindfulness, an idea, in positive psychology has shown to boost an individual's ability to effectively utilize their personal resources in work related tasks. Individuals who engage in mindfulness have been noted to handle workplace stress demonstrate stronger problem solving abilities make sound decisions and achieve higher performance levels. Companies like Apple, Aetna, Procter & Gamble and General Mills are actively providing mindfulness training programs for their employees with the expectation that it will positively impact employee well-being and motivation (Murtaza et al., 2024). Healthcare professionals, including doctors, nurses, and allied health workers, operate under immense pressure and face challenges such as long working hours, high patient loads, and emotionally charged environments. These conditions can lead to burnout, job dissatisfaction, and decreased performance, ultimately affecting patient outcomes. Therefore, understanding and enhancing the factors that contribute to job performance is paramount. The work environment in hospitals is inherently challenging due to the high-stakes nature of healthcare, which demands exceptional performance from employees. In recent years, there has been a growing interest in the psychological and emotional factors that can enhance the work performance of hospital employees. Among these factors, mindfulness, emotional intelligence, and resilience have emerged as significant contributors to improved work outcomes (Qureshi et al., 2023).

The Self-Determination Theory (SDT) posits that human behaviors are inherently self- directed and that individuals

autonomously guide their actions to fulfill three fundamental psychological needs: the need for autonomy, the need for competence, and the need for relatedness (Deci & Ryan, 2008). It is suggested that human motivation is shaped by SDT, which indicates that individuals possess an intrinsic inclination to enhance their abilities, engage in exploration and learning, and confront challenges and new experiences. Furthermore, the theory discusses how individuals' perceptions of autonomy in their tasks can promote the conversion of Mindfulness into effective performance (Zhao et al., 2023). Individuals, as outlined by the Self-Determination Theory, concentrate on resolving issues by gaining control over their emotions, thoughts, and actions, thereby aiming for peak performance. Consequently, when psychological needs are met, there is an enhancement in performance (Chen, 2024). This research has utilized SDT to examine the effects of Mindfulness, Emotional Intelligence, and Organizational Support on Employee Performance, with Ethical Practices serving as a mediating factor.

Mindfulness on Employee Performance

Mindfulness, a practice of maintaining a non-judgmental awareness of the present moment, has gained recognition for its potential benefits in reducing stress and improving mental well-being. In healthcare settings, mindfulness can help professionals manage the demands of their work environment more effectively. Research indicates that mindfulness practices can reduce burnout, enhance emotional regulation, and improve cognitive functions such as attention and decision-making (Yagi et al., 2023). These improvements are crucial for maintaining high levels of job performance in healthcare. Research indicates that mindfulness can reduce stress, improve focus, and enhance emotional regulation, all of which are critical in a high-pressure environment like a hospital (Sunardi & Tatariyanto, 2023). By fostering a mindful approach, hospital employees can better manage the demands of their roles, leading to improved job performance and patient care. Mindfulness has been shown to reduce stress and burnout, which are prevalent issues in the healthcare sector. Moreover, mindfulness practices can enhance cognitive functions that are critical for job performance. According to a study by (Asuero et al., 2014) healthcare professionals who engaged in mindfulness training showed improvements in working memory, attention, and cognitive flexibility. These cognitive enhancements are crucial for maintaining high performance in healthcare settings where quick, accurate decision-making is essential.

The positive impact of mindfulness on interpersonal relationships within the workplace is another key aspect. A study from the literature noted that mindfulness training improved empathy and communication skills among healthcare professionals, leading to better patient-provider interactions and increased patient satisfaction (Selič-Zupančič et al., 2023). Enhanced interpersonal skills can foster a more collaborative and supportive work environment, which is vital for effective healthcare delivery. Furthermore, mindfulness can improve job performance by fostering a sense of personal accomplishment and professional fulfilment. Mindfulness practices encourage self- reflection and a deeper connection to one's work, which can lead to greater job satisfaction and commitment. Mindfulness involves maintaining moment-by-moment awareness of thoughts, feelings, bodily sensations, and the environment. Its application in healthcare settings has been widely studied, particularly in reducing stress and burnout among hospital employees. Mindfulness practices have been shown to reduce stress and burnout among healthcare professionals, leading to improved job satisfaction and performance (Khari & Bali, 2024).

To summarize, Mindfulness improves emotional regulation by promoting awareness and acceptance of emotional experiences. This is particularly beneficial in high-stress environments like hospitals, where employees frequently encounter emotionally challenging situations. Improved focus helps healthcare workers manage their tasks more effectively, leading to better performance outcomes. The following hypothesis is arrived from these arguments of literature.

Hypothesis 1. Mindfulness has positive impact on Employee Performance

Organization Culture on Employee Performance

This refers to the shared values, beliefs, and norms that shape the behavior and practices within an organization. A positive organizational culture in hospitals is characterized by supportive leadership, effective communication, and a collaborative work environment. Such a culture can boost employee morale, increase job satisfaction, and foster a sense of belonging, all of which are crucial for enhancing work performance (Braithwaite et al., 2017). Hospitals with a strong, positive organizational culture are better positioned to achieve high levels of employee engagement and performance. The culture of an organization encompasses its values, beliefs, and behaviors, and significantly influences employees' attitudes and performance. Conversely, a toxic culture can lead to high turnover rates, job dissatisfaction, and suboptimal performance. Understanding how organizational culture impacts job performance can help healthcare institutions develop strategies to create more supportive and effective work environments.

A positive organizational culture fosters employee engagement and commitment, which are critical for high performance. Studies show that hospitals with supportive cultures have higher levels of employee satisfaction and lower turnover rates. Organizational culture impacts the quality of patient care. Hospitals with a culture that emphasizes teamwork, communication, and continuous improvement tend to deliver better patient outcomes (Rojak

et al., 2024). Leadership plays a crucial role in shaping organizational culture. Leaders who promote a positive culture and lead by example can significantly enhance job performance and satisfaction among hospital employees. The following hypothesis is arrived from these arguments of literature.

Hypothesis 2. Organization Culture has positive impact on Employee Performance

Emotional Intelligence on Employee Performance

This refers to the ability to recognize, understand, and manage one's own emotions, as well as the emotions of others. High levels of emotional intelligence are associated with better teamwork, communication, and conflict-resolution skills (Matta & Alam, 2023). In the context of hospital work, where collaboration and effective communication are vital, emotional intelligence plays a crucial role in ensuring that employees can work efficiently and harmoniously. Studies have shown that healthcare professionals with high EI tend to have better patient interactions and job satisfaction (Louwen et al., 2023). Emotional intelligence (EI) refers to the ability to recognize, understand, and manage one's own emotions, as well as those of others.

High levels of EI are associated with better communication, conflict resolution, and teamwork, all of which are essential in healthcare settings. Healthcare professionals with high EI can navigate the emotional complexities of patient care, leading to improved patient outcomes and higher job performance. Research suggests that EI can mitigate the effects of stress and burnout, further enhancing job performance (Matta & Alam, 2023). High EI facilitates better communication and collaboration among healthcare teams, essential for coordinated patient care. Research shows that healthcare professionals with high EI have better relationships with colleagues and patients, leading to improved work performance and patient satisfaction. EI enables individuals to manage their stress more effectively by recognizing and regulating their emotional responses. Leaders with high EI are more effective in motivating and managing their teams. This can lead to a more supportive work environment and higher overall job performance among hospital employees. The following hypothesis is arrived from these arguments of literature.

Hypothesis 3. Emotional Intelligence has positive impact on Employee Performance

Ethical Practices on Employee Performance

Ethical practices in healthcare involve adherence to ethical standards and principles such as patient confidentiality, informed consent, and professional integrity. Upholding ethical practices is vital for maintaining trust between healthcare providers and patients, as well as within the healthcare team. Ethical behavior fosters a work environment where employees feel respected and valued, which can lead to higher job satisfaction and commitment (Louwen et al., 2023). Moreover, hospitals that prioritize ethical practices are likely to experience fewer conflicts and legal issues, contributing to a more stable and productive work environment. Ethical practices are fundamental in healthcare, where professionals must often make critical decisions that affect patient lives. Adherence to ethical standards fosters trust, accountability, and professional integrity, which are crucial for effective healthcare delivery. Ethical practices ensure that patient care is prioritized and that professionals maintain high standards of conduct. The presence of a strong ethical framework within healthcare organizations can enhance job performance by promoting a sense of responsibility and professional pride among employees. Ethical practices build trust among employees and between healthcare providers and patients. A strong ethical climate reduces conflicts and enhances morale, leading to better job performance. Ethical behavior is crucial for effective decision-making in healthcare, where decisions often have significant moral and ethical implications. An ethical climate supports sound decision-making processes and improves overall performance (Marisya et al., 2023). Adherence to ethical standards ensures compliance with regulatory requirements, reducing the risk of legal issues and enhancing the hospital's reputation. This creates a stable work environment that supports high performance. The following hypotheses are arrived from these arguments of literature.

Hypothesis 4. *Ethical Practices fully mediates between Mindfulness and Employee Performance*

Hypothesis 5. *Ethical Practices fully mediates between Organization Culture and Employee Performance*

Hypothesis 6. *Ethical Practices fully mediates between Emotional Intelligence and Employee Performance*

3. RESEARCH GAP IDENTIFICATION

Despite the extensive literature on the individual components of mindfulness, emotional intelligence, resilience, organizational culture, and ethical practices, there remains a gap in understanding their combined influence on the work performance of hospital employees. This gap highlights the need for a comprehensive study that integrates these factors within the unique context of the healthcare environment. Most existing research examines these factors in isolation rather than in combination. Studies have shown the individual benefits of mindfulness (Khari & Bali, 2024; Zhao et al., 2023), and emotional intelligence (Louwen et al., 2023) on employee performance and well-being. However, the interplay between these psychological constructs and how they collectively influence work performance in hospitals is underexplored. Most research on organizational culture and ethical practices focuses on general organizational settings rather than the specific context of hospitals. Hospitals present unique ethical dilemmas and

cultural challenges that differ significantly from other workplaces. Therefore, there is a need for context- specific studies that explore how organizational culture and ethical practices specifically affect hospital employees' performance. There is a paucity of research examining how mindfulness and emotional intelligence interact dynamically with organizational culture and ethical practices to influence work performance. The potential moderating or mediating effects of organizational culture and ethical practices on the relationship between these psychological factors and work performance remain largely unexplored. Most existing studies are cross-sectional, providing a snapshot of the relationships between these variables at a single point in time. Longitudinal studies are needed to understand how these factors interact over time and their long-term impact on work performance and employee well-being.

Addressing these research gaps is essential for developing a comprehensive understanding of how mindfulness, emotional intelligence, resilience, organizational culture, and ethical practices collectively influence the work performance of hospital employees. This understanding can lead to the creation of more effective, integrated interventions and policies tailored to the unique demands of the healthcare sector, ultimately improving employee well-being and patient care.

The literature indicates that mindfulness, emotional intelligence, resilience, organizational culture, and ethical practices are critical for the work performance of hospital employees. However, further research is needed to explore their combined effects and develop integrated interventions. By addressing this research gap, healthcare organizations can create supportive environments that enhance employee well-being and performance, ultimately leading to better patient care and organizational effectiveness. In the high-pressure and highly demanding healthcare industry, fostering mindfulness among healthcare professionals is absolutely essential. Mindfulness is not merely a luxury but rather a fundamental necessity in this field, given that the health and well-being of patients depend heavily on the competency and emotional resilience of these dedicated individuals. The emphasis on mindfulness within the healthcare workforce is firmly grounded in the belief that it not only enhances clinical practice but also serves as a powerful antidote to burnout while promoting a culture of compassionate patient care. Through comprehensive mindfulness training programs, the overarching goal is to equip healthcare staff with valuable tools to effectively manage the stress that often accompanies their roles, enhance their capacity to maintain unwavering focus, and ultimately cultivate a deeper sense of empathy in their interactions with patients, thereby elevating the overall quality of healthcare delivery. The study on the influence of mindfulness, emotional intelligence, resilience, organizational culture, and ethical practices on the work performance of hospital employees is driven by the critical need to enhance healthcare delivery through improved

employee performance. The unique challenges faced by hospital employees, including high stress, emotional demands, and ethical dilemmas, necessitate a comprehensive understanding of the factors that can positively impact their performance. This study aims to fill significant gaps in the existing literature and provide actionable insights for healthcare administrators.

Rationale behind Mediation Analysis of Ethical Practices between Mindfulness,

Emotional Intelligence and Organization Culture on Employee Performance

Hospitals are high-stress environments where employees routinely face life-and-death situations, emotional strain, and high workloads. These conditions can lead to burnout, decreased job satisfaction, and ultimately, impaired work performance (Shanafelt *et al.*, 2015). Addressing these challenges requires an understanding of the psychological and organizational factors that can mitigate stress and enhance resilience and productivity among hospital staff. Studies indicate high levels of burnout among healthcare workers, with significant consequences for both employee well-being and patient care (Maslach & Leiter, 2016). Identifying strategies to reduce burnout is essential for sustaining a competent and healthy workforce.

Mindfulness and emotional intelligence are psychological constructs that have shown promise in enhancing employee well-being and performance in various settings. However, their specific impact on hospital employees, who operate in one of the most demanding work environments, requires further exploration. Research has demonstrated that mindfulness practices can reduce stress and improve emotional regulation, leading to better job performance and reduced burnout (Khari & Bali, 2024). In hospitals, where maintaining focus and emotional stability is crucial, mindfulness could play a significant role in enhancing employee performance. In an era marked by the relentless demands and pressures of the healthcare industry, the significance of employee job performance within the health sector cannot be overstated. As healthcare organizations strive to provide quality patient care, they face the dual challenge of managing a highly stressful work environment and ensuring that their workforce remains effective (Dsouza et al., 2023). EI emphasizes better teamwork, communication, and patient interactions. In the collaborative environment of a hospital, high EI can improve interpersonal relationships and the quality of care provided to patients (Louwen et al., 2023).

The organizational culture and ethical practices within a hospital are pivotal in shaping employee behavior and performance. A positive organizational culture and strong ethical standards can enhance job satisfaction, reduce turnover, and improve overall performance. A supportive and collaborative organizational culture can enhance employee engagement and productivity (Braithwaite et al., 2017).

Understanding how different cultural attributes affect hospital employees can guide the development of policies that foster a positive work environment. Ethical behavior in healthcare is fundamental to maintaining trust and professionalism. Hospitals with a strong ethical climate experience fewer conflicts and legal issues, contributing to a more stable and productive work environment (Dsouza et al., 2023). Put together, these factors, mindfulness, emotional intelligence, resilience, organizational culture and ethical practices, form a robust framework for enhancing the work performance of hospital employees. By understanding and integrating these elements, hospital administrations can create a supportive work environment that not only improves

employee well-being but also leads to better patient outcomes, along with cultivate a supportive and ethical work environment that not only improves employee well-being and satisfaction but also leads to superior patient care and operational effectiveness.

Proposed Conceptual Framework

The conceptual framework for all the identified constructs has been derived based on the theories identified from literature review. The workplace and its significance to organizations are studied with the identification of various constructs in the literature review. The significant constructs identified from this research has been mentioned in figure 1.
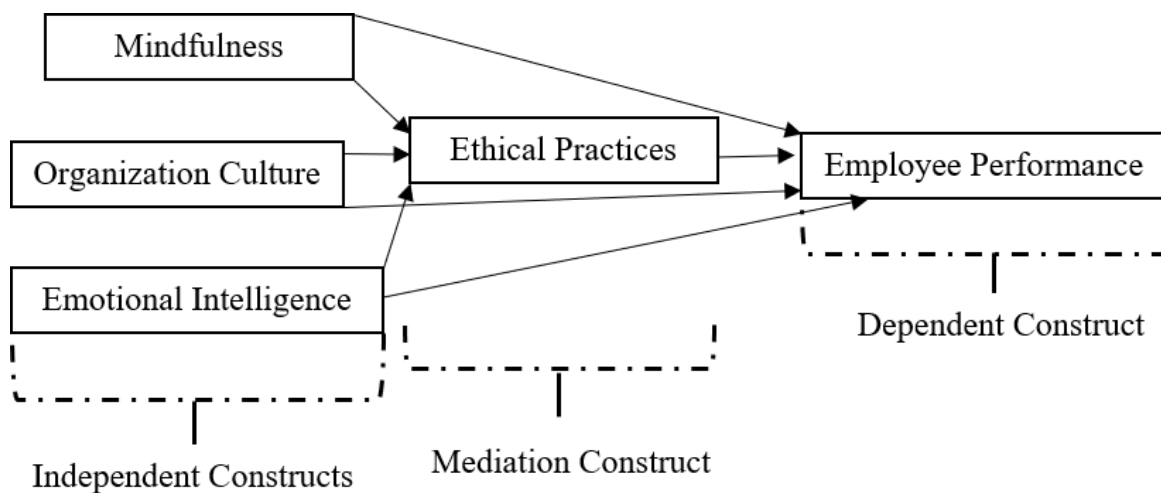
Figure 1: Conceptual Framework

4. METHODOLOGY

Sample and Data Collection

This research involves quantitative analysis of cross-sectional data using survey questionnaire adopted from the literature. The measures of this research has been adopted from the developed scales from the literature for Mindfulness (M. Zada et al., 2023), Organization culture (Dewi & Wibowo, 2020), and Ethical practices (Ullah et al., 2021). All the responses are validated using statistical methods for internal consistency and validity test. This research has chosen the registered allopathic doctors of India as the targeted population. There are about 13,08,009 allopathic doctors registered in India, in which the survey questionnaire has been distributed to 2,00,000 doctors. The survey has been carried out by distributing the questionnaire through emails, WhatsApp, LinkedIn, and through other social media platforms. After removing the missing, biased, and unfilled responses, 409 respondents are considered as final sample for this study. The data is analyzed using SPSS and SMART-PLS tools and the outcome of the hypotheses are discussed

based on the values obtained from the structural equation model.

The descriptive statistics (Figure 2) of gender shows that 264 respondents were male (64.5%) and 145 respondents were female (35.5%). The age group of the respondents 16.1 % between 18-35 years of age, 37.1% fall between the age group of 36 to 45 years, 29% fall between the age group of 46 to 55 years, 17.7% fall in the category of 56 years and above. The work experience level of the respondents are 14.5% within 0-5 years, 29% in the range of 5-10 years, 30.6% are having 11-15 years and 25.8% are above 15 years.
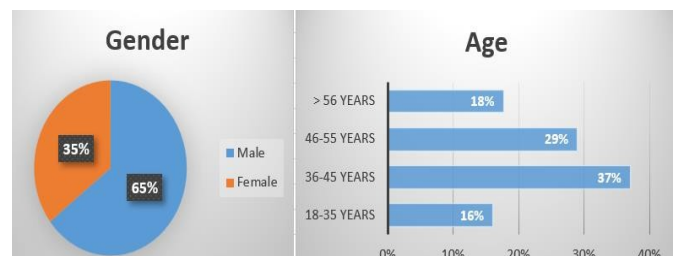
Figure 2: Descriptive Statistics

Development of Structural Model

Normality test has been conducted using Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) tests. The values of constructs are not more than 1 and the significance value is less than 0.05 implies that data is not normally distributed (Table 1). The Cronbach's alpha value of 0.958 signifies the data reliability.

TABLE 1: Normality Test

Construct	Cronbach's alpha
EI	0.873
EP	0.650
ET	0.842
M	0.746
OC	0.841

Cronbach's Alpha is 0.9650, which is greater than the threshold value of 0.70 and suggests a high level of internal consistency. Constructs are validated using Principal Component Analysis (PCA) with Kaiser-Meyer-Olkin (KMO) value of 0.939 which is between the accepted values of 0.8 – 1.0 (Byrne, 2016; Chowdhury, 2018). Factor loadings for all variables of each construct is investigated and the outliers (EP2, EP3, ET1, M1, OC1) are removed. The significance of all other variables are having the values of more than 0.6. The KMO test statistic typically ranges from 0 to 1, and a higher value indicates better suitability for factor analysis. In this study KMO value is 0.931, which is a very high KMO value, suggesting that the data is highly suitable for factor analysis.

TABLE 2: Factor Loadings – All constructs

Variables	EI	EP	ET	M	OC
EI1	0.758				
EI2	0.793				
EI3	0.871				
EI4	0.888				
EI5	0.715				
EP1		0.840			
EP4		0.615			
EP5		0.796			
ET2			0.781		
ET3			0.853		
ET4			0.883		
ET5			0.778		
M2				0.744	
M3				0.896	
M4				0.583	
M5				0.689	
OC2					0.802
OC3					0.832
OC4					0.814
OC5					0.841

Multicollinearity of constructs is tested and the results are investigated for the validation of constructs. Table 2 shows the Regression Coefficients of all predictors with dependent facets. The confidence interval of 95% explains the B values of all constructs lie between lower and upper bound values. Variance Inflation Factor (VIF) of each construct is not more than the value of 3. A VIF value of 1 implies there is no correlation among the elements, and the value of more than 4 needs investigation. In contrast, the value of 10 or more has significant multicollinearity which requires changes to the developed constructs (Winterton, 2008).
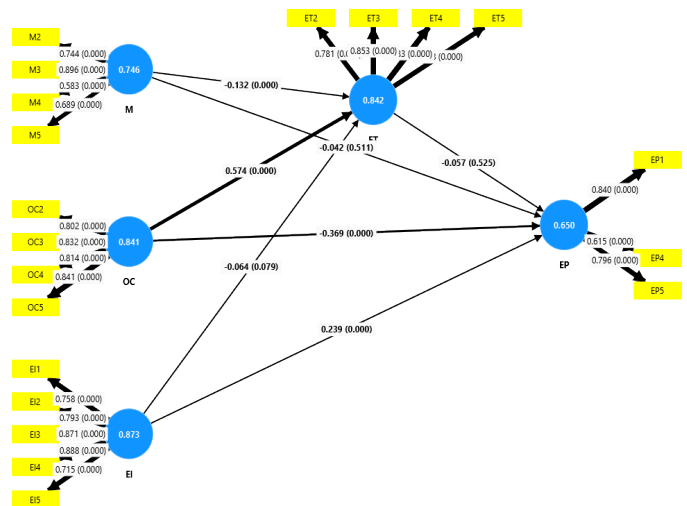
Figure 3: Structural Model

The Structural model (Figure 3) explains that the latent variables are significant with the variables associated to it having p-value less than 0.01. There is positive relation of 0.574 between Organization Culture and Ethical Practices. Emotional Intelligence has negative relation of value -0.064 with Ethical Practices. Employee Performance is positively influenced by Emotional Intelligence with the value of 0.239. Mindfulness has negative relation with Ethical Practices having the value of -0.132 and also negative impact on Employee Performance with the value of -0.042. The direct impact of Mindfulness on Employee Performance is not significant but there is a full mediation through Ethical Practices. All constructs are validated for variance to the measurement error using Average variance extracted (AVE). AVE is accepted with values greater than 0.5 (Hair, 2006).

TABLE 3: AVE – All constructs

Construct	AVE
EI	0.653
EP	0.573
ET	0.680
M	0.543
OC	0.677

The structural model is validated and the outcome of this model is further investigated for the interpretation of hypotheses.

5. FINDINGS

This section covers the mediating effect of Ethical Practices (ET) on Mindfulness (M) and Employee Performance (EP), Organization Culture (OC) and Employee Performance (EP), Emotional Intelligence (EI) and Employee Performance (EP) as per the hypothesis development. The Partial least squares structural equation modeling (PLS-SEM) is applied to investigate the hypotheses for all the identified constructs with 3000 iterations.

The direct value of -0.042 is not significant (p-value > 0.01) for Hypothesis *Ha1,* which implies that there is no positive effect of Mindfulness (M) on Employee Performance (EP). The direct value of -0.369 is significant (p-value < 0.01) for Hypothesis *Ha2,* which implies that there is positive effect of Organization Culture (OC) on Employee Performance (EP). The direct value of 0.239 is significant (p-value < 0.01) for Hypothesis *Ha3*, which implies that there is positive effect of Emotional Intelligence (EI) on Employee Performance (EP). The direct value of -0.042 is not significant (p-value > 0.01) and the indirect value of 0.008 is significant (p-value < 0.01) for Hypothesis *Ha4,* which implies that there is a full mediation effect of Ethical Practices (ET) between Mindfulness (M) and Employee Performance (EP). The

direct value of -0.369 is significant (p-value <0.01) and the indirect value of -0.033 is not significant (p-value > 0.01) for Hypothesis *Ha5*, which implies that there is a partial mediation effect of Ethical Practices (ET) between Organization Culture (OC) and Employee Performance (EP). The direct value of 0.239 is significant (p-value < 0.01) and the indirect value of 0.004 is not significant (p-value > 0.01) for Hypothesis *Ha6*, which implies that there is a partial mediation effect of Ethical Practices (ET) between Emotional Intelligence (EI) and Employee Performance (EP). Hypotheses results are summarized and explained in Table 4.

TABLE 4: Hypotheses Results

Hypothesis	Relationship	Path Coefficient	Direct effect	Indirect effect	Mediation Result
Ha1	Mindfulness has positive impact on Employee Performance	-0.045	-0.042 (ns)	NA	Not Significant
Ha2	Organization Culture has positive impact on Employee Performance	-0.373	-0.369 (s)	NA	Significant
Ha3	Emotional Intelligence has positive impact on Employee Performance	0.246	0.239 (s)	NA	Significant
Ha4	Ethical Practices fully mediates between Mindfulness and Employee Performance	0.005	-0.042 (ns)	0.008 (s)	Full Mediation
Ha5	Ethical Practices fully mediates between Organization Culture and Employee Performance	-0.212	-0.369 (s)	-0.033 (ns)	Partial Mediation
Ha6	Ethical Practices fully mediates between Emotional Intelligence and Employee Performance	-0.015	0.239 (s)	0.004 (ns)	Partial Mediation

s – significant; ns – non-significant;

The results are being presented and discussed for hypotheses analysis. The relationship between all the constructs are studied and significance of it are interpreted using the values

of the model. Emotional Intelligence (EI) has significant relationship with Employee Performance (EP) having p-value less than 0.05 and t-value as 7.402. Emotional Intelligence (EI) has no significant relationship with Ethical Practices (ET) having p-value greater than 0.05 and t-value as 1.758. Ethical Practices (ET) has no significant relationship with Employee Performance (EP) with p-value greater than 0.05 and t-value as 0.636. Mindfulness (M) has no significant relationship with Employee Performance (EP) having p-value of 0.511 and t-value as 0.657, but significant relationship with Ethical Practices (ET) having p-value less than 0.05 and t-value as 3.652. Organization Culture (OC) has significant relationship with Ethical Practices (ET) and Employee Performance (EP) having p-value of less than 0.05. The goodness of fit is studied and the values are accepted with GFI value of 0.97 and SRMR as 0.1. The results of the hypotheses do support the literature with additional insights on the mediation effect of Ethical Practices on Employee Performance. The findings of this study reveal a statistically significant positive mediation effect between mindfulness and employee job performance through Ethical Practices. The quantitative analysis demonstrates that employees who engage in regular mindfulness practices tend to exhibit higher levels of job performance. Organization Culture has significant positive impact on Employee Performance. It is very important for the organizations to have an Organization Culture that is being supported by both employer and employee for enhancing the Employee Performance. The partial mediation effect of Ethical Practices between Organization Culture and Employee Performance signifies further investigation. Emotional Intelligence plays a significant positive role on Employee Performance. The direct positive impact of Emotional Intelligence on Employee Performance emphasis the need to manage own emotions in positive ways. The partial mediation effect of Ethical Practices between Emotional Intelligence and Employee Performance demands further investigation.

6. IMPLICTIONS

The study thoroughly examines its findings and asserts that a detailed array of dimensions—such as professional aspirations, collaboration, communication, concentration, productivity, efficiency, and employee contributions—serves as universally relevant metrics for the comprehensive assessment of employee performance. These carefully identified measures collectively establish a holistic framework, demonstrating their universal applicability across various organizational settings. This claim highlights the inherent significance and practicality of these well-defined metrics, presenting them not merely as standalone indicators but as essential elements that provide a comprehensive and nuanced perspective on the complex aspects of employee performance.

From a practical perspective, it is essential to acknowledge that, in addition to the roles played by leaders and managers within an organization, employees themselves significantly influence their own performance levels. Therefore, the development and management of employee attitudes are critical in determining overall performance outcomes. Human resource managers are encouraged to expand their focus beyond conventional human resource management practices and to take into account factors that arise directly from employees. This necessity also applies to organizational leaders, who have the authority to select suitable leadership strategies, thereby improving the effectiveness of human resource management and promoting greater employee engagement.

In the quest to enhance employee performance, it is essential for human resource leaders and managers within organizations to acknowledge the significant impact of mindfulness and employee creativity. By recognizing and cultivating these elements, companies can create an environment that promotes improved employee performance. This strategy establishes a comprehensive framework in human resource management, integrating both managerial practices and the inherent contributions of the workforce.

The research model put forth makes a substantial contribution to the progression of studies within the domain of human resource management and organizational behaviour. By tackling the existing gaps in research concerning mindfulness, organization culture, emotional intelligence, ethical practices, and employee performance, the model clarifies the complex interconnections among these factors. It demonstrates that mindfulness can influence employee performance both directly and indirectly, with ethical practices serving as a vital mediating factor in this relationship. It also demonstrates that organization culture and emotional intelligence can influence employee performance indirectly, with ethical practices as a significant mediating factor. This comprehensive insight not only enriches the existing literature but also offers valuable guidance for organizational leaders and human resource professionals aiming to improve employee performance in modern workplace environments.

7. CONCLUSION

This research concludes with the significant constructs from the literature review and through the research gaps for the development of structural model for investigating the influence of mindfulness and emotional intelligence on employee performance through the mediation of ethical practices. The model has been conceptualized with three independent constructs (Mindfulness, Emotional Intelligence, and Organization Culture), One mediation construct (Ethical Practices), and one dependent construct (Employee Performance). The outcome of this research and the key results chaperoned human resource development to transform the workplace for the beneficial of both employer

and employee. The main findings of the research are that organization culture and emotional intelligence have significant positive impact on employee performance. Ethical practices has significant positive mediation effect between mindfulness and employee performance. Workers in hospitality industry frequently encounter mental and psychological challenges, as well as emotional fatigue, stemming from the inherent demands of their roles. These issues significantly influence their levels of work engagement, customer interaction, and overall productivity. The practice of mindfulness serves as a valuable strategy to address these challenges, fostering a more content and efficient workforce in the hospitality field. Through the practice of mindfulness, employees can improve their cognitive abilities, manage their emotions more effectively, and develop better interpersonal skills, all of which lead to increased productivity. The insights gained from this research on mindfulness practices are crucial for advancing effective human resource management, fostering engagement, and promoting development within companies. In summary, the findings of this research hold practical implications for human resource development aimed at improving performance and ensuring sustainable well-being within organizations.

8. LIMITATIONS AND FURTHER RESEARCH AGENDA

This limited study may restrict the generalizability of the findings if conducted with a targeted sample. The study used a cross-sectional design, collecting data once from the participants. This design may limit the ability to establish causal relationships and understand changes over time. Due to time constraints, a convenient/random sampling method was used for data collection. This may introduce bias and affect the representativeness of the sample.

It is important to recognize that, although the mediating role of ethical practices has been recognized, full mediation has not been achieved for organization culture and emotional intelligence. Factors such as mindfulness, organization culture and emotional intelligence have been established as direct influences on employee performance; however, the mediation provided by ethical practices serves to strengthen and enrich these direct connections. This finding highlights a significant gap in research regarding the thorough investigation of the mediating interactions between various factors in the fields of human resource management and organizational behaviour, as well as their effects on employee performance.

Consequently, the identified gap offers a promising opportunity for future research initiatives, encouraging scholars to explore the complex interactions of variables and the subtle mediation processes that enhance our understanding of the factors influencing employee performance within the domains of human resource management and organizational behaviour. While this research possesses notable academic value, it is essential to identify the inherent methodological constraints, particularly the limited sample size and respondent demographics, which necessitate a careful expansion in future studies. Although the current empirical findings support the existence of certain relationships, it is important to recognize that some values may remain at lower levels, potentially due to the omission of specific items. The academic direction suggests that a thoughtful increase in sample size will enhance statistical reliability, thereby reinforcing the credibility of the identified relationships.

Looking ahead, the path of academic research encourages future scholars to apply this enhanced model within the context of larger sample sizes, which is likely to lead to a deeper and more nuanced understanding of the complex relationships involving mindfulness, employee creativity, and performance. Furthermore, the thoughtful integration of the full range of mindfulness items previously collected in academic literature is expected to enhance the scope and depth of future studies. A scholarly call to action arises, urging researchers to explore the intricate connections between the proposed model and the critical roles of leadership and human resource management in shaping ethical practices and performance, thus fostering a more insightful and comprehensive understanding of organizational dynamics.

9. DECLARATION

I Dr Usha Narayan, hereby confirm that the manuscript titled " **Sustainable Business – A Study on Employee Mindfulness in the Healthcare Sector**" authored by Dr. Usha Narayan, Dr. Gururaj B Urs, Mr. Prasannakumar Kalahasthi, Mr. Srikanth Payal has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to IMPeC 2025 Digitalization, Entrepreneurship, and Sustainability.

We declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Al-kharabsheh, S. A., Attiany, M. S., Alshawabkeh, R. O. K., Hamadneh, S., & Alshurideh, M. T. (2023). The impact of digital HRM on employee performancethrough employee motivation. *International Journal of Data and Network Science*, *7*(1), 275–282. https://doi.org/10.5267/j.ijdns.2022.10.006

[2.] Arifuddin, A., Lita, W., Catherine, S., & Yingxiang, S. (2023). The Influence of Leadership Style and Work Motivation on Employee Performance. *Journal Markcount Finance*, *1*(3), 206–215. https://doi.org/10.55849/jmf.v1i3.116

[3.] Asuero, A. M., Queraltó, J. M., Pujol-Ribera, E., Berenguera, A., Rodriguez-Blanco, T., & Epstein, R. M. (2014). Effectiveness of a Mindfulness Education Program in Primary Health Care Professionals: A Pragmatic Controlled Trial. *Journal of Continuing Education in the Health Professions*, *34*(1), 4–12.https://doi.org/10.1002/chp.21211

[4.] Balaoing, G. (2023). *Nursing Burnout and Preventative Measures*.https://doi.org/10.33015/dominican.edu/2023.NURS.ST.05

[5.] Braithwaite, J., Herkes, J., Ludlow, K., Testa, L., & Lamprell, G. (2017). Association between organisational and workplace cultures, and patient outcomes: Systematic review. *BMJ Open*, *7*(11), e017708. https://doi.org/10.1136/bmjopen-2017-017708

[6.] Byrne, B. M. (2016). *Structural Equation Modeling With AMOS: Basic Concepts, Applications, and Programming, Third Edition* (0 ed.). Routledge. https://doi.org/10.4324/9781315757421

[7.] Chen, S. (2024). Structural modeling of Chinese students' academic achievement identity and basic psychological needs: Do academic self-efficacy, and mindfulness play a mediating role? *BMC Psychology*, *12*(1), 142. https://doi.org/10.1186/s40359-024-01571-6

[8.] Chowdhury, T. A. (2018). Media preferences among young consumers in Bangladesh: A multidimensional approach. *Journal of Marketing Communications*, *24*(5), 486–505. https://doi.org/10.1080/13527266.2015.1113433

[9.] Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology / Psychologie Canadienne*, *49*(3), 182–185. https://doi.org/10.1037/a0012801

[10.] Dewi, N. N., & Wibowo, R. (2020). The effect of leadership style, organizational culture and motivation on employee performance. *Management Science Letters*, 2037–2044. https://doi.org/10.5267/j.msl.2020.2.008

[11.] Dsouza, M. P., Shetty, A., Dinesh, T. K., & Damodar, P. (2023). Stimulating employee performance and well-being: A review of mindfulness impact in the hospitality sector. *IIMBG Journal of Sustainable Business and Innovation*, *1*(1), 4–17. https://doi.org/10.1108/IJSBI-06-2023-0037

[12.] Fitzhugh, H., Michaelides, G., Daniels, K., Connolly, S., & Nasamu, E. (2023). Mindfulness for Performance and Wellbeing in the Police: Linking Individual and Organizational Outcomes. *Review of Public Personnel Administration*, 0734371X2311557. https://doi.org/10.1177/0734371X231155794

[13.] Gajda, D., & Zbierowski, P. (2023). Exploring the consequences of mindfulness at work: The impact of mindful organizing on employee attitudes and behavior toward work and organization. *Personnel Review*, *52*(9), 2342–2362. https://doi.org/10.1108/PR-05-2020-0385

[14.] Hair, J. F. (Ed.). (2006). *Multivariate data analysis* (6th ed.). Pearson Prentice Hall. He, J., Li, X., Wang, H., & Xu, Z. (2023). A study on the relationship between mindfulness and work performance of web editors: Based on the chain mediating effect of workplace spirituality and digital competencies. *Frontiers in Psychology*, *13*, 1068735. https://doi.org/10.3389/fpsyg.2022.1068735

[15.] Jiménez-Picón, N., Romero-Martín, M., Ponce-Blandón, J. A., Ramirez-Baena, L., Palomo-Lara, J. C., & Gómez-Salgado, J. (2021). The Relationship between Mindfulness and Emotional Intelligence as a Protective Factor for Healthcare Professionals: Systematic Review. *International Journal of Environmental Research and Public Health*, *18*(10), 5491. https://doi.org/10.3390/ijerph18105491

[16.] Kaplunenko, Y., & Kuchyna, V. (2023). Studying the relationship between meditation and mindfulness, dissociative manifestations, and emotional intelligence. *Visnyk of V. N. Karazin Kharkiv National University. A Series of Psychology*, *74*, 13–23. https://doi.org/10.26565/2225-7756-2023-74-02

[17.] Khari, C., & Bali, A. (2024). Leader mindfulness and employee innovative work behaviour: A mediated moderation model. *European Journal of Innovation Management*, *27*(3), 962–980. https://doi.org/10.1108/EJIM-02-2022-0064

[18.] Kumprang, K., & Suriyankietkaew, S. (2024). Mechanisms of Organizational Mindfulness on Employee Well-Being and Engagement: A Multi-Level Analysis. *Administrative Sciences*, *14*(6), 121. https://doi.org/10.3390/admsci14060121

[19.] Li, X., Ma, L., & Li, Q. (2022). How Mindfulness Affects Life Satisfaction: Based on the Mindfulness-to-Meaning Theory. *Frontiers in Psychology*, *13*, 887940. https://doi.org/10.3389/fpsyg.2022.887940

[20.] Louwen, C., Reidlinger, D., & Milne, N. (2023). Profiling health professionals' personality traits, behaviour styles and emotional intelligence: A systematic review. *BMC Medical Education*, *23*(1), 120. https://doi.org/10.1186/s12909-023-04003-y

[21.] Marisya, F., Mayasari, V., Astuti, S. D., & Purwanto, M. B. (2023). Implementation of Leadership Ethics and Transformational Leadership in Employee Performance.

[22.] *Asian Journal of Applied Business and Management*, *2*(4), 545–556. https://doi.org/10.55927/ajabm.v2i4.6714

[23.] Maslach, C., & Leiter, M. P. (2016). Understanding the burnout experience: Recent research and its implications for psychiatry. *World Psychiatry*, *15*(2), 103–111. https://doi.org/10.1002/wps.20311

[24.] Matta, R., & Alam, R. E. (2023). The impact of emotional intelligence on employees' performance and productivity. *International Journal of Work Innovation*, *4*(1), 35. https://doi.org/10.1504/IJWI.2023.130440

[25.] Murtaza, G., Roques, O., Talpur, Q., Khan, R., & Haq, I. U. (2024). Effects of perceived organisational politics and effort–reward imbalance on work outcomes – the moderating role of mindfulness. *Personnel Review*, *53*(1), 76–98. https://doi.org/10.1108/PR-09-2020-0706

[26.] Qureshi, R., Irfan, M., Ali, H., Khan, A., Ali, S., Shah, Z., Gondal, T. M., Sadak, F., Shah, Z., Hadi, M. U., Khan, S., Bermak, A., & Shekhar, A. (2023). *Artificial Intelligence and Biosensors in Healthcare and its Clinical Relevance: A Review*. https://doi.org/10.36227/techrxiv.22293442

[27.] Rojak, J. A., Sanaji, S., Witjaksono, A. D., & Kistyanto, A. (2024). The Influence of Transformational Leadership and Organizational Culture on Employee Performance. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *5*(1), 977–990. https://doi.org/10.62775/edukasia.v5i1.926

[28.] Selič-Zupančič, P., Klemenc-Ketiš, Z., & Onuk Tement, S. (2023). The Impact of Psychological Interventions with Elements of Mindfulness on Burnout and Well-Being in Healthcare Professionals: A Systematic Review. *Journal of Multidisciplinary Healthcare*, *Volume 16*, 1821–1831. https://doi.org/10.2147/JMDH.S398552

[29.] Sunardi, N., & Tatariyanto, F. (2023). The Impact of the Covid-19 Pandemic and Fintech Adoption on Financial

Performance Moderating by Capital Adequacy.

[30.]*International Journal of Islamic Business and Management Review*, *3*(1), 102–118. https://doi.org/10.54099/ijibmr.v3i1.620

[31.]Trygg Lycke, S., Airosa, F., & Lundh, L. (2023). Emergency Department Nurses' Experiences of a Mindfulness Training Intervention: A Phenomenological Exploration. *Journal of Holistic Nursing*, *41*(2), 170–184. https://doi.org/10.1177/08980101221100091

[32.]Ullah, S., Khan, B. U., & Malik, M. J. (2021). The Hindrance of Moral Emotions: Using Leader Role Modeling to Foster Morally Courageous Behavior in Employees. *Open Journal of Social Sciences*, *09*(06), 429–450. https://doi.org/10.4236/jss.2021.96030

[33.]Winterton, J. (2008). Review: Business Research Methods ALAN BRYMAN and EMMA BELL. Oxford: Oxford University Press, 2007. xxxii + 786 pp. £34.99 (pbk). ISBN 9780199284986. *Management Learning*, *39*(5), 628–632. https://doi.org/10.1177/13505076080390050804

[34.]Yagi, M., Tsubouchi, T., Hamatani, N., Takashina, M., Saruwatari, N., Minami, K., Wakisaka, Y., Fujitaka, S., Hirayama, S., Nihongi, H., Hasegawa, A., Koizumi,

[35.]M., Shimizu, S., Ogawa, K., & Kanai, T. (2023). Validation of robust radiobiological optimization algorithms based on the mixed beam model for intensity-modulated carbon-ion therapy. *PLOS ONE*, *18*(7), e0288545. https://doi.org/10.1371/journal.pone.0288545

[36.]Young, P., Chow, V., Haslam, C., Wood, A., & Barker, J. (2023). Can Rational Emotive Behaviour Therapy (REBT) and Mindfulness be Integrated Effectively within High Performance Settings? *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, *41*(2), 411–431. https://doi.org/10.1007/s10942-022-00475-x

[37.]Zada, M., Khan, J., Saeed, I., Zada, S., & Jun, Z. Y. (2023). Curiosity may have killed the cat but it has the power to improve employee creativity. *Current Psychology*, *42*(36), 32299–32313. https://doi.org/10.1007/s12144-022-04171-y

[38.]Zada, S., Khan, J., Zada, M., Saeed, I., & Jun, Z. Y. (2023). Does Servant Leadership Enhance Employee Creativity and Performance?: Mediating Role of Knowledge

[39.]Sharing and Moderating the Role of Self-Efficacy. *Journal of Organizational and End User Computing*, *35*(1), 1–24. https://doi.org/10.4018/JOEUC.321656

[40.]Zhao, M., Yao, L., Ma, R., Sarmad, M., Orangzab, -, Ayub, A., & Jun, Z. (2023). How Green Mindfulness and Green Shared Vision Interact to Influence Green Creative Behavior. *Psychology Research and Behavior Management*, *Volume 16*, 1707–1723. https://doi.org/10.2147/PRBM.S405399.

TRACK 3: FINANCE & ACCOUNTING MANAGEMENT

Foreign and Domestic Institutional Investors: Their Role in Shaping Volatility in Indian Stock Market

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ABSTRACT

This study evaluates the nexus between market volatility and institutional investments in India's NSE NIFTY 50 indices, focussing on Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs). To analyse distributional features, monthly data from January 2014 to December 2023 is used to obtain descriptive statistics such as mean, median, standard deviation, kurtosis, and skewness. Monthly returns are computed using the log-return formula. The data is sourced from the NSE and Moneycontrol websites and comprises 120 monthly observations for analysis. Stationarity and heteroscedasticity are assessed using Pearson correlation, Granger causality, Phillips-Perron (PP), and Augmented Dickey-Fuller (ADF) tests, as well as Jarque-Bera (J-B) and ARCH-LM tests. A GARCH (1,1) model examines the volatility dynamics of the NIFTY 50, FIIs, and DIIs. The results reveal that FIIs have a positive impact on NIFTY returns, while DIIs have a negative association, with investment flows impacted by major incidents such as COVID-19. The GARCH model demonstrates that FIIs enhance market volatility whereas DIIs decrease it. Granger causality shows that NIFTY index fluctuations predict FII and DII flows, but not vice versa. There is no substantial causal relationship between FIIs and DIIs. This study addresses the various roles that FIIs and DIIs play in deciding market volatility in India's stock market.

Keywords: FIIs, DIIs, Market Volatility, GARCH Model, Granger Causality Tests.

1. INTRODUCTION

People in India invest significantly in the stock market which represents one of the oldest and most popular places for individuals to put their savings and get significant returns. Yet, because the market is highly volatile, it is essential to conduct comprehensive studies before investing. The market attracts various types of investors, with the most prevalent being FIIs and DIIs. It was discovered that FIIs and DIIs engage in extensive market trading, investing thousands of crores in the stock market. Before investing money, an experienced investor is believed to carefully examine the actions of FIIs and DIIs. Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs) often act oppositely: when FIIs sell, DIIs buy, and vice versa, creating a dynamic interplay in market behavior. Foreign Institutional Investors (FIIs) improve market efficiency by lowering capital costs, but their investment flows can also increase volatility in stock markets. This volatility occurs because FIIs frequently invest substantial quantities at a set price in the primary market, which is difficult to replicate in the secondary market. Furthermore, FII capital flows can have an influence on primary market equities, often resulting in lower prices than those in the secondary market, adding to market volatility (Bansal & Agrawal, 2018, p. 2). Despite receiving criticism for significant and sudden capital withdrawals during recent financial crises, attributed to their 'hot money' nature, which allows for quick exits, Foreign Institutional Investors (FIIs) have emerged as key participants in the Indian capital market, shaping its dynamics. (Loomba, 2012). SEBI defines the term "foreign institutional investor as follow Means an institution established or incorporated outside India which proposes to make investment in India in securities. Provided that a domestic asset management company or domestic portfolio manager who manages funds raised or collected or brought from outside India for investment in India on behalf of a sub-account, shall be deemed to be a Foreign Institutional Investor,''. "Investments into the equity market boost stock prices, reduce the cost of equity financing, increase knowledge transfer, boost market performance, strengthen corporate governance, and enhance the security market's market structure," (Barik and Mishra, 2023). Foreign capital is crucial for all economies, regardless of their level of development. It is used by developing countries to increase investment and speed up economic growth. Transition nations rely on foreign capital to carry out reforms, transition to open economies, address long-standing difficulties, and promote stable GDP development while integrating into the global market. Foreign investment is especially important in emerging countries for unlocking economic potential. It is frequently associated with real exchange rate appreciation, stock market and real estate booms, reserve accumulation, monetary growth, and repercussions on production and consumption. Volatility has a significant impact on investing decisions. Unforeseen information might cause investors to engage in unusual trading actions, influencing market volatility. However, this trading behaviour does not have the same influence on all market segments; its impact might vary dramatically among categories, affecting overall market dynamics (Chhimwal & Bapat, 2020, p. 1). Foreign Institutional Investors (FIIs) make capital investment decisions based on both local and foreign economic conditions, as well as short-term expectations defined by

'market' sentiment'. These short-term expectations encourage speculation and quick movement in FII capital flows, resulting in higher volatility in the host country's stock market (Joo et al., 2015, p. 2). The Indian stock market is extremely volatile, both FIIs and DIIs having an important role in both positive and negative moves. FIIs and DIIs typically acquire and sell equities in bulk, resulting in considerable withdrawal effects when they depart (Gahlot, 2019, p. 2).

2. LITERATURE REVIEW

Bansal and Agrawal (2018) This study looks at the link between FII capital flows and stock market volatility in India. The study utilises statistical methods such as the Augmented Dickey-Fuller (ADF) test, standard deviation, mean, variance, skewness, correlation, and the GARCH model to analyse daily data from the SENSEX, NIFTY, and FII markets during a 15-year period (April 1, 2001 to March 31, 2017). It show a robust link between FIIs and stock market returns, with positive correlations and indications of volatility transmission among indices.

Gahlot (2019) This research uses Granger causality and TGARCH models to examine the influence of Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs) on Indian stock market volatility. The findings reveal that FIIs have a greater impact on stock returns than DIIs. While current news (ARCH) has no meaningful effect on returns, historical volatility (GARCH) does, demonstrating that market volatility is persistent over time. The leverage coefficient emphasises the disproportionate reaction of volatility particularly bad news as per report, FIIs improve company governance and assist lower market current account deficits.

Joo et al. (2015) The purpose of this study is to investigate the link between FII investments and stock market volatility by analysing monthly data from the NIFTY, SENSEX, and FII activities from January 1999 to December 2013. The study uses the Augmented Dickey-Fuller (ADF) unit root test to evaluate non-stationarity and statistical methods such as mean, variance, and correlation to investigate the impact, in addition to the GARCH model. The data show that there is a considerable link between FII capital flows and NIFTY and SENSEX volatility

Loomba (2012) This research attempts to establish an awareness of the dynamics of FII trading behaviour and their impact on the Indian equities market. The analysis is based on daily data from the BSE Sensex and FII activities during a ten-year period, from January 1, 2001 to December 31, 2011. It shows evidence of a considerable positive relationship between FII activity and its consequences on the Indian capital market. The study also concludes that FII net inflows adequately explain changes in the Indian capital market.

Barik and Mishra (2023) This study uses as a key factor in this analysis are the SENSEX and domestic institutional investments (DIIs). The ADF test, correlation analysis, and GARCH model were used to analyse data from January 2011 to December 2022. The findings show that DIIs have a considerable influence on Indian stock market volatility, with a high positive connection between DIIs and the SENSEX index. The data indicate that DIIs have an important role in increasing market volatility. As a result, governments should devise effective measures to address this unpredictability.

Chhimwal and Bapat (2020) This study examines how unforeseen DII and FPI flows impact the volatility of big, mid, and small-cap equities in Indian markets. We use the ARMA (1, 1) and TGARCH (1, 1) models to analyse how unexpected FPI and DII flows affect volatility. The study found that unexpected flow of FPIs has a favourable influence on market volatility, while unexpected flow of DIIs reduces this impact. Furthermore, sudden selling of FPIs leads to higher volatility than unexpected purchases. Unexpected DII flows have a greater impact on small-cap equities. The findings of this study are relevant for policymakers and regulators.

Swapna (2018) This article explores the impact of Foreign Institutional Investors (FIIs) on the Indian Stock Market, with a particular emphasis on the BSE and NSE indexes. Data from 2005-06 to 2016-17, including average SENSEX and NIFTY 50 index values, were obtained from BSE, NSE, and SEBI documents. The study investigates FII purchases, sales, and net investments to determine their influence on these indexes. The data demonstrates a high positive association between FIIs and market movements, indicating that big stock market falls were frequently caused by FIIs withdrawing money.

Sahoo (2021) The researchers investigated how GDP and Foreign Institutional Investment (FII) influence the Indian Stock Market using monthly data for GDP, FII, BSE, and NSE. They employed the Augmented Dickey Fuller (ADF) Test, Multiple Regression, and Granger Causality Tests to analyze the data. The study found that while foreign portfolio investment was stationary at GDP levels, GDP itself required differencing. Both GDP and FII significantly impacted NSE and BSE indices. To explore causality, the BSE Granger causality model was applied. The analysis, based on 15 years of average closing prices from 2000 to 2015, showed a significant relationship and efficiency in the Indian stock market with respect to these variables.

3. RESEARCH GAP

In the capital market, institutional investors are classified into two types: Domestic institutional investors (DIIs) and Foreign institutional investors (FIIs). Several studies have already been conducted either in the domain of Domestic Investors or foreign Institutional investors but relatively very few have been done for both investors. To fill this gap, my

upcoming research work in this area is primarily aimed at analyzing the influence of DIIs and FIIs on the volatility of the Indian stock market. For this purpose, Nifty 50, Foreign and domestic institutional investments have been taken as the variables.

4. RESEARCH OBJECTIVES

1. To analyse the trend of DIIs and FIIs in Indian stock market.

2. To examine the role of DIIs and FIIs in the volatility of Indian stock market.

5. RESEARCH HYPOTHESIS

There is no significant effect of FIIs and DIIs net investments on Volatility of Indian Stock Market.

6. RESEARCH METHODOLOGY

In this study, descriptive properties including mean, median, standard deviation, kurtosis, and skewness are calculated to identify the distributional features of the monthly return series. The target group of the study is restricted to the market indices like NSE NIFTY 50, Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs).

Method of data collection

Data for this study was collected from the official NSE website, www.nseindia.com and Moneycontrol website. The closing prices on monthly basis of the index in sample were collected for the period from 1st January 2014 to 31st December 2023. Engle and Mezrich (1995) state that a minimum of eight years of data is required for an GARCH estimation. The sample size consists of 120 observations of the monthly closing prices for the indices to analyse the volatility of Indian stock market. Volatility is estimated on monthly returns. Monthly return will be calculated using this following formula -

$$G_t = \log (S_t / S_{t-1}) * 100 \qquad (1)$$

Where S_t is stock price on Month t, G_t is the Month return on equity, and S_{t-1} is the stock price on Month t-1.

Tools for data analysis

To determine the relationship among NIFTY 50, FIIs and DIIs, Pearson correlation test and Granger Causality Tests has been used along with Philips-Perron (PP) tests and Augmented Dickey-Fuller (ADF) was used to check the stationary of data. Jarque-Bera (J-B) test and Autoregressive Conditional Heteroscedasticity - Lagrange Multiplier (ARCH-LM) tests has also been applied. In order to determine the volatility between NIFTY 50 and FIIs and DIIs, we apply GARCH (1,1) model. All the analysis was done by using E-views 10 Software. The GARCH model (Bollerslev, 1986), This enable the conditional variance to depend on prior own lags. For example, the volatility of

today is dependent upon both the volatility and the squared error of the previous day (news or shocks). In the GARCH model, both previous squared returns (the ARCH term) and prior volatility (the GARCH term) can impact present volatility (Mishra & Mishra, 2024). This may be expressed in the simplest form as follows:

$$\sigma^2_t = \alpha_0 + \alpha_1\mu^2_{t-1} + \beta_1\sigma^2_{t-1} \qquad (2)$$

where: $\alpha_0 > 0$, $\alpha_1 \geq 0$, $\beta_1 \geq 0$

RESULTS AND DISCUSSIONS

TABLE 1: Descriptive Statistics

Statistics	Nifty Returns	FIIs	DIIs
Mean	0.010691	-3315.124	6945.337
Median	0.014104	-1265.880	5260.380
Maximum	0.136976	65317.13	55595.18
Minimum	-0.264569	-65816.70	-48319.17
Std. Dev.	0.048193	19923.93	14961.94
Skewness	-1.379261	-0.221579	0.237403
Kurtosis	10.62825	4.782479	5.436307
Jarque-Bera	326.2567	16.86810	30.80517
Probability	0.000000	0.000217	0.000000
Sum	1.272192	-397814.9	833440.4
Sum Sq. Dev.	0.274068	4.72E+10	2.66E+10
Observations	120	120	120

Source(s): Authors' EViews 10 Calculation

Table 1 presents statistical description of the NIFTY50, FIIs and DIIs for the given period of time. The table demonstrates that the nifty return has the mean value of 0.010691, followed by FIIs, which has the negative mean of -3315.124 among the other selected variables. Domestic institutional investors (DIIs) demonstrates a positive mean of 6945.337. If an investment had been put in nifty50, a shareholder might have had the opportunity of earning a larger yield than any others. The standard deviation of the NIFTY return is 4.82%, but FIIs and DIIs have more variability in net investments, with standard deviations of 19,923.93 and 14,961.94, respectively, reflecting considerable changes and uncertainty in these sectors. The NIFTY index has a skewness of -1.379261, indicating a substantial left skew with values concentrated downward. The skewness of FIIs is -0.221579, indicating a slight left skew with higher-end values. DIIs have a skewness of 0.237403, indicating a small right skew with lower-end values. The NIFTY index has a kurtosis of 10.62825, indicating more peaked and outlier-prone distributions, whereas FIIs and DIIs have kurtosis of 4.782 and 5.436, indicating a flatter distribution. The Jarque-Bera

test indicates that all indices differ from normality. The NIFTY index, FII net investments, and DII net investments have Jarque-Bera coefficients of 326.25, 16.87, and 30.81, respectively. The data is not normally distributed ($p < 0.05$), rejecting the null hypothesis of normality.

Figure 1: Trends of FIIs and DIIs
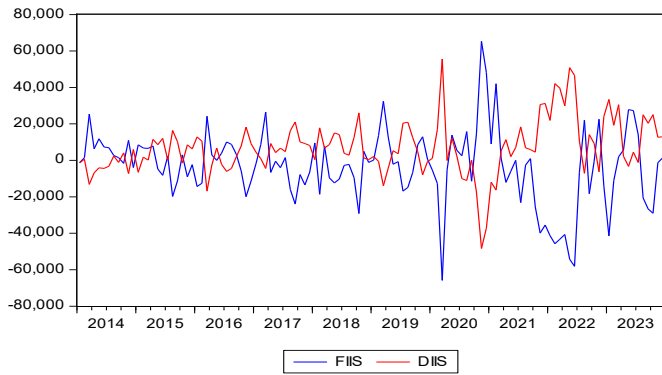
Source(s): Authors' EViews 10 Calculation

Figure 1 depicts the trend analysis and it shows that the flow of FIIs and DIIs is increasing from time to time and in the last few years it shows more fluctuations. The graph reveals that the red line (DIIS) has serious volatility, with strong spikes and dips suggesting large variations. The blue line (FIIS) swings much as well, although it follows a particular pattern. The most noticeable oscillations in the blue and red lines occur between 2019 and 2021, as seen by big spikes in the red line. These movements are most likely the result of market reactions to the COVID-19 epidemic or other financial developments. The graph is a valuable tool for comparing investor behaviour and market patterns at important economic times.

TABLE 2: Stationarity Test

Value	NIFTY	FIIs	DIIs
ADF	-11.16501*	-5.896045*	-5.493543*
PP	-11.18064*	-5.957267*	-5.489665*
Critical Value			
1%	-3.486551	-3.486064	-3.486064
5%	-2.886074	-2.885863	-2.885863
10%	-2.579931	-2.579818	-2.579818

Source(s): Authors' EViews 10 Calculation

Indicates Significant at 1% level

To apply GARCH and ARCH models, time series data must be stationary. Stationarity is tested by examining trends through graphs and conducting the Augmented Dickey-Fuller test and Phillips-perron test on the collected data. This ensures the data meets model requirements. The table 2 displays the stationarity test findings (ADF and PP) for three time series variables: NIFTY (Indian stock market index), FIIs (Foreign Institutional Investors), and DIIs (Domestic Institutional Investors). The test statistics (ADF and PP) for NIFTY, FIIs, and DIIs are more negative than the critical values at 10%, 5%, and 1%, respectively, showing that the unit root null hypothesis is not accepted and these time series are stationary.

TABLE 3: ARCH Test

Heteroskedasticity Test: ARCH LM			
F-statistic	1.119014	Prob. F (1,104)	0.2926
Obs*R-squared	1.128392	Prob. Chi-Square (1)	0.2881

Source(s): Authors' EViews 10 Calculation

The heteroskedasticity test, performed with the ARCH (Autoregressive Conditional Heteroskedasticity) model, yielded an F-statistic of 1.119 and a p-value of 0.2926. This p-value is significantly larger than the normal significance criteria, thus we cannot reject the null hypothesis of homoskedasticity. As a result, there is insufficient evidence to indicate the presence of heteroskedasticity in the data. Furthermore, the Obs*R-squared statistic is 1.128, with a p-value of 0.2881, emphasising the absence of substantial heteroskedasticity. Overall, the results suggest that the model's residuals do not include significant evidence of heteroskedasticity.

TABLE 4: Correlation Test

Covariance Analysis: Ordinary			
Date: 08/24/24 Time: 08:39			
Sample: 2014M02 2023M12			
Included observations: 119			
Balanced sample (listwise missing value deletion)			
Correlation			
Probability	NIFTY	FIIS	DIIS
NIFTY	1.000000		

FIIS	0.588297	1.000000	
	0.0000	-----	
DIIS	-0.603028	-0.912512	1.000000
	0.0000	0.0000	-----

Source(s): Authors' EViews 10 Calculation

The covariance study, which was performed using a balanced sample from February 2014 to December 2023, had 119 observations. The correlation matrix depicts the correlations among the NIFTY index, Foreign Institutional Investors (FIIS), and Domestic Institutional Investors. The NIFTY index has a positive correlation of 0.588 with FIIS, which is statistically significant with a probability of 0.0000, showing a moderate positive link between these two variables. In comparison, the NIFTY index and DIIS have a correlation of -0.603, indicating a substantial negative connection with a probability of 0.0000. Additionally, FIIS and DIIS exhibit a high negative correlation of -0.913, which is statistically significant with a probability of 0.0000. This implies a significant adverse relation between FIIS and DIIS in terms of the NIFTY index.

GARCH Model

Model 1: Independent Variable NET FIIs Investment and Dependent Variable as NIFTY RETURNS

TABLE 5: GARCH Test as Independent Variable FIIs

GARCH = C (5) + C (6) *RESID (-1) ^2 + C (7) *GARCH (-1)				
Variance Equation				
Variance	Coefficient	Std. Error	Z-Statistic	Prob.
C	0.000375	0.000365	1.028823	0.3036
RESID (-1) ^2 (α)	0.149389	0.090594	1.648986	0.0992
GARCH (-1) (β)	0.599389	2.268245	2.234485	0.0255
FIIs	1.55E-06	2.02E-07	7.645401	0.0000

Source(s): Authors' EViews 10 Calculation

TABLE 5 represents the GARCH model which depicts how foreign institutional investors (FIIs) affect the volatility of the NIFTY 50. The RESID (-1) ^2 variable, which represents prior shocks, has a small influence with a coefficient of 0.149389 and probability of 0.0992. GARCH (-1) predicts substantial volatility persistence with a probability of 0.0255.

The FIIs coefficient is 1.55E-06 with a very low p-value (0.0000), meaning the effect of FIIs is highly statistically significant. The positive coefficient indicates that higher FII inflows are associated with increased volatility in the NIFTY index. Hence, FIIs significantly affect the NIFTY index, and their inflows are positively correlated with volatility in the market.

Model 2: Independent Variable NET DIIs Investment and Dependent Variable as NIFTY RETURNS

TABLE 6: GARCH Test as Independent Variable DIIs

GARCH = C (5) + C (6) *RESID (-1) ^2 + C (7) *GARCH (-1)				
Variance Equation				
Variance	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000960	0.0001904	0.504345	0.6140
RESID (-1) ^2 (α)	0.150000	0.237919	0.630466	0.5284
GARCH (-1) (β)	0.600000	0.714408	0.839856	0.4010
DIIs	-2.24E-06	4.35E-07	-5.150428	0.0000

Source(s): Authors' EViews 10 Calculation

TABLE 6 shows the GARCH model findings evaluate the volatility of the NIFTY index using the variable "DIIS". The study indicates that DIIS has a substantial negative influence on the NIFTY index, with a coefficient of -1.40E-06 and a p-value of 0.0000, rejecting the null hypothesis. The GARCH (1,1) model shows a significant coefficient of 0.481192 for previous squared residuals (RESID (-1) ^2). This suggests that past shocks have a considerable impact on present volatility. However, the GARCH (-1) term is non-significant (p = 0.6383), implying that historical volatility has no effect on current volatility. The DIIS coefficient is negative, which implies that greater DIIS values correspond with lower NIFTY returns, indicating a substantial negative link between DIIS and NIFTY index performance.

TABLE 7: Granger Causality Tests

Pairwise Granger Causality Tests			
Date: 08/12/24 Time: 09:10			
Sample: 2014M01 2023M12			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
FII does not Granger Cause NIFTY	118	0.29064	0.7483
NIFTY does not Granger Cause FII		3.26483	0.0419
DII does not Granger Cause NIFTY	118	0.08065	0.9226
NIFTY does not Granger Cause DII		2.80346	0.0649
DII does not Granger Cause FII	118	1.92331	0.1509
FII does not Granger Cause DII		0.03344	0.9671
Source(s): Authors' EViews 10 Calculation			

Source(s): Authors' EViews 10 Calculation

TABLE 7 indicates Pairwise Granger Causality Tests investigate estimation correlations between time series. FII does not Granger cause NIFTY, as evidenced by an F-statistic of 0.29064 and a p-value of 0.7483, both of which are more than the 0.05 significant threshold. However, NIFTY Granger induces FII, as shown by an F-statistic of 3.26483 and a p-value of 0.0419, both of which are less than the 0.05 threshold. DII does not Granger cause NIFTY (F-statistic of 0.08065, p-value of 0.9226), while NIFTY has the potential to Granger cause DII (F-statistic of 2.80346, p-value of 0.0649). There is no substantial Granger causality between DII and FII or NIFTY, and no causation exists between FII and DII in any direction.

7. FINDINGS OF THE STUDY

The following paper has studied the association between the FIIs, DIIs, and the volatility in the NIFTY. According to the trend study, both Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs) have increased investment flows in recent years, albeit with significant variations. The DIIs show high volatility, with sharp rises and drops, notably between 2019 and 2021, indicating market reactions to important events such as the COVID-19 pandemic. While FIIs fluctuate, they do so in a more constant manner than DIIs do. This trend emphasises the effect of important economic events on investor behaviour and market dynamics. The correlation study shows a somewhat positive association between the NIFTY index and FIIs, implying that when FIIs increase their investments, the NIFTY index tends to grow. In contrast, there is a strong negative connection between the NIFTY index and DIIs, meaning that more DII investments result in lower NIFTY index values. Furthermore, a strong negative correlation between FIIs and DIIs indicates a considerable adverse link in their investment behaviours in respect to the NIFTY Index. The GARCH model results show that FIIs considerably enhance volatility in the NIFTY index. The positive correlation for FIIs suggests that higher FII inflows are connected with increased market volatility, emphasising FIIs' significant effect on market swings. The GARCH model for DIIs demonstrates a significant negative impact on the NIFTY index, implying that higher DII investment is associated with lower NIFTY returns. This negative coefficient means that DIIs might put downward pressure on the index. The Granger causality tests show that the NIFTY index may Granger-cause both FIIs and DIIs, implying that changes in the NIFTY index anticipate changes in these investment flows. However, FIIs and DIIs do not Granger-cause the NIFTY index, implying that their investment flows do not forecast changes in the index. Furthermore, there is no significant Granger causality between FIIs and DIIs, indicating that these two categories of institutional investors have little impact on one another's investing behaviours. In conclusion, the study sheds light on the links between institutional investors and market volatility, emphasising the separate effects of FIIs and DIIs

on the NIFTY index, as well as the absence of causal influence among these factors.

8. CONCLUSIONS

The study indicates how Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs) influence the NIFTY index, providing insights for investment strategy formulation. FIIs contribute to greater market volatility, whilst DIIs reduce returns. This intelligence helps investors and portfolio managers refine risk management and asset allocation strategies. These findings can be used by policymakers to develop stabilising measures that balance the effects of FIIs and DIIs. Furthermore, the NIFTY index can estimate changes in investment flows, which improves market forecasts. The paper also emphasises the need of accounting for exogenous shocks, such as the COVID-19 pandemic. The study examines data from 2019 to 2021, a timeframe characterised by unusual occurrences like as the COVID-19 pandemic, which may alter regular market patterns. Expanding the timeframe may offer a better understanding of institutional investments and market volatility. While GARCH models are used to quantify volatility, they may not capture all elements that influence market dynamics. The study's dependence on historical data may contain errors, and it ignores elements such as macroeconomic situations and worldwide trends. Furthermore, the lack of Granger causation between FIIs, DIIs, and the NIFTY index indicates a need for additional research. Future research might improve findings by extending the study's timeline to include times before 2019 and beyond 2021, providing a more comprehensive picture of how FIIs, DIIs, and market volatility interact throughout economic cycles. Macroeconomic data, geopolitical developments, and global market shifts might all contribute to a better understanding. Comparative research of many nations or indexes may indicate deeper tendencies. Diverse statistical methods, such as machine learning and multivariate GARCH, as well as the exploration of investment strategies, might help to refine findings and educate investors and policymakers. as per data 30% of the total FIIs investment in INDIA are in just 3 stocks: Reliance, HDFC Ltd & TCS! Overall, the significant role of DIIs in affecting NIFTY volatility suggests that their investment behavior could be an important factor to consider in understanding market volatility.

9. DECLARATION

I, Ravi Ranjan Mishra, hereby confirm that the manuscript titled " Foreign and Domestic Institutional Investors: Their Role in Shaping Volatility in Indian Stock Market" authored by Ravi Ranjan Mishra & Shirish Mishra, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved

the manuscript and agreed to its submission to International Management Perspective Conference 2025 (IMPeC-25).

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Aggarwal, V., Doifode, A., & Tiwary, M. K. (2021). Do lower foreign flows and higher domestic flows reduce Indian equity market volatility? *Vision the Journal of Business Perspective*, *26*(4), 461–470. https://doi.org/10.1177/0972262921990981

[2.] Bansal, P. K. (2021). Critical study of Indian stock market relationship with domestic (DIIs) and foreign institutional investors (FIIs). *Materials Today Proceedings*, *37*, 2837–2843. https://doi.org/10.1016/j.matpr.2020.08.658

[3.] Bansal, P. K., & Agrawal, O. P. (2018). Impact of Foreign Institutional Investors on the Volatility of Indian Stock Market using GARCH Model. *FOCUS Journal of International Business*, *5*(01). https://doi.org/10.17492/focus.v5i01.13139

[4.] Bekaert, G., & Wu, G. (2000). Asymmetric volatility and risk in equity markets. *Review of Financial Studies/˜the œReview of Financial Studies*, *13*(1), 1–42. https://doi.org/10.1093/rfs/13.1.1

[5.] Chauhan, A. K., & Chaklader, B. (2020). Do Local Investors Exhibit Smart Value Investment? Empirical Evidence from India. *Global Business Review*, *24*(5), 833–844. https://doi.org/10.1177/0972150920915330

[6.] Chhimwal, B., & Bapat, V. (2020). Impact of foreign and domestic investment in stock market volatility: Empirical evidence from India. *Cogent Economics & Finance*, *8*(1), 1754321. https://doi.org/10.1080/23322039.2020.1754321

[7.] Choudhary, K., Singh, P., & Soni, A. (2019). Relationship between FIIs' herding and returns in the Indian equity market: Further empirical evidence. *Global Business Review*, *23*(1), 137–155. https://doi.org/10.1177/0972150919845223

[8.] Das, K. C. (2023). Indian start-ups going public: return and volatility of stocks during bear and bull regimes. *International Journal of Emerging Markets*. https://doi.org/10.1108/ijoem-06-2022-0898

[9.] Engle, R. F., & Mezrich, J. (1995). Grappling with GARCH. *Risk*, *8*(9), 112-117.

[10.] Gahlot, R. (2019). An analytical study on effect of FIIs & DIIs on Indian stock market. *Journal of Transnational Management*, *24*(2), 67–82. https://doi.org/10.1080/15475778.2019.1601485

[11.] Joo, B. A., Joo, & Mir, Z. A. (2015). Impact of FIIs Investment on Volatility of Indian Stock Market: An Empirical Investigation. *Journal of Business & Economic Policy*. https://dissem.in/p/26965801

[12.] Kanojia, S., Singh, D., & Goswami, A. (2020). Impact of herding on the returns in the Indian stock market: an empirical study. *Review of Behavioral Finance*, *14*(1), 115–129. https://doi.org/10.1108/rbf-01-2020-0017

[13.] Khatun, M. G. (2022). How has the correlation between FII and DII resulted in a positive trend in Indian stock markets in spite of lower GDP; catalysing the markets to rise?

[14.] Kristian, M., Adiwena, S., & Laksana, Y. B. (2023). FOREIGN INVESTOR AND MARKET VOLATILITY: EVIDENCE ON INDONESIA STOCK MARKET. *International Journal of Application on Economics and Business*, *1*(2), 410–418. https://doi.org/10.24912/ijaeb.v1i2.410-418

[15.] Loomba, J. (2012). Do FIIs impact volatility of Indian stock market. *International Journal of Marketing, Financial Services & Management Research*, *1*(7), 80-93.

[16.] Marisetty, N. (2024). Evaluating the efficacy of GARCH models in forecasting volatility dynamics across major global financial indices: A Decade-long analysis. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4939424

[17.] Mishra, A. K., Agrawal, S., & Patwa, J. A. (2022). Return and volatility spillover between India and leading Asian and global equity markets: an empirical analysis. *Journal of Economics Finance and Administrative Science*, *27*(54), 294–312. https://doi.org/10.1108/jefas-06-2021-0082

[18.] Mishra, R. R., & Mishra, S. (2024). Asymmetric Effects and Volatility Clustering in NSE NIFTY 50: A Comparative Analysis of GARCH Models. *Asian Journal of Economics, Business and Accounting*, *24*(11), 142–152. https://doi.org/10.9734/ajeba/2024/v24i111547

[19.] Mishra, R. R., & Mishra, S. (2024). Nexus between stock return and market volatility in Indian perspective. *Journal of Applied Economic Sciences (JAES)*, 417. https://doi.org/10.57017/jaes.v19.4(86).05

[20.] Purnima Rani Barik and Dr. Lopamudra Mishra, DIIS and Volatility of Indian Stock Market: An Analysis, International Journal of Management (IJM), 14(1), 2023, pp. 32-40. https://iaeme.com/Home/issue/IJM?Volume=14&Issue=1

[21.] Sahoo, A. P. (2021). Impact of GDP and FII on stock market: A study in BSE and NSE in India. *ComFin Research*, *9*(1), 47–51. https://doi.org/10.34293/commerce.v9i1.3529

[22.] Srihari, G., Kusuma, T., Chetanraj, D. B., Kumar, J. S., & Aluvala, R. (2024). Predictive modeling of return volatility in sustainable investments: An in-depth analysis of ARIMA, GARCH, and ARCH techniques. *Investment Management & Financial Innovations*, *21*(1), 213. https://doi.org/10.21511/imfi.21(1).2024.17

[23.] Swapna, G. S. G. (2018). Impact of FIIs on Indian Stock Market with Special Reference to BSE and NSE Index. *International Journal of Accounting and Financial Management Research*, *8*(5), 15–24. https://doi.org/10.24247/ijafmrdec20183

[24.] Walia, K., Walia, R., & Jain, M. (2012). Impact of foreign institutional investment on stock market. *International journal of computing and corporate research*, *2*(5), 1-15.

[25.] Zhao, Y., & Chen, Z. (2021). Forecasting stock price movement: new evidence from a novel hybrid deep learning model. *Journal of Asian Business and Economic Studies*, *29*(2), 91–104. https://doi.org/10.1108/jabes-05-2021-0061.

Risk, Personality, and Social Media: A Trio in Investment Decisions

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ABSTRACT

Characteristics that characterize consistent patterns of behavior that set an individual apart are called personality traits. Consequently, predicting investors' investment decisions will be made easier by comprehending the impact of personality traits on risk tolerance under social media influencer influence with certain Emotional intelligence. The purpose of this study is to evaluate the influence of personality traits, such as extraversion, conscientiousness, agreeableness, neuroticism, and openness to new experiences, on the relationship between social media and risk tolerance as well as the effect of risk tolerance on investment decisions with certain level of emotional intelligence. A structured questionnaire was utilized in the study to gather data from 285 retail investors in India. A descriptive, quantitative research design was used in conjunction with convenient snowball sampling techniques. Additionally, the PLS-SEM approach was used to statistically evaluate and analyse the collected data on Smart-PLS 4. According to the study, social media has an impact on investing decisions, with risk tolerance acting as a mediating factor. Though they didn't directly affect the investment choice, the personality traits did have an effect on how social media and risk tolerance interacted. Additionally, the results of the mediation-moderation analysis showed that personality traits moderated the relationship between social media and risk tolerance and that risk tolerance fully mediated the relationship between social media and investment intention. By examining the influence of the big five personality traits on the relationship between social media and risk tolerance, that is, the mediating role of Risk Tolerance on social media influencing investments and moderating roles of Personality Traits. The study adds to the body of knowledge by expanding the applicability of the theory of social media, risk tolerance, emotional intelligence and personality traits theory.

Keywords: Social Media, Investment Decision, Influencer, Personality Traits, Risk Tolerance, Emotional Intelligence.

1. INTRODUCTION

Millennials and Gen Z are increasingly active in capital markets but face significant risks from investment fraud, largely due to low financial literacy and the influence of social media personalities promoting high-return opportunities without sufficient risk context (Sonny, 2021; Prasetyantoko, 2022). Social media shapes investor behavior by providing real-time stock performance updates (Loibl & Hira, 2009; Wang et al., 2016), with platforms like blogs and Twitter disseminating stock trend information (Chahine & Malhotra, 2018; Farkas & Keshk, 2019; Rickett, 2016). Influencers heavily impact young investors' market participation (Arora et al., 2019; Jerslev, 2016; Kim et al., 2021), and factors such as peer influence and family connections further guide their investment decisions (Gupta & Goyal, 2022; Sokolova & Kefi, 2020; Yuan & Lou, 2020).

The irrational behaviors of individual investors challenge the Efficient Market Hypothesis (EMH) (Fama, 1965), with behavioral finance examining how psychological factors affect decision-making (Lo et al., 2005). Investment Decision-Making (IDM) involves risk-return analysis influenced by Personality Traits (PT) and Investor Sentiment (IS), the latter reflecting overall market attitudes (Baker & Wurgler, 2006). Risk tolerance, how much uncertainty an investor can withstand varies and is shaped by personality traits (Bayar et al., 2020; Sadiq & Khan, 2019). The Five Factor Personality Model highlights key traits that affect risk perception (Kubilay & Bayrakdaroglu, 2016; Peterson, 2012).

This study examines the interplay of these factors among Indian investors, applying Prospect Theory (Kahneman & Tversky, 1979) and the Five Factor Personality Model (Digman, 1990; Hamza & Arif, 2019) to understand how financial literacy and personality influence risk tolerance and investment decisions. Additionally, emotional intelligence, encompassing self-motivation and emotional regulation, plays a crucial role in financial behavior (Goleman, 2001), yet research on women's financial management remains limited (Setyawati & Suroso, 2016, 2017).

2. LITERATURE REVIEW

Social Media and Investment behaviour

Social media significantly influences young adult investors in stock markets, affecting stock prices and investor behavior (Duz Tan & Tas, 2021; Zhang et al., 2016). It acts as a vital platform for sharing financial news, thus reducing information asymmetry and improving financial literacy (Chahine & Malhotra, 2018; Miller & Skinner, 2015; Talwar et al., 2021; Yanto et al., 2021). However, caution is necessary when interpreting information from these platforms to avoid biased decisions stemming from out dated or unreliable news (Jiao et al., 2016). Stocks that are frequently discussed on social media tend to experience increased volatility and trading volume, influencing their

prices (Jiao et al., 2016; Sul et al., 2017). While informed investors may initially benefit from social media insights, repetitive discussions can foster speculative behavior driven by "stale" information (Jiao et al., 2016). The ability to effectively process social media data is crucial for making informed investment decisions (Ali Al Atoom et al., 2021), as lacking this skill may diminish social media's positive impact on decision-making (Ahmed et al., 2019).

The transition to Web 2.0 platforms, like Facebook and Twitter, has revolutionized communication, facilitating user-generated content and enhancing connectivity (Asur & Huberman, 2010; Kaplan & Haenlein, 2010). This evolution has propelled the rise of Social Media Influencers (SMIs), who significantly impact consumer behavior and marketing effectiveness (Appel et al., 2020; Audrezet & Charry, 2019). Understanding the influence of SMI attributes expertise, trustworthiness, and likability on consumer purchase intentions remains limited (Mavrck; Influencer Marketing Hub, 2019; Freberg et al., 2011).

Investor behavior is often irrational, driven by herd mentality rather than fundamental analysis (Kapoor & Prosad, 2017). This was notably observed during the 2008 Indonesian Capital Market crisis, where panic selling led to significant declines despite favourable fundamentals. Personality traits also play a critical role in shaping investment decisions; traits like openness to experience are positively correlated with risk tolerance, while neuroticism typically deters riskier investments (Deniz & Satici, 2017; Pak & Mahmood, 2015; Nandanand, 2016). Understanding these personality dimensions can help investors mitigate biases and enhance decision-making aligned with their financial goals (Pak & Mahmood, 2015; Jameel & Saddiqui, 2019; Rabbani et al., 2019).

Big Five Personality Traits and Risk Consistency

Neuroticism, characterized by emotional instability and stress susceptibility significantly affects decision-making, often leading to avoidance behavior and emotional reactions (Oehler et al., 2018; Camgoz et al., 2017). Individuals with high neuroticism typically experience increased anxiety, making them less inclined to engage in entrepreneurial ventures that require resilience (Zhao & Seibert, 2006). This trait is also associated with compulsive buying and risky behaviors, such as alcohol consumption and unsafe sex, as individuals seek stress relief (Hoch & Loewenstein, 1991; Trobst et al., 2002).

In contrast, extroversion, which denotes sociability and enthusiasm, is linked to a greater propensity for novelty-seeking and risk-taking across various domains (Ozer & Mutlu, 2019; Weller & Tikir, 2011). Extraverts are more likely to partake in risky behaviors, motivated by a desire for stimulation and a diminished fear of negative consequences (Schmitt, 2004; Chauvin et al., 2007).

Conscientiousness, reflecting organization and self-discipline, negatively correlates with risk-taking behaviors, as conscientious individuals prioritize stability and avoid uncertain activities (Mayfield et al., 2008; Barrick, Mount, & Judge, 2001; Arthur & Graziano, 1996). Openness to experience correlates positively with risk-taking, as individuals high in this trait are inclined to explore new experiences, leading to activities such as unsafe driving (Durand et al., 2008; McCrae & Costa, 1997; Booth-Kewley & Vickers, 1994).

Agreeableness, characterized by trust and cooperation, promotes a cautious approach to risk, as agreeable individuals tend to prioritize social harmony and avoid disruptive behaviors (Camgoz et al., 2017; Costa & McCrae, 1992; Terracciano et al., 2008).

Personality traits significantly shape investment outcomes and decision-making processes. Neuroticism influences behavioral biases in financial contexts (Durand et al., 2008; Baker et al., 2021), while investor sentiment plays a crucial role in investment decisions (Haritha & Uchil, 2019). Conscientiousness is linked to responsibility and risk aversion, while extraversion is associated with higher investor performance and risk tolerance (Akhtar et al., 2017; Kaur & Goel, 2022).

Financial risk tolerance (FRT), defined as the willingness to accept financial uncertainty, is influenced by demographic factors. Generally, younger age, male gender, being single, and higher income levels are associated with higher FRT, although age-related findings can vary (Haliassos & Bertaut, 1995; Sulaiman, 2012; Wang & Hanna, 1997). These inconsistencies suggest other influential variables are at play (Grable, 2000; Sulaiman, 2012). Empirical evidence shows a positive relationship between FRT and actual financial behaviors, such as higher stock holdings and investment in riskier assets, contrasting with risk-averse behaviors like Treasury Bill investments (Finke & Huston, 2003; Corter & Chen, 2006; Jacobs-Lawson & Hershey, 2005).

Understanding these dynamics is crucial for tailored financial advice and portfolio management.

Research Gap Identification

In conclusion, understanding the influence of social media influencers, personality traits, financial risk tolerance and emotional inteligence together on investment decisions is crucial for both investors and financial advisors in indian context. These insights not only help in predicting investor behaviours but also inform strategies for tailored financial advice and portfolio management based on individual personality profiles and risk preferences.

Theoretical Framework

Social Aspects Theory, focusing on social influence and capital, is widely used in understanding social media

attitudes and actions (Kelman, 1958; Chang & Chuang, 2011; Portes, 1998). Other theories like Social Loafing Theory (Latané, Williams, & Harkins, 1979), Social Power (Wei, 2009, 2013), and Social Learning Theory by Bandura & Wittenberg (1971) also contribute to understanding social media's impact on investment decisions and investor behavior (Cheng et al., 2019; Walther & Bade, 2020; Olenski, 2018; Wang, 2022; Maknickienė et al., 2021). These theories shape research questions focusing on social media's influence on investment decisions and understanding investor behavior.

The study employs two theories the Prospect Theory, and the Five Factor Personality Model to link the personality traits of investors on their risk tolerance which In turn mediates the influence of social media on investment decision.

Prospect Theory

Prospect Theory, developed by Kahneman and Tversky (1979), contrasts with Expected Utility Theory by emphasizing actual behavior in decision-making under uncertainty. It suggests that individuals are risk-averse regarding gains and risk-seeking concerning losses, which impacts their financial decisions. Investors exhibit varying risk preferences, with some tolerating shortfalls while others accept losses only up to a certain threshold before avoiding further losses (Grable et al., 2020). The reflection effect, where choices are mirrored between gains and losses, reinforces this theory, highlighting the influence of risk preferences on investment decisions (Grable et al., 2020).

Five Factor Personality Model

The Big Five Personality Traits, or Five Factor Personality Model, categorizes individual differences into five domains: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (Digman, 1990; Gosling et al., 2003). These traits significantly influence financial behavior, including savings and investment decisions. Extraversion is associated with lower savings due to a preference for immediate consumption and social spending (Brandstätter & Jacob, 2013; Nyhus & Webley, 2001). Conversely, neuroticism correlates negatively with savings as emotionally unstable individuals may engage in compulsive spending (Brandstätter & Jacob, 2013; Nyhus & Webley, 2001). Conscientiousness positively impacts savings through better organization and planning (Brandstätter & Jacob, 2013; Nyhus & Webley, 2001), while openness to experience enhances long-term investment intentions (Mayfield et al., 2008).

Understanding these personality traits aids financial advisors in tailoring strategies that align with clients' risk preferences and goals. Behavioral finance challenges traditional theories like the Efficient Market Hypothesis (Fama, 1965), emphasizing that psychological factors influence investor decisions, leading to biases such as herding behavior and mental accounting (Haritha & Uchil, 2020). The Five Factor Model (FFM) identifies how traits like Neuroticism and Extraversion shape investor behavior and decision-making (Kumar & Goyal, 2016), highlighting the interplay between personality and financial outcomes (Durand et al., 2008; Oehler et al., 2018). This framework helps analyze patterns in investor behavior, offering insights into risk tolerance and decision-making in various market conditions. The FFM, widely accepted in psychology and management literature, provides a framework to analyze how these traits impact investment choices and market outcomes (Costa & McCrae, 1992; Mayfield et al., 2008).

The model's orthogonal dimensions NEU, EX, CON, OP, and AG help psychologists and researchers assess the diverse patterns of thoughts and emotions that shape investor behavior (John & Srivatsava, 1999; Alderotti et al., 2023; Rustichini et al., 2016). Understanding these dimensions offers insights into why investors may exhibit varying levels of risk tolerance, decision-making biases, and overall financial behavior in both rational and irrational markets.

Domain Consistency of Risk Preferences

The debate surrounding domain consistency versus domain specificity in risk preferences is crucial in risk research. Domain consistency posits uniform risk preferences across contexts, while domain specificity suggests that risk-taking varies by situation. Soane and Chmiel (2005) argue that both perspectives are valid, with context-specific preferences influenced by factors such as information framing and prospect theory (Tversky & Kahneman, 1986). Cross-domain consistency may result from stable personality traits.

Emotional Intelligence and Risky Investment Intention

Emotional intelligence (EI), defined as the ability to understand and utilize emotional information (Wong et al., 2002), plays a significant role in financial decision-making. The study posits that EI mediates relationships in the Theory of Planned Behavior (TPB), indicating that individuals with higher EI make better financial risk tolerance decisions (Goleman, 2006). High EI correlates with successful investment outcomes (Kunnanatt, 2004) and better financial risk tolerance (Dhiman & Raheja, 2018), while low EI can lead to poor decision-making (Bouzguenda, 2018) and decreased financial performance (Ameriks et al., 2009).

Moreover, higher EI is linked to enhanced financial intelligence (Kartika et al., 2023) and distinguishes effective leaders (Fisher, 2016). Although EI's influence on risk-taking has been studied, its direct relationship to financial risk-taking remains under-explored (Hess & Bacigalupo, 2011). High-EI investors tend to maintain rationality amid social pressures, while low-EI individuals may act impulsively (Fraser et al., 2018). Thus, EI contributes to improved decision-making in volatile markets (Johnson & Brown, 2024; Smith et al., 2023). Finally, distinguishing between

ability-based and trait-based EI is essential, as both predict workplace success (Joseph & Newman, 2010), emphasizing the importance of controlling for personality factors in assessing EI's contributions (García & Costa, 2014).
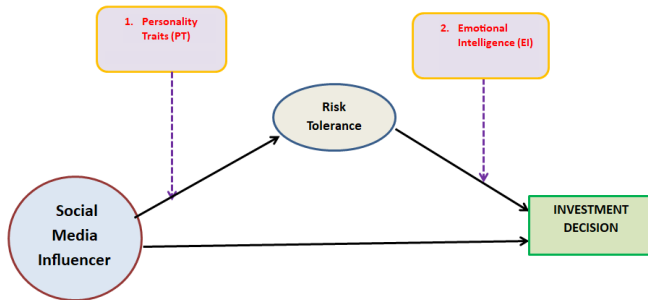
Figure 1: Research Model

NOTE: Hypothesied developed

The Hypothesized Model

These findings underscore the role of personality traits in shaping risk preferences across different life domains. Understanding these relationships is crucial for predicting risk tolerance (FRT) and subsequent investment behavior, as highlighted in the hypothesized model of the study. By investigating these variables the model above (Figure 1) was hypothesized, the study aims to provide deeper insights into how personality traits and emotional intelligence influence risk tolerance and investment decisions, particularly in the context of evolving factors such as social media influence.

Hypothesis H1: Social media positively affects the risk tolerance of investors.

Hypothesis H2: Risk tolerance positively affects investment behaviour.

Hypothesis H3: Social media positively affects the investment decision of investor.

Hypothesis H4: Risk tolerance mediates the influence of social media influencers on the investment behaviour.

Hypothesis H5: Personality traits influence the relation between the social media and risk tolerance of investors.

Hypothesis H6: Emotional Intelligence influences the relationship between the investor's risk tolerance and Investment decisions/behaviour of investors.

The hypotheses investigate how personality traits influence Investment behavior indirectly through financial risk tolerance (FRT) and moderating effect of Emotional Intelligence. The study will employ the PLS-SEM method to test these hypotheses. This method not only assesses direct and indirect effects but also mitigates issues of reverse causality by using instrumental variables. Reverse causality can lead to unreliable research findings due to potential

correlations between error terms in dependent and independent variables. This article not only tests the hypotheses but also tries to prove that the variables in this framework do not have a confusing relationship pattern as stated. Investment decisions/ behaviour has been affected by financial preferences (financial preferences, such as risk tolerance, have been caused by individual personality traits and Emotional Intelligence).

Methodology

This study employed a quantitative approach with a descriptive-correlational research design to analyze the relationships between variables. It also utilized a predictive correlational design to determine the strength and direction of these relationships. Causal relationships were assessed using multiple regression analysis, and Smart-PLS 4 SEM software was used for data analysis. The study targeted Indian investors earning a minimum of Rs. 500,000 annually, involved in various investment avenues including stocks, bonds, mutual funds, and cryptocurrency. Respondents were selected via non-probability sampling, specifically convenience and snowball sampling techniques. The minimum sample size of 270 was estimated using the G Power software, with an effect size of 0.07, probability error of 0.05, and a confidence interval of 95%, for this research a total of 285 participants were included. Survey instruments adapted from previous studies by Pak and Mahmood (2015) for Big Five personality traits and Ainia and Lutfi (2019) for risk tolerance were used. The questionnaire, conducted online via Google Forms, consisted of sections on demographics, personality traits, social media use, investment behavior, and risk tolerance, assessed using a 5-Point Likert scale. Pilot testing ensured the reliability with Cronbach's Alpha values exceeding 0.70 for all constructs indicating strong internal consistency (Badoc-Gonzales et al., 2020; Mahmood, 2021).

Figure 2. The Hypnotized structured research model (Constructs: SM-Social Media, RT-Risk Tolerance, EI-Emotional Intelligence, ID- Investment Decision and

Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience) Figure 2. The Hypnotized structured research model (Constructs: SM-Social Media, RT-Risk Tolerance, EI- Emotional Intelligence, ID-Investment Decision and Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience) Figure 2. The Hypnotized structured research model (Constructs: SM-Social Media, RT-Risk Tolerance, EI- Emotional Intelligence, ID- Investment Decision and Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience) Figure 2. The Hypnotized structured research model (Constructs: SM-Social Media, RT-Risk Tolerance, EI- Emotional Intelligence, ID-Investment Decision and Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience)

Figure 2: The Hypnotized structured research model

Note: Developed Using Smart-PLS Software. (Constructs: SM-Social Media, RT-Risk Tolerance, EI- Emotional Intelligence, ID- Investment Decision and Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience).

Figure 2. The Hypnotized structured research model (Constructs: SM-Social Media, RT-Risk Tolerance, EI-Emotional Intelligence, ID- Investment Decision and Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience)The Hypnotized structured research model (Constructs: SM-Social Media, RT-Risk Tolerance, EI- Emotional Intelligence, ID- Investment Decision and Personality Traits (PA-agreeableness, PE- Extraversion, PO-Openness to Experience

3. RELIABILITY ANALYSIS

TABLE 1: Construct Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
EI	0.800	0.905	0.906	0.828
ID	0.892	0.943	0.922	0.748
P	0.890	0.891	0.919	0.695
RT	0.794	1.167	0.895	0.811
SM	0.805	0.822	0.869	0.625

Note: Source : Compiled from the data Using Smart-PLS Software.

TABLE 2: Outer Loading

	EI	ID	P	RT	SM	EI x RT	P x SM
EI2	0.871						
EI3	0.947						
ID1		0.810					
ID2		0.916					
ID3		0.896					
ID5		0.833					
PA1			0.793				
PA3			0.867				
PE2			0.880				
PE3			0.805				
PO2			0.818				
RT1				0.967			
RT2				0.829			
SM1					0.841		
SM2					0.786		
SM3					0.782		
SM4					0.751		
P x SM							1.000
EI x RT						1.000	

Note: Source : Compiled from the data Using Smart-PLS Software.

TABLE 3: Cronbach alpha and Sample number

No. of Items Reliability	Cronbach's Alpha	Sample No.
Statistics of the Big Five	0.890	05
Reliability Statistics of Social Media	0.805	04
Reliability Statistics of Investment Behaviour/Decision	0.892	04
Reliability Statistics of Risk Tolerance	0.794	02
Reliability Statistics of Emotional Intelligence	0.80	02

Note: Source : Compiled from the data Using Smart-PLS Software.

Statistical Analysed Results, Findings and Discussions

The descriptive statistics revealed insights into respondents' perceptions and personality traits. The mean scores indicated high levels of risk tolerance among participants, with a moderate level of variability. Openness to experience scored the highest mean and showed considerable variability, suggesting strong agreement among respondents in embracing new ideas. Agreeableness also had a high mean and variability, indicating cooperative behavior. Conscientiousness demonstrated a slightly lower mean with moderate variability, highlighting determination. Extraversion was moderately rated with a similar level of variability, indicating sociability. Neuroticism showed the lowest mean and higher variability, suggesting varying levels of pessimism among respondents. These findings provide a comprehensive overview of respondents' attitudes and personality traits related to risk tolerance and social behavior.

TABLE 4: Collinearity Statistics Outer Model

	VIF
EI2	1.778
EI3	1.778
ID1	2.311
ID2	4.507
ID3	3.468
ID5	1.484
PA1	1.831
PA3	2.211
PE2	3.180
PE3	2.168
PO2	1.980
RT1	1.545
RT2	1.545
SM1	1.776
SM2	1.512
SM3	1.594
SM4	1.761
EI x RT	1.000

Note: Source : Compiled from the data Using Smart-PLS Software.

TABLE 5: Collinearity Statistics Inner Model

	EI	ID	P	RT
EI		1.638		
ID				
P				1.056
RT		1.537		
SM		1.262		1.336
EI x RT		1.195		
P x SM				1.296

Note: Source : Compiled from the data Using Smart-PLS Software.

Reliability of the constructs have been proved by the data representing factor loading data for each Items, variance inflation factor (VIF) < 5.0 and Cronbach Alfa values being all greater than 0.70 and AVE >0.5 (Table 1 and 4).
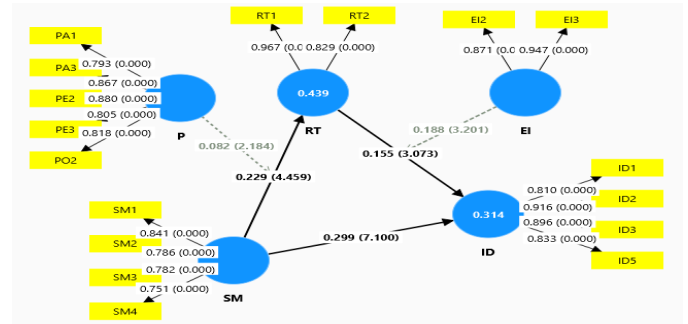
Figure 3: Research SEM measurement model.

Note: Source : Developed from data using Smart-PLS Software. Structural model with path coefficients and T-value and measurement model with path coefficients and P-value.
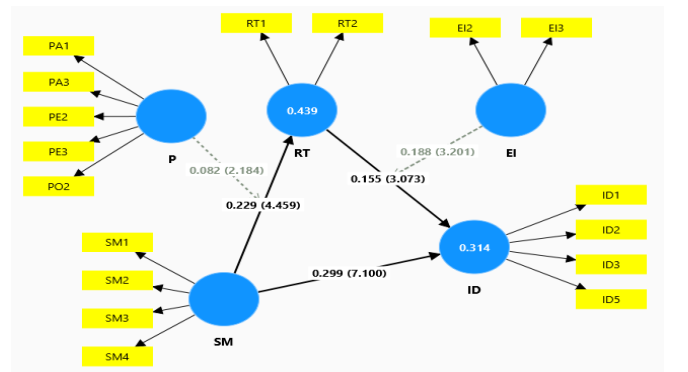
Figure 4: Structural Equation model

Note: Source : Developed from data using Smart-PLS Software. Path coefficient, t-values and constructs Regression coefficients.

4. DISCRIMINANT ANALYSIS

TABLE 6: Discriminant Validity

Variables	EI	ID	P	RT	SM
EI	0.910				
ID	0.395	0.865			
P	0.617	0.374	0.834		
RT	0.551	0.420	0.603	0.900	
SM	0.447	0.472	0.295	0.430	0.791

Note: Source : Compiled from the data Using Smart-PLS Software.

Discriminant validity, assessing the dissimilarity between different concepts' measurements, was confirmed through the square root of the Average Variance Extracted (AVE) exceeding correlations with other constructs, as shown in

Table 6. These results validate the distinctiveness of each construct within the measurement model. Moving forward, the structural model was examined using bootstrapping with over 2100 subsamples, focusing on path coefficients and their significance (Hair et al., 2014; Table 8). The analysis revealed a significant positive influence of Social Media on investment behavior (t > 1.96, p < 0.05). Additionally, the R-square value (R2 = 0.32, Table 7) indicates that social media explains more than 32% of the variance in intention through risk tolerance to invest in financial products, highlighting its critical role as an antecedent to investment intention. These findings underscore the substantial impact of social media on financial decision-making and reinforce its importance in influencing investment behaviour.

5. REGRESSION ANALYSIS

TABLE 7. Regression Coefficient

	R-square	R-square adjusted
ID	0.314	0.304
RT	0.439	0.433

Note: Source : Compiled from the data Using Smart-PLS Software.

6. MODERATION AND MEDIATION BOOT STRAPPING DATA

TABLE 8: Total effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
EI -> ID	0.225	0.227	0.054	4.138	0.000
P -> ID	0.084	0.084	0.028	3.010	0.003
P -> RT	0.543	0.546	0.036	15.182	0.000
RT -> ID	0.155	0.153	0.050	3.073	0.002
SM -> ID	0.334	0.336	0.038	8.725	0.000
SM -> RT	0.229	0.230	0.051	4.459	0.000
EI x RT -> ID	0.188	0.190	0.059	3.201	0.001
P x SM -> ID	0.013	0.012	0.006	2.136	0.033
P x SM -> RT	0.082	0.084	0.038	2.184	0.029

Note: *Source : Compiled from the data Using Smart-PLS Software.*

TABLE 9: Specific Indirect Effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
SM -> RT -> ID	0.036	0.036	0.016	2.222	0.026
P x SM -> RT -> ID	0.013	0.012	0.006	2.136	0.033
P -> RT -> ID	0.084	0.084	0.028	3.010	0.003

Note: *Source : Compiled from the data Using Smart-PLS Software.*

The paragraph describes a moderation analysis to assess path coefficients' significance and relationships between the construct, facilitated by prior measurement and structural model analyses. Similar methodologies have been used in previous studies (Mengkebayaer et al., 2022; Shahbaz, 2023). Conducted within Smart PLS 4 software, Personality Traits acted as the categorical moderator. Results in Table 8 and 9 show path coefficients indicating a strong impact of Personality Traits on Investment behavior (with T-value> 1.96, P-value<0.05), surpassing critical thresholds for statistical significance.

An in-depth examination of the t-values and p-values bolsters the significance of both paths. For P->ID Category the t-value is >1.96 and P-value> 0.05. Similarly, for RT-> ID category, the t-value and p-value also meet these criteria (t > 1.96; p < 0.05), confirming the statistical significance of both paths.

The statistical findings suggest that group differences are meaningful, not chance occurrences. This supports the conclusion that Personality Traits play a crucial role in moderating the relationship between social media and investment behavior, particularly through their influence on Risk Tolerance.

TABLE 10. Model Fit

Parameters	Saturated model	Estimated model
SRMR	0.118	0.119
d_ULS	2.143	2.159
d_G	1.270	1.284
Chi-square	1694.010	1701.172
NFI	0.586	0.584

Note: *Source : Compiled from the data Using Smart-PLS Software.*

The findings from Table 8 and 9 indicate significant relationships among social media (SM), Risk Tolerance (RT), and investor behavior (IB). Social media shows a positive association with both Risk Tolerance and investor behavior, supported by t-value >1.96 and p-values <0.05 Similarly, Risk Tolerance significantly correlates with investor behavior, with t-value >1.96 and p-value <0.05. These results validate all hypotheses formulated in the study: H1 the impact quality of stock performance information on risk tolerance, H2 on the impact of enhanced Risk Tolerance on trading activity, and H3 on the influence of social media quality on trading activity. Additionally, H4 is confirmed, indicating that Risk Tolerance mediates the relationship between social media and trading behavior. The study further explores the influence of the Big Five personality traits, revealing significant associations aligned with the initial hypotheses: Extraversion, Agreeableness and openness

positively moderates the impact of social media influencer on Risk Tolerance, conscientiousness and Neuroticism have negative moderation. While Emotional Intelligence, have low positive moderating effect on the relationship between risk tolerances and investment decision/behaviour. Incorporating these traits and EI into the model significantly enhances its explanatory power (Table 7, 7, 8 and 9), as evidenced by the adjusted R2 increasing from 0.30 to 0.31 and 43 to 44, suggesting personality traits explain a substantial portion of variation in Financial Risk Tolerance (FRT) supporting H5 and Emotional intelligence positively moderates the effect of risk tolerance on the investment decision/ Intensions supporting H6. The mediation effect was found to be more pronounced than the moderation effect of EI followed by Personality Traits.

7. CONCLUSION AND RECOMMENDATIONS

Implications, Limitations and Further Research Agenda.

The study explores the impact of The Big Five Personality Traits and social media on investors' risk tolerance in India through multiple linear regression analysis. Findings indicate that extraversion, agreeableness and openness positively and significantly influence risk tolerance with descending order of magnitude, whereas neuroticism, conscientiousness were found to be insignificant factors. This suggests that investors can make more informed decisions influenced by certain personality traits and enhanced social media influencers exposure with certain risk tolerance. The study contributes to understanding these traits and their implications for investor's risk tolerance and emotional intelligence in investment decisions under social media influencer influence, potentially aiding in policy-making and business strategies. However, limitations include the study's online nature and its focus on Indian investors, which may restrict generalizability. Future research could employ qualitative methods like thematic analysis or interviews to deepen insights into these variables' influences across different economic and political contexts. The study underscores the importance of social media influencer's literacy and financial initiatives to enhance investors' risk tolerance with certain personality traits and Emotional intelligence and add on to improvise investment decision-making capabilities, proposing educational reforms and collaborative efforts among government, financial institutions, and educators to achieve these goals (Badoc-Gonzales et al., 2021; Badoc-Gonzales et al., 2022).

8. DECLARATION

I, RAVI SHANKAR, hereby confirm that the manuscript titled " Risk, Personality, and Social Media: A Trio in Investment Decisions" authored by Ravi Shankar and Shelly Srivastava, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to IMPeC 2025, IIM Sambalpur.

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Aggarwal, A., Chand, P. K., Jhamb, D., & Mittal, A. (2020). Leader–member exchange, work engagement, and psychological withdrawal behavior: the mediating role of psychological empowerment. Frontiers in psychology, 11, 423.

[2.] Ahern, K. R., Duchin, R., & Shumway, T. (2014). Peer effects in risk aversion and trust. The Review of Financial Studies, 27(11), 3213-3240.

[3.] Ainia, N. S. N., & Lutfi, L. (2019). The influence of risk perception, risk tolerance, overconfidence, and loss aversion towards investment decision making. Journal of Economics, Business, & Accountancy Ventura, 21(3), 401-413.

[4.] Akerjordet, K., & Severinsson, E. (2007). Emotional intelligence: a review of the literature with specific focus on empirical and epistemological perspectives. Journal of clinical nursing, 16(8), 1405-1416.

[5.] Akhtar, F., Thyagaraj, K. S., & Das, N. (2018). The impact of social influence on the relationship between personality traits and perceived investment performance of individual investors. International Journal of Managerial Finance, 14(1), 130-148. https://doi.org/10.1108/ ijmf-05-2016-0102.

[6.] Alderotti, G., Rapallini, C., & Traverso, S. (2023). The Big Five personality traits and earnings: A meta-analysis. Journal of Economic Psychology, 94. https://doi. org/10.1016/j.joep.2022.102570.

[7.] Ali, A. (2011). Predicting individual investors' intention to invest: An experimental analysis of attitude as a mediator. International Journal of Economics and Management Engineering, 5(2), 157-164. https://doi.org/doi. org/10.5281/zenodo.1078847.

[8.] Amelang, M.; Steinmayr, R. (2006). Is there a validity increment for tests of emotional intelligence in explaining the variance of performance criteria? Intelligence, 34, 459–468.

[9.] Ameriks J, Wranik T, Salovey P, et al. (2009). Emotional Intelligence and Investor Behavior. Charlottesville, VA: Research Foundation of CFA Institute.

[10.] Ameriks, J., Wranik, T., Salovey, P., & LaBarge, K. (2009). Emotional intelligence and investor behavior. Charlottesville, VA: Research Foundation of CFA Institute.

[11.] Anic, G. (2007). The association between risk taking and personality [Doctoral dissertation]. University of South Florida. Bali, T., Demirtas, O., Levy, H., & Wolf, A. (2009). Bond versus stocks: Investors' age and risk taking. Journal of Monetary Economics, 56(6), 817–830.

[12.] Arie Kapteyn, Federica Teppa (2011). Subjective measures of risk aversion, fixed costs, and portfolio choice, Journal of Economic Psychology, Volume 32, Issue 4, Pages 564-580, https://doi.org/10.1016/j.joep.2011.04.002.

[13.] Arthur, W., & Graziano, W. G. (1996). The five factor model, conscientiousness, and driving accident involvement. Journal of Personality, 64(3), 593–618.

[14.] Badoc-Gonzales, B. P., Mandigma, M. B. S., & Tan, J. J.

(2021). Resilience and sustainability interventions in selected Post-Haiyan Philippines: MSMEs perspective. International Journal of Disaster Risk Reduction, 57, 102162.

[15.]Badoc-Gonzales, B., Mandigma, M. B., & Tan, J. (2020). Merging sustainable pillars into the tourism plan format for micro, small, and medium enterprises in post-typhoon Haiyan areas in the Philippines. The International Journal of Interdisciplinary Environmental Studies, 14(2), 1-31.

[16.]Badoc-Gonzales, B.P., Tan, J., Mandigma, M.B.S. (2021). Institutional Change of Disaster Risk Reduction Management Offices in Selected Areas of Post-Haiyan Philippines. In: Faghih, N., Samadi, A.H. (eds) Legal-Economic Institutions, Entrepreneurship, and Management . Contributions to Management Science. Springer, Cham. https://doi.org/10.1007/978-3-030-60978-8_11

[17.]Baker, H.K., Kapoor, S., & Khare, T. (2022). Personality traits and behavioral biases of Indian financial professionals. Review of Behavioral Finance. https://doi.org/10.1108/rbf- 11-2021-0246

[18.]Baker, H.K., Kapoor, S., & Khare, T. (2022). Personality traits and behavioral biases of Indian financial professionals. Review of Behavioral Finance. https://doi.org/10.1108/rbf-11-2021-0246.

[19.]Baker, H.K., Kumar, S., & Goyal, N. (2021). Personality traits and investor sentiment. Review of Behavioral Finance, 13(4). https:// doi.org/10.1108/rbf-08-2017-0077

[20.]Baker, M., & Wurgler, J. (2006). Investor Sentiment and the Cross- Section of Stock Returns. The Journal of Finance, 61(4), 1645-1680. https://doi.org/10.1111/j.1540-6261.2006.00885.x.

[21.]Baker, M., & Wurgler, J. (2006). Investor Sentiment and the Cross- Section of Stock Returns. The Journal of Finance, 61(4), 1645-1680. https://doi.org/10.1111/j.1540-6261.2006.00885.x.

[22.]Bal, P.M.; van Kleef, M.; Jansen, P.G.W. (2015). The impact of career customization on work outcomes: Boundary conditions of manager support and employee age. J. Organ. Behav., 36, 421–440.

[23.]Bandura, A., & Wittenberg, C. (1971). The impact of visual media on personality. The Mental Health of the Child: Program Reports of the National Institute of Mental Health, (2168), 247.

[24.]Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? International Journal of Selection and Assessment, 9(1–2), 9–30.

[25.]Bouzguenda K. (2018). Emotional intelligence and financial decision making: are we talking about a paradigmatic shift or a change in practices? Res Inter Bus Fin. 44:273–284. doi:10.1016/j.ribaf.2017.07.096.

[26.]Brandstätter, H., & Güth, W. (2000). A psychological approach to individual differences in intertemporal consumption patterns. Journal of Economic Psychology, 21(5), 465-479.

[27.]Brandstetter, L., & Jacob, M. (2013). Do corporate tax cuts increase investments? (No. 153). arqus Discussion Paper.

[28.]Browne, K. (2024). The Effects of an Emotional Intelligence and Empathy Interactive Education Program With Prelicensure Nursing Students (Doctoral dissertation, Liberty University).

[29.]Buelow, M. T., & Cayton, C. (2020). Relationships between the big five personality characteristics and performance on behavioral decision making tasks. Personality and Individual

Differences, 160, 109931. https://doi.org/10.1016/j.paid.2020.109931.

[30.]Camgoz, S. M., Karan, M. B., & Ergeneli, A. (2017). Relationship between the Big-Five personality and the financial performance of fund managers. Diversity, Conflict, and Leadership, 137-152. https://doi.org/10.4324/9780203793084-7.

[31.]Chang, H. H., & Chuang, S. S. (2011). Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator. Information & management, 48(1), 9-18.

[32.]Chauvin, B., Hermand, D., & Mullet, E. (2007). Risk perception and personality facets. Risk Analysis, 27(1), 171–185.

[33.]Chauvin, B., Hermand, D., & Mullet, E. (2007). Risk perception and personality facets. Risk Analysis, 27(1), 171–185.

[34.]Cheng, C., Wang, H. Y., Sigerson, L., & Chau, C. L. (2019). Do the socially rich get richer? A nuanced perspective on social network site use and online social capital accrual. Psychological bulletin, 145(7), 734.

[35.]Corter, J. E., & Chen, Y. J. (2006). Do investment risk tolerance attitudes predict portfolio risk? Journal of Business and Psychology, 20(3), 369–381.

[36.]Costa, P. T., & McCrae, R. R. (1992). Revised NEO Personality Inventory and NEO Five-Factor Inventory: Professional Manual. Psychological Assessment Resources, FL.

[37.]Costa, P. T., & McCrae, R. R. (1997). Personality trait structures as a human universal. American Psychologist, 52(5), 509-516. https://doi. org/10.1002/0471142735. im1803s100

[38.]De Haro, J.M.; Castejón, J.L. (2014). Does trait emotional intelligence predict unique variance in early career success beyond IQ and personality? J. Career Assess., 22, 715–725.

[39.]De Long, J. B., Shleifer, A., Summers, L. H., & Waldmann, R. J. (1990). Noise Trader Risk in Financial Markets. Journal of Political Economy, 98(4), 703-738. https://doi.org/10.1086/261703.

[40.]Delavande, A., Rohwedder, S., & Willis, R. J. (2008). Preparation for retirement, financial literacy and cognitive resources (Working Paper No. 2008-190). Ann Arbor, MI: Michigan Retirement Research Center.

[41.]Demaree, H. A., DeDonno, M. A., Burns, K. J., & Everhart, D. E. (2008). You bet: How personality differences affect risk-taking preferences. Personality and Individual Differences, 44(7), 1484-1494.

[42.]Dhiman RS. (2018). Do personality traits and emotional intelligence of investors determine their risk tolerance? Manag Lab Stud. 43(1–2):88–99. doi:10.1177/0258042X17745184.

[43.]Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. Annual Review of Psychology, 41, 417–440.

[44.]Durand, R. B., Newby, R., & Sanghani, J. (2008). An Intimate Portrait of the Individual Investor. Journal of Behavioral Finance, 9(4), 193-208. https://doi.org/10.1080/15427560802341020

[45.]Durand, R., Newby, R., Peggs, L., & Siekierka, M. (2014). Personality. Journal of Behavioral Finance, 14(2), 116-133. https://doi.org/10.1 080/15427560.2013.791294

[46.]Extremera, N., & Fernández-Berrocal, P. (2005). Perceived emotional intelligence and life satisfaction: Predictive and incremental validity using the Trait Meta-Mood Scale. Personality and Individual Differences, 39(5), 937-948.

[47.] Extremera, N., Lourdes, R., P. & Sánchez-Álvarez, N., (2006). Validation of the Spanish version of the Wong Law Emotional Intelligence Scale (WLEIS-S. Psicothema 2019, Vol. 31, No. 1, 94-100 doi: 10.7334/psicothema2018.147.

[48.] Extremera, N.; Rey, L.; Sánchez-Álvarez, N. (2019). Validation of the Spanish version of theWong Law Emotional Intelligence Scale (WLEIS-S). Psicothema, 31, 94–100.

[49.] Fama, E. F. (1965). The Behavior of Stock-Market Prices. The Journal of Business, 38(1), 34-105.

[50.] Ferreira, S. J. (2019, October). Is financial risk tolerance influenced by personality traits? Proceedings of Economics and Finance Conferences, 9511451, International Institute of Social and Economic Sciences.

[51.] Finke, M. S., & Huston, S. J. (2003). The brighter side of financial risk: Financial risk tolerance and wealth. Journal of Family and Economic Issues, 23(3), 233–256.

[52.] Fisher, J. (2016). The thoughtful leader: A model of integrative leadership. University of Toronto Press.

[53.] Fraser, G., Wilson, M. S., Garisch, J. A., Robinson, K., Brocklesby, M., Kingi, T., ... & Russell, L. (2018). Non-suicidal self-injury, sexuality concerns, and emotion regulation among sexually diverse adolescents: A multiple mediation analysis. Archives of suicide research, 22(3), 432-452.

[54.] García, J. M. D. H., & Costa, J. L. C. (2014). Does trait emotional intelligence predict unique variance in early career success beyond IQ and personality?. Journal of Career Assessment, 22(4), 715-725.

[55.] Gendron B. (2007). Quelles compétences émotionnelles du leadership éthique, de l'enseignant au manager, pour une dynamique de réussite et de socialisation professionnelle. Actes du colloque.;7(8):325.

[56.] Gendron, J. (2022). Mass Media and Muscle: The Impact of Social Media on Young Adult Men's Everyday Experiences and Body Dissatisfaction–A Qualitative Inquiry (Master's thesis, University of Missouri-Columbia).

[57.] Goleman, D. (2006). The socially intelligent. Educational leadership, 64(1), 76-81.

[58.] Gosling, S. D., Rentfrow, P. J., & Swann, W. B. J. (2003). A very brief measure of the big five personality domains. Journal of Research in Personality, 37, 504–528.

[59.] Grable, J., Kwak, E. J., Fulk, M., & Routh, A. (2022). A simplified measure of investor risk aversion. Journal of Interdisciplinary Economics, 34(1), 7-34.

[60.] Gupta, B. (2020). The Indian corporate bond market. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3613799.

[61.] Haliassos, M., & Bertaut, C. C. (1995). Why do so few hold stocks? The Economic Journal, 105(432), 1110-1129.

[62.] Haritha, P. H., & Uchil, R. (2019). Impact of investor sentiment on decision-making in Indian stock market: an empirical analysis. Journal of Advances in Management Research, ahead-of-print(ahead-ofprint). https://doi.org/10.1108/jamr- 03-2019-0041

[63.] Haritha, P. H., & Uchil, R. (2020). Influence of investor sentiment and its antecedent on investment decision-making using partial least square technique. Management Research Review, 43(11), 1441-1459. https://doi.org/10.1108/MRR-06-2019-0254.

[64.] Hess, J. D., & Bacigalupo, A. C. (2011). Enhancing decisions and decision-making processes through the application of emotional intelligence skills. Management decision, 49(5), 710-721.

[65.] Hoch, S. J., & Loewenstein, G. F. (1991). Time-inconsistent preferences and consumer self-control. Journal of Consumer Research, 17(4), 492–507.

[66.] Hong, H., Kubik, J. D., & Stein, J. C. (2001). Social interactions and stock market participation. The Journal of Finance, 59(1), 137–163.

[67.] Isidore, R. R., & Arun, C. J. (2021). The Behavior of the Various Personalities of Secondary Equity Investors: Big Five Personality Model. ˜the œJournal of Wealth Management, 24(1), 55–77. https://doi.org/10.3905/jwm.2021.1.128.

[68.] Jacobs-Lawson, J. M., & Hershey, D. A. (2005). Influence of future time perspective, financial knowledge, and financial risk tolerance on retirement savings behaviors. Financial Services Review, 14(4), 331–344.

[69.] Jhon, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. In

[70.] Joseph, D. L., & Newman, D. A. (2010). Emotional intelligence: an integrative meta-analysis and cascading model. Journal of applied psychology, 95(1), 54-78.

[71.] Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47(2), 263-292. https://doi.org/10.2307/1914185.

[72.] Kamath, A. N., Shenoy, S. S., Abhilash, N., & N, S. K. (2023). Impact of personality traits on investment decision-making: Mediating role of investor sentiment in India. Investment Management and Financial Innovations/Investment Management & Financial Innovations, 20(3), 200–211. https://doi.org/10.21511/imfi.20(3).2023.17.

[73.] Kartika, L. N., & Christanto, Y. M. (2023). Analysis Of Influencer, Customer Online Review, And Trust On Intention To Purchase On Social Media In Special Region Of Yogyakarta. International Journal of Innovative Research and Advanced Studies (IJIRAS), 10(7), 112-120.

[74.] Kaur, A., & Goel, P. (2022). Impact of Big-five Personality Traits on Investor's Risk Attitude. Indian Journal of Economics and Development, 18(2), 477-482. Retrieved from https://www.indianjournals.com/ijor.aspx?target=ijor:ijed1&volume=18&issue=2&article=027.

[75.] Kaustiaa, M., & Knüpfer, S. (2012). Peer performance and stock market entry. Journal of Financial Economics, 104(2), 321–338.

[76.] Kelman, H. C. (1958). Compliance, identification, and internalization three processes of attitude change. Journal of conflict resolution, 2(1), 51-60.

[77.] Kubilay, B., & Bayrakdaroglu, A. (2016). An empirical research on investor biases in financial decision-making, financial risk tolerance and financial personality. International Journal of Financial Research, 7(2), 171.

[78.] Kumar, S., & Goyal, N. (2016). Evidence on rationality and behavioural biases in investment

[79.] Kunnanatt, J. T. (2004). Emotional intelligence: The new science of interpersonal effectiveness. Human resource development quarterly, 15(4), 489.

[80.] L. A. Pervin & O. P. John (Eds.), Handbook of personality: Theory and research (pp. 102-138). Guilford Press. Retrieved from https://psycnet. apa.org/record/1999-04371-004.

[81.] Latané, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. Journal of personality and social psychology, 37(6), 822.

[82.] Law, K. S., Wong, C.-S., & Song, L. J. (2004). The Construct and Criterion Validity of Emotional Intelligence and Its Potential Utility for Management Studies. Journal of Applied Psychology, 89(3), 483–496. https://doi.org/10.1037/0021-

9010.89.3.483

[83.] Mahmood, Z. (Ed.). (2021). Industry Use Cases on Blockchain Technology Applications in IoT and the Financial Sector. IGI Global.

[84.] Maknickienė, N., & Rapkevičiūtė, L. (2021, May). A study on social media opinion about women investors. In International Scientific Conference „Contemporary Issues in Business, Management and Economics Engineering".

[85.] Mandigma, M. B. S., & Badoc-Gonzales, B. P. (2022). Tax exemptions of cooperatives in the Philippines and in other countries: a comparative study. Review of Integrative Business and Economics Research, 11, 144-163.

[86.] Matha, R, E, G., Raghavendra, N., L, K., & P, S. S. (2022). Role of big-five personality traits in predicting behavioral intention: A case of Indian corporate bond investors. Problems and Perspectives in Management/Problems & Perspectives in Management, 20(4), 638–652. https://doi.org/10.21511/ppm.20(4).2022.48.

[87.] Mathur, G., & Nathani, N. (2019). Personality traits and risk tolerance among young investors. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 8(10), 2019–2013.

[88.] Mayer, J. D., Salovey, P., & Caruso, D. R. (2004). TARGET ARTICLES:" emotional intelligence: Theory, findings, and Implications". Psychological inquiry, 15(3), 197-215.

[89.] Mayfield, C., Perdue, G., & Wooten, K. (2008). Investment management and personality type. Financial Services Review, 17(3), 219-236. Retrieved from https://www.proquest.com/docview/212002632.

[90.] McCrae, R. R., & Costa, P. T. (1997). Conceptions and correlates of openness to experience. In Handbook of personality psychology. London: Academic Press.

[91.] Mengkebayaer, M., Nawaz, M. A., & Sajid, M. U. (2022). Eco-destination loyalty: Role of perceived value and experience in framing destination attachment and equity with moderating role of destination memory. Frontiers in Psychology, 13, 908798.

[92.] Miao, C.; Humphrey, R.H.; Qian, S.(2017). A meta-analysis of emotional intelligence and work attitudes. J. Occup. Organ. Psychol. 90, 177–202.

[93.] Ngcamu, L. J., Quaye, E. S., Horvey, S. S., & Jaravaza, D. C. (2023). Personality traits, money attitudes and consumer decision-making styles as predictors of investment products choice in South Africa. Journal of Consumer Behaviour, 22(3), 618–631. https://doi.org/10.1002/cb.2146.

[94.] Nyhus, E. K., & Webley, P. (2001). The role of personality in household saving and borrowing behaviour. European journal of personality, 15(S1), S85-S103.

[95.] Oehler, A., Wendt, S., Wedlich, F., & Horn, M. (2018). Investors' Personality Influences Investment Decisions: Experimental Evidence on Extraversion and Neuroticism. Journal of Behavioral Finance, 19(1), 30-48. https://doi.org/10.1080/15427 560.2017.1366495

[96.] Oleński, J. (2018). Typology of micro and small countries in the light of transborder economics. TRANSBORDER ECONOMICS. International Journal on Transborder Economics, Finance, Politics and Statistics., 3(1), 7-42.

[97.] Ouyang, Z.; Sang, J.; Li, P.; Peng, J. (2015). Organizational justice and job insecurity as mediators of the effect of emotional intelligence on job satisfaction: A study from China. Personal. Individ. Direct. 76, 147–152.

[98.] Ozer, G., & Mutlu, U. (2019). The effects of personality traits on financial behaviour. Pressacademia, 8(3), 155-164. https://doi.org/10.17261/pressacademia. 2019.1122

[99.] Pak, O. and Mahmood, M. (2015), "Impact of personality on risk tolerance and investment decisions: A study on potential investors of Kazakhstan", International Journal of Commerce and Management, Vol. 25 No. 4, pp. 370-384. https://doi.org/10.1108/IJCoMA-01-2013-0002

[100.] Petrides, K. V. (2011). Emotional intelligence. The Wiley-Blackwell handbook of individual differences, 656-678.

[101.] Petrides, K.V.; Furnham, A. (2000). On the dimensional structure of emotional intelligence. Personal. Individual . Di_er., 29, 313–320.

[102.] Petrides, K.V.; Pita, R.; Kokkinaki, F. (2007). The location of trait emotional intelligence in personality factor space. Br. J. Psychol. 2007, 98, 273–289.

[103.] Pinjisakikool, T. (2017). The influence of personality traits on households' financial risk tolerance and financial behaviour. Journal of Interdisciplinary Economics, 30(1), 32–54. https://doi.org/10.1177/0260107917731034.

[104.] Portes, A. (2000). The two meanings of social capital. In Sociological forum (Vol. 15, pp. 1-12). Kluwer Academic Publishers-Plenum Publishers.

[105.] Rustichini, A., DeYoung, C. G., Anderson, J. E., & Burks, S. V. (2016). Toward the integration of personality theory and decision theory in explaining economic behavior: An experimental investigation. Journal of Behavioral and Experimental Economics, 64, 122-137. https://doi.org/10.1016/j. socec.2016.04.019.

[106.] Sachdev, M., & Lehal, R. (2023). The influence of personality traits on investment decision-making: a moderated mediation approach. International Journal of Bank Marketing, 14(4), 810-834. https:// oi.org/10.1108/IJBM-07-2022-0313.

[107.] Sadiq, M. N., & Khan, R. A. A. (2019). Impact of personality traits on investment intention: The mediating role of risk behaviour and the moderating role of financial literacy. Journal of Finance & Economics Research, 4(1), 1-18. https://doi.org/10.20547/jfer1904101.

[108.] Sadiq, M., & Amna, H. (2019). Impact of personality traits on risk tolerance and investors' decision making. International Journal of Applied Behavioral Economics (IJABE), 8(1), 1–20.

[109.] Salovey P, Mayer JD. (1989). Emotional intelligence. Imagin, Cog Person. 9(3):185–211. doi:10.2190/DUGG-P24E-52WK-6CDG.

[110.] Salovey, P., Sluyter, D. (1997). What is Emotional Intelligence;.Eds.; Basic Books: New York, NY, USA, pp. 3–31.

[111.] Satish Kumar & Nisha Goyal, 2016. "Evidence on rationality and behavioural biases in investment decision making," Qualitative Research in Financial Markets, Emerald Group Publishing Limited, vol. 8(4), pages 270-287, November. DOI: 10.1108/QRFM-05-2016-0016.

[112.] Schmitt, D. P. (2004). The big five related to risky sexual behaviour across 10 world regions: Differential personality associations of sexual promiscuity and relationship infidelity. European Journal of Personality, 18(4), 301–319.

[113.] Shahbaz Abbas, Kuaanan Techato, Lin-Han Chiang Hsieh, Abdellatif M. Sadeq (2024). Integrating relational values in social acceptance of photovoltaic energy storage systems: A consumers' perspective assessment using structural equation modeling, Energy, Volume 304, 132092, https://doi.org/10.1016/j.energy.2024.132092.

[114.] Smith, J. L. (2023). A Survey of Emotional Intelligence in Athletic Training (Doctoral dissertation, Clarkson College).

[115.] Soekarno, S., & Pranoto, S. (2020). Influence of Financial Literacy on the Stock Market Participation and Financial Behavior among Indonesian Millennials. 27, 115-125. doi:10.1108/s1571-038620200000027009.

[116.] Sokolova, K., & Kefi, H. (2020). Instagram and YouTube bloggers promote it, why should I buy? How credibility and parasocial interaction influence purchase intentions. Journal of Retailing and Consumer Services, 53(January 2019). doi:10.1016/j.jretconser.2019.01.011

[117.] Sulaiman, E. K. (2012). An empirical analysis of financial risk tolerance and demographic features of individual investors. Procedia Economics and Finance, 2, 109-115.

[118.] Tauni, M. Z., Fang, H. X., & Iqbal, A. (2017). The role of financial advice and word-of-mouth communication on the association between investor personality and stock trading behavior: Evidence from Chinese stock market. Personality and Individual Differences, 108, 55–65. https://doi.org/10.1016/j.paid.2016.11.048.

[119.] Tauni, M. Z., Memon, Z. A., Fang, H.-X., Jebran, K., & Ahsan, T. (2019). Influence of Investor and Advisor Big Five Personality Congruence on Futures Trading Behavior. Emerging Markets Finance and Trade, 55(15), 3615-3630. https://doi.org/10.1080/154049 6x.2019.1672529.

[120.] Terracciano, A., Lo¨ckenhoff, C. E., Crum, R. M., Bienvenu, O. J., & Costa, P. T., Jr. (2008). Five-factor model personality profiles of drug users. BMC Psychiatry, 8. Retrieved from https://bmcpsychiatry.biomedcentral.com/articles/10.1186/1471-244X-8-22.

[121.] Trobst, K. K., Herbst, J. H., Masters, H. L., III, & Costa, P. T., Jr. (2002). Personality pathways to unsafe sex: Personality, condom use, and HIV risk behaviors. Journal of Research in Personality, 36(2), 117–133.

[122.] Van der Heijden, B.I.J.M.; de Lange, A.H.; Demerouti, E.; Van der Heijde, C.M. (2009). Age effects on the employability–career success relationship. J. Vocat. Behav. 74, 156–164.

[123.] Walther, M., & Bade, M. (2020). Observational learning and willingness to pay in equity crowdfunding. Business Research, 13, 639-661.

[124.] Wang, J. (2022). Investor Sentiment and Stock Return: Evidence from China. 13th International Conference on E-business, Management and Economics, 399-405. https://doi.org/10.1145/3556089.3556151.

[125.] Wang, X. (2022). Financial liberalization and the investment-cash flow sensitivity. Journal of International Financial Markets, Institutions and Money, 77, 101527.

[126.] Wei, L. (2009). Filter blogs vs. personal journals: Understanding the knowledge production gap on the Internet. Journal of computer-mediated communication, 14(3), 532-558.

[127.] Wei, R. (2013). Mobile media: Coming of age with a big splash. Mobile media & communication, 1(1), 50-56.

[128.] Weller, J. A., & Tikir, A. (2011). Predicting domain-specific risk taking with the HEXACO personality structure. Journal of Behavioral Decision Making, 24(2), 180–201.

[129.] Wong CS, Law KS. Wong and Law. (2002). Emotional Intelligence Scale. Lead Quar. doi:10.1037/t07398-000.

[130.] Wong, C.S. (2015). Emotional Intelligence at Work: 18-Year Journey of a Researcher; Routledge: New York, NY, USA.

[131.] Yuan, S., & Lou, C. (2020). How Social Media Influencers Foster Relationships with Followers: The Roles of Source Credibility and Fairness in Parasocial Relationship and Product Interest. Journal of Interactive Advertising, 20(2), 1-15. doi:0.1080/15252019.2020.1769514.

[132.] Zhang, A. C. (2014). Financial advice and asset allocation of individual investors. Pacific Accounting Review, 26(3), 226–247.

[133.] Zhang, H., Chen, Y., Rong, W., Wang, J., & Tan, J. (2022, August 30). Effect of social media rumors on stock market volatility: A case of data mining in China. Frontiers in Physics, 10. https://doi.org/10.3389/fphy.2022.987799.

[134.] Zhang, M., Nazir, M. S., Farooqi, R., & Ishfaq, M. (2022, March 22). Moderating Role of Information Asymmetry Between Cognitive Biases and Investment Decisions: A Mediating Effect of Risk Perception. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.828956

[135.] Zhang, P., & Cain, K. W. (2017). Reassessing the link between risk aversion and entrepreneurial intention. International Journal of Entrepreneurial Behavior & Research, 23(5), 793-811. https://doi.org/10.1108/ijebr-08-2016-0248.

[136.] Zhang, X., Shi, J., Wang, D., & Fang, B. (2018). Exploiting investors social network for stock prediction in China's market. Journal of Computational Science, 28, 294–303. https://doi.org/10.1016/j.jocs.2017.10.013

[137.] Zhang, Y., Guo, B., Ding, Y., Liu, J., Qiu, C., Liu, S., & Yu, Z. (2022). Investigation of the determinants for misinformation correction effectiveness on social media during COVID-19 pandemic. Information Processing and Management, 59(3), 102935. https://doi.org/10.1016/j.ipm.2022.102935.

[138.] Zhang, Y., Trusov, M., Stephen, A. T., & Jamal, Z. (2017). Online shopping and social media: friends or foes?. Journal of Marketing, 81(6), 24-41.

[139.] Zhao, H., & Seibert, S. E. (2006). The big five personality dimensions and entrepreneurial status: A meta-analytical review. Journal of Applied Psychology, 91(2), 259–271.

[140.] Zhong, B., Hardin, M., & Sun, T. (2011). Less effortful thinking leads to more social networking? The associations between the use of social network sites and personality trait. Computers in Human Behavior, 27(3), 1265–1271.

Do green Indices Show co-integrating Relation with Crude and Broader Market Indices during Shocks: Empirical Evidence from India using Quantile ARDL Approach

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ABSTRACT

The study makes an attempt to understand cointegration dynamics between India's green indices, crude and broader stock market index to explore the existence of a long term relation amongst these variables during different market scenarios with a focus on the extreme market conditions. The indices under consideration are BSE Carbonex, BSE Greenex, NSE 500, BSE Tech and Crude and the study considers ten year daily closing prices ; April 1, 2014-March 31, 2024. The methodology applied is Quantile Regression and Quantile ARDL Co-integration Models. Quantile Models are considered ideal for capturing responsiveness of variables at tails and study considers analysis under nine quantiles: $Q_\tau : Q_{0.10}, Q_{0.20}, Q_{0.30}, Q_{0.40}, Q_{0.50}, Q_{0.60}, Q_{0.70}, Q_{0.80}$ and $Q_{0.90}$. The results revealed presence of co-integration mainly at upper quantiles ($Q_{0.70}, Q_{0.80}$ and $Q_{0.90}$) with some evidence of cointegration at two lower quantiles ($Q_{0.10}$ & $Q_{0.20}$) and no co-integration being visible at middle quantiles ($Q_{0.30}, Q_{0.40}, Q_{0.50}$ and $Q_{0.60}$). The speed of correction to long run equilibrium as given by error correction term; ECM(-1) was extremely slow at lower end quantiles, which increases slightly as we reach upper end quantiles. The quantile process of change in relation between India' Green Index and Other Indices showed a gradual fall moving from lower to upper quantiles for variables MCX Crude and BSE Tech, while with respect to NSE 500 this was highest at upper quantiles i.e. just the opposite as compared to other two variables. The study results have two major implications, first India's green indices are seen moving independently of Crude and follow only broader markets at higher quantiles and second, the tendency amongst investors to shift to green indices during such conditions does not appear materializing. Then, no co-integration at mid to lower quantiles (except lowest quantiles) is an indication of maturity of investors and reflects inclination of investors to shift to less resilient green indices during these periods

Keywords: Cointegration, Green Index, Crude, Qunatile ARDL

1. INTRODUCTION

The entry of renewable fuels in the energy fuels market has not only created a viable alternative to traditional fuels but have also shown the way for a better quality of life by switching over to such environment friendly fuels. Today with climate change now becoming a reality and started impacting ordinary people, a clear attitudinal shift is visible in the overall consumer perception in favour of cleaner fuels. This change is also visible amongst the investing class who have started investing in stocks of green companies thereby creating a new thematic segment which is now classified under a separate category 'sustainable investing'.

The term 'sustainable investing' is closely related to some other terms like ethical investing, green investing, responsible investing, ESG investing and so on. According to some researchers, the term 'sustainable investing' is strongly related to investors perception of 'sustainability' and this can go from one extreme to another i.e. from being very basic to where investor considers this to be highly sophisticated (Dorfleitner and Utz, 2012). A large number of investors consider 'sustainable investing' as something which takes a

company away from 'hard core capitalization'(McCann, et al 2003).

An important aspect of 'sustainable investing' is the demographic profile of the investors. Studies have shown that investors who favour 'sustainable investing' are young, highly educated but are not superrich and have average incomes. Such investors are also the consumers who support green products and are willing to pay more if the Company's intention is to 'go green'(Lewis, and Mackenzie, 2000;Henisz, et al., 2019). However, such investors also have their own set of expectations e.g. their investments in sustainable funds should be able generate decent returns if not extraordinary returns, companies chosen by sustainable funds must rigidly follow principles as laid down and so on.

The institutional investors too seem to have realized the potential of green investing and many fund managers do believe that the segment caters to their needs of portfolio diversification in a better manner. The fund managers are usually aware that to attract investors they need to generate 'alpha' on restricted investments, which cannot be far inferior to the 'alpha' generated on conventional investments. The empirical evidence too has shown that in terms of

returns, this sector is capable of delivering similar or near similar returns as compared to traditional sectors, on the other hand, the risk element in terms of variability of returns has been found to be considerably lower as compared to conventional sectors. This lower risk often becomes important for investors especially during crisis periods when reducing risk becomes more important than generating returns. Even for return performance many believe that the firms which incorporate sustainability in their operations shall outperform their peers who fail to do so in the long run (Sharma and Shahani, 2023)

Then, as seen during the two recent crisis viz. the sub prime crisis of 2008 and Covid 19 crisis, most of the asset classes do tend to move in tandem thereby leaving very little scope for investors to decide the asset class suitable for investment thereby compelling investors to stick to their existing portfolio . Further since such a portfolio was created during normal market conditions, it is heavily invested in equities especially the traditional equity indices and sticking to such a portfolio during crisis often results in erosion of their capital. The investors have actually very little choice as they may not find beneficial to shift to other securities say debt where prices are usually high during the crisis due to falling yields or even gold which has the history of achieving great peaks during most crisis periods.

Thus, under such a scenario when there is little scope for diversification of funds, any asset which could move against the general market movement would be considered as a boom and would attract all round investment. Now the question arises; Do 'sustainable funds' qualify to be such an asset ? As already discussed above, 'sustainable investing' as a class of asset does appear to satisfy the risk element i.e. carry lower risk during crisis and this thus becomes an important driving force during such a period. This however calls for a detailed analysis with respect to co-movement of 'sustainable investments' with other assets during the crisis period and exploring the same empirically to determine the asset's suitability for investment during these crisis periods. Such a study would be useful not only for policy makers but for those intending diversification as crisis in financial markets has now become a regular feature occurring at frequent intervals.

Considering the above aspect, a study has been designed to understand the movement of this segment i.e. 'sustainable investing' in light of how close or different this is from movement of broader market indices and also the movement of traditional fossil fuel 'crude'. Furthermore, since the interest of the present study lies in identifying the asset which could move against the movement of other asset classes during a crisis period, this co-movement has been established during different market phases or cycles which includes boom, recession, normal, recovery or a crisis. Furthermore, we have carefully selected the econometric tool to be applied which is capable of capturing co-movement

during different market cycles which also includes the crisis period.

Moving to the existing research on 'Sustainability Investing' the area has become one of the most sought after research which has been explored at length during the recent past with most studies having focused mainly on either of the two dimensions, first being comparison between 'sustainable investing' and 'conventional investing' and second being exploring linkages between 'sustainable investments' and other financial assets (stocks, debt, commodities, currencies etc.) or with macro variables like inflation and interest rates. If we go by the studies in the first category a lot of studies have found the performance of sustainable funds to be at par or slightly lower in terms of 'return' than conventional / traditional funds and studies which have found such results include Managi et al., (2012); Wallis and Klein,(2015); Tripathi & Kaur, (2022) amongst others.

Then, a lot of studies have found that sustainable funds give satisfactory performance not only in terms of 'return' but also in terms of lower 'variability of returns' or risk during crisis periods and studies here include Ashwin Kumar et al., (2016); Mousa, et al.,(2021);. Hoang, et al., (2021). The superior performance of such funds during crisis could be due to lower downside risk in these funds which actually translates to better performance thereby enabling funds to build a skewed rather than symmetric portfolio. Since a lot of emphasis is placed on risk adjusted portfolio, the downside risk of these funds especially as seen by many researchers during the crisis periods actually becomes the USP for such funds. Again there is one more angle which justifies why fund managers and investors at large are eager to invest in such funds. This is behavioural aspect or psychological dimension and could be traced to 'prospect theory' given by Kahneman and Tversky (2013). Under this theory an investor considers fear of loss to be having a higher psychological impact than an equivalent gain. This was seen during the subprime crisis of 2008 when the turnover of sustainable investments rendered a positive 13 % growth during the period 2007-09 but the growth for conventional funds was near 0 % during the same period (Sharma and Shahani 2023; Nofsinger and Varma, 2014).

Moving to the second research dimension explored, researchers here have made an attempt to study the short and long run co-movement of 'sustainable investments' with other assets, e.g. gold (Mensi et al., 2017), crude (Maraqa and Bein, 2020), green bonds (Zhang et al., 2022) macro variables(Kaur & Chaudhary, 2022), conventional stock indices (Kilic et al. 2022; Caporale et al. 2022; Tripathi and Kaur, 2022), economic policy (Irfan, et al., 2021). The results pertaining to this dimension are mixed with some studies showing a positive long run relation between 'sustainable investments' and 'conventional and/or other assets' while other studies failing to find such a relation. Further, considering the variables which we have selected

under the study, we would be focusing only on select studies which have included some of these variables.

A study by Seth and Singh (2023) on sustainable and conventional indices of six nations, could establish short run causal relation amongst variables along with limited bi-directional volatility spillover for two markets; Japan and Brazil. However the results showed that such a relation could not convert to a long run relation as co-integration could not be proved under the study. On the other hand, Gökmenoğlu and Menteş (2023) could prove co-integration amongst four asset classes' viz. crude, natural gas, gold and stock index. The important result outcome was that when conventional popular stock index; Dow Jones Industrial Average was considered as stock index, the speed of adjustment towards long run equilibrium was considerably higher than when the second sustainability index; Dow Jones Sustainability World Index was considered as the stock index. Further, crude was seen impacting both stock indices in a negative manner while causality was uni-directional from crude to conventional DJIA but bidirectional with respect to sustainability index.

Then, with respect to crude a study by Nakajima et al., (2021) showed evidence of return spillover from crude to US and European Market sustainability indices. Then, Maraqa and Bein, (2020) in an interesting study investigated linkages between traditional stock indices of crude importing and crude exporting countries, two sustainability stock indices (Dow Jones sustainability World Index and Dow Jones Sustainability Europe index) and crude oil. The results showed that sustainability indices had higher interaction with crude importing countries, while crude exporting ones had higher correlation with simple crude return which became even more stronger after global financial crisis. Significant 'volatility' transmission was also seen amongst all the three variables.

On the other hand, some researchers have studied the relation between 'sustainable investments' and other assets through residuals and ascertained the spillover dynamics of 'sustainable investments' towards other assets and the studies include a US markets paper by Cocca, et al., (2024) where the researchers found NASDAQ green index to be transmitter of shocks with other thematic indices from same stock market to be receiver of shocks. Almost similar results were seen in a study by Lucey and Ren, (2023) where they too found risk transmitters as sustainable indices which was towards both other sustainable indices and non-sustainable indices. Again Seth and Singh(2023) could notice return spillover from sustainable indices towards conventional indices for Japan and Brazil. However few studies have found opposite to be true; i.e. spillover from traditional to sustainable index and this was seen in Jain et al. (2019); Balcilar et al. (2017); Baykut and Kula (2019). Then in a study Attarzadeh and Balcilar, (2022) found conventional stock and tech indices were shock transmitters while energy and crude indices being the net receivers of shocks.

We also searched for studies which employed variables and tools of analysis which were similar to the present study and one such study was carried out by Shahbaz, et al., (2021) where they employed causality-in quantiles and quantile regression to focus on relation between clean energy, crude, tech and equity indices during extreme situations and results showed causality amongst clean energy, crude and equity indices was well established with higher predictive power at both lower and upper quantiles. Again strong relation between crude and clean energy stocks could be seen during the extreme quantiles. Then, Naeem, et al., (2023) using quantile regression and quantile VAR found time varying spillover at tails amongst indices of total energy, clean energy, green bonds and broader Stock Market Index. The study also showed that the two indices, stock index and clean energy index were volatility transmitters while remaining two were volatility receivers.

Research Gap Identification

Thus, as seen under literature review the focus of present studies on 'sustainable investing' is mainly on either comparing such investments to conventional investments or exploring linkages between 'sustainable investments' and other financial assets with very few studies talking about long term relation where focus is exploring such a relation during extreme market conditions. In light of the above and keeping in view the objective of the study which relates to understand how close or different the movement of 'sustainable investing' is from movement of broader market indices and also movement of traditional fossil fuel 'crude', we have designed the present study. This study tries to capture the existence of a long term relation between India's green indices, crude and broader stock market; the NSE 500 during different market scenarios with a special focus on extreme market conditions. We have carefully selected our variables for the study and these include thematic stock indices, BSE Carbonex and BSE Greenex, a broader stock market index; NSE 500, Crude closing prices from MCX exchange, India's leading commodity exchange and another thematic index, the BSE Tech index. The inclusion of BSE Tech is based upon recent research which has revealed that clean energy stocks are now more inclined towards technology stocks as both tend to compete for same resources(Bohl et al., 2013).The study considers ten year daily closing prices; April 1,2014-March 31,2024 and methodology applied is Quantile Regression and Quantile ARDL Co-integration considered ideal for capturing responsiveness at tails. Since quantile methodology is based upon the analysis at different quantiles, under the present study we would be analysing the co-integration relation at nine quantiles:

$: Q_\tau : Q_{0.10}, Q_{0.20}, Q_{0.30}, Q_{0.40}, Q_{0.50}, Q_{0.60}, Q_{0.70}, Q_{0.80}$ and $Q_{0.90}$.

The rest of the paper is structured as follows: Section 2 gives descriptive statistics and distribution characteristics of our variables, Section 3 explains the methodology employed,

Section 4 provides empirical results and discussion, Section 5 as conclusion, Section 6 as Study Implications, Limitations and Scope for further Research. The paper ends with references as Section 7.

2. DESCRIPTIVE STATISTICS AND VARIABLE CHARACTERISTICS

The section documents the descriptive statistics of daily spot returns on five variables viz; BSE Carbonex, BSE Greenex, Crude, BSE Tech and NSE 500 Stock Index for the period April 1, 2014-Mar 31, 2024. The closing price data has been transformed to daily spot returns by applying the formula $\frac{P_t - P_{t-1}}{P_{t-1}}$ where P_t is closing spot price of variable at day 't' and P_{t-1} is closing spot price of same variable at day 't-1'. The computation of returns from closing prices facilitates easy comparison of variables across different parameters, the outcome of the same has been discussed under Table I.

TABLE 1 : Statistical Description of Return on Variables (April 1, 2014-Mar 31, 2024)

Particulars	Ret. on BSE Carbonex	Ret. on BSE Greenex	Ret on Crude	Ret on BSE Tech	Ret on NSE 500
Mean	0.000561	0.000585	0.000526	0.000549	0.000655
Std. Dev.	0.010416	0.010519	0.030875	0.011837	0.014669
C.V = σ / μ	18.57	17.98	58.69	21.56	22.39
Skewness	-1.137273	-0.941685	0.422950	-0.363908	6.131984
Kurtosis	20.53621	15.32106	44.10078	9.802364	361.6761
Jarque - Bera	32037.93	15917.48	173153.5	4795.241	13196523
Prob (JB)	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	2459	2459	2459	2459	2459

Table 1 reveals that for the period April 1, 2014-Mar 31, 2024, mean return on NSE 500 was highest, followed by return on two green indices i.e. BSE Carbonex and BSE Greenex with daily returns from crude being the lowest. On the other hand, in terms of variability of returns, crude's variability is highest thereby making crude as the variable with highest risk and lowest return. The study also computed Coefficient of Variation(C.V) for each variable. C.V is a useful tool which measures risk adjusted return and is of interest to an investor taking calculated risk and the study results showed this was highest for crude, with the two green indices having least risk adjusted return. Thus, the results do reinforce the acceptability of India's green indices as an asset which is suitable for investors who consider both risk and return dimensions before making any investment.

Moving to the analysis of variables based upon third and fourth moment i.e. skewness and kurtosis; the two moments are mainly concerned with the shape of the variable distribution and also provide important information about response of the variable to outliers and also during extreme market movements. The results reveal a high positive skewness for broader market index, NSE 500 showing a concentration of outliers on the upper tail of the distribution. On the other hand, India's two green indices have negative skewness but are close to skewness of a normal distribution which is symmetric with a skewness at '0' . The same story goes for fourth moment kurtosis where NSE 500 has exceptionally high peak distribution while green indices have a peak moderately above the kurtosis of a normal distribution which is '3'. Furthermore when we put the third and fourth moment in a formula we obtain a test of normality called J-B test of normality

$$\{JB = \frac{n}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right)\},$$

, where 'n' is the number of observations, 'S' is the Skewness and 'K' is the Kurtosis of the distribution. Applying JB formula to each of our variables revealed that none of our five distributions is was normally distributed.

Further, before moving to further analysis where we test for movement between India's Green Indices and other indices, we make an important decision to restrict our analysis to only one of the two green indices viz. BSE Carbonex and avoid BSE Greenex. The need for this was to avoid duplication of results as the two indices are highly similar with many constituent companies being common to both. Moreover the correlation between the two green indices is also extremely high at +0.99. Another important decision we consider is to transform the variables at their natural log levels as necessitated by the shape of our distribution which showed the presence of outliers.

3. MODEL DESCRIPTION

3.1 Establishing a regression relation (OLS and Quantile) amongst the variables

To model the relation amongst the variables included in the study viz. BSE Carbonex, BSE Tech, Crude and NSE 500 Index we have first applied a linear regression model (OLS) followed by a non linear quantile regression. In terms of comparison, the first model i.e. OLS establishes a relation amongst the variables on the basis of averages, the model although is extremely popular and widely used in empirical research, however it suffers from a drawback of making the regression vulnerable to outliers thereby impacting the results. In simple words, OLS cannot capture extreme or tail

relation amongst the variables explicitly but only provides an average relation. This thus results in under-estimation of the regression parameters thereby putting a serious question mark on the results obtained. On the other hand, Quantile Regression would predict the conditional π^{th} quantile of the dependent variable *(as against conditional mean in OLS)* and here the relation amongst variables is established across several quantiles thereby providing a more comprehensive idea of the joint distribution than simple OLS. Furthermore for our relation *(BSE Carbonex as a function of three variables; BSE Tech, Crude and NSE 500 Indices)*, we specify a basic framework using these two methodologies as under:

$$ln.Y_t = \beta_1 + \beta_2 \, ln.X_{1,t} + \beta_3 \, ln.\,X_{2,t} + \beta_4 \, ln.X_{3,t} + u_t \quad (1)$$

Y_t = BSE Carbonex, X_1, X_2 and X_3 being the three independent variables NSE 500, Crude and BSE Tech respectively.

From eq. (1) we get

$$u_t = Y_t - (\beta_1 + \beta_2 ln.NSE\ 500_t + \beta_3\ ln.Crude_t + \beta_4\ ln.BSE\ Tech_t) \quad (2)$$

Then, eq. (2) may be written as :-

$$u_t = ln.Y_t - \left(ln.X'_t \beta\right) \quad (3)$$

The parameters of eq. (3) are estimated either by using OLS or Quantile Methodology in the following manner:

3.1.1 OLS Methodology

$$\underset{\beta_1 \beta_2 \beta_3 \beta_4}{\underbrace{min}} \sum_{t=1}^{n} (u_t^2)$$

By applying OLS, the target to be achieved shall be

3.1.2 Quantile Regression Methodology

$$; \underset{\beta_1 \beta_2 \beta_3 \beta_4}{\underbrace{arg\ min}} \sum_{t=1}^{n} |Y_{i,t} - (X'_t \beta)|$$

By applying quantile regression, methodology target shall be

Thus, in Ordinary Least Squares we minimize sum of the squared error terms while in quantile regression we try to find 'β' which minimizes the sum of absolute deviations. Another point to be considered is the interpretation of slope coefficients under two models; whereas slope coefficient under simple OLS would reflect a unit change in Independent variable results in 'x' units change in dependent variable, the slope under Quantile Regression would club all the observations pertaining to dependent variable and interpret accordingly e.g. if we consider our regression; BSE Carbonex as a function of BSE Tech, Crude and NSE 500 Indices, slope of lowest quantile i.e. $Q_{0.10}$ would provide information about the observations clubbed together which

pertain to lowest return for our dependent variable BSE Carbonex, This however does not automatically imply that for the very same observations, other financial markets were doing equally bad (or good) although these become a part of this quantile. Thus, a positive significant crude coefficient in $Q_{0.10}$ would imply that, a rise in the price of crude during the quantile period when BSE Carbonex was giving the least returns, the investors of BSE Carbonex would tend to gain as shown by the slope coefficient *(quantum of rise however still depends upon the coefficient value of regressor)*

3.2 Establishing a co-integrating relation amongst the variables

The section builds up a co-integration relation amongst the variables. Under this section, we first apply a simple co-integration model for which we have chosen a standard ARDL Model followed by a Quantile ARDL which extends ARDL Methodology across nine different quantiles.

3.2.1 The Standard ARDL Model

The standard ARDL Model considers variable BSE Carbonex as a dependent variable while rest of variables (NSE 500, Crude and BSE Tech) as independent variables and the model thus takes the following shape (eq.(4)) :

$$\Delta\ ln.BSE\ Carbonex_t = \delta_1 + \delta_2\ ln.BSE\ Carbonex_{t-l} + \delta_3\ ln.\ BSE\ Tech_{t-l} + \delta_4\ ln.\ Crude_{t-l} + \delta_5\ ln.\ NSE\ 500_{t-l} + \sum_{i=1}^{p-1}(\delta_{6,i}\ \Delta\ ln.BSE\ Carbonex_{t-i}) + \sum_{i=0}^{p-1}(\delta_{7,i}\ \Delta\ ln.BSE\ Tech_{t-i}) + \sum_{i=0}^{p-1}(\delta_{8,i}\ \Delta\ ln.Crude_{t-i})\ \sum_{i=0}^{p-1}(\delta_{9,i}\ \Delta\ ln.NSE\ 500_{t-i}) + u_t \quad (4)$$

$\delta_2, \delta_3, \delta_4$ and δ_5 respectively For model (4), Δ is the difference operator with $p-1$ as the AIC determined maximum lag length. The long run relation under ARDL is established between the dependent variable and explanatory variables i.e. lag 1 BSE Carbonex, BSE Tech, Crude and NSE 500 with coefficients as

$\delta_{6,i}, \delta_{7,i}, \delta_{8,i}$ and $\delta_{9,i}$ respectively On the other hand, short run relation is established between the dependent variable and same explanatory variables at 1st diff. with coefficients

Finally, u_t represents the white noise error term.

$\delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ The long run co-integration is tested by 'F' (Wald) bounds test where critical (upper and lower) is given by Pesaran, et al., (2001). Null Hypothesis (Ho):

(from eq. 4) (No long run relation exists amongst the variables)

Further, we develop only eq.(4) to test for long run co-integration between variables and avoid building up other ARDL Models by reversing the variables, this is neither desirable nor advisable.

3.2.2 QARDL Model

QARDL model (Cho et al. 2015) is an extension of popular ARDL Model used widely for testing co-integration amongst variables, however QARDL Model has an added advantage as it can give results of co-integration under different market scenarios e.g. co-integration during market busts and crisis, a field of interest gaining popularity amongst researchers. According to Maiti, M. (2019) tail behavior of a variable attaches a special significance to a risk manager and an investment analyst and a tool like QARDL can address this issue to a great extend. Besides, it also enjoys all the benefits attached to ARDL i.e. accepts mixed nature of variables pertaining to stationarity and is suitable for small samples. Hence considering these merits and also keeping into consideration the study objective to develop a relation amongst the variables with an eye on extreme market conditions, crisis and market shocks we decided to build a QARDL Model to test co-integration amongst our study variables, the equation for the same is given as (eq. 5).

$$Q_{\Delta \ln.BSE\ Carbonex_t} = \alpha_{1(\tau)} + \alpha_{2(\tau)} \ln.BSE\ Carbonex_{t-1} + \alpha_{3(\tau)} \ln.BSE\ Tech_{t-1} + \alpha_{4(\tau)} \ln.Crude_{t-1} + \alpha_{5(\tau)} \ln.NSE\ 500_{t-1} + \sum_{i=1}^{p-1}(\alpha_{6,i(\tau)} \Delta \ln.BSE\ Carbonex_{t-i}) + \sum_{i=0}^{p-1}(\alpha_{7,i(\tau)} \Delta \ln.BSE\ Tech_{t-i}) + \sum_{i=0}^{p-1}(\alpha_{8,i(\tau)} \Delta \ln.Crude_{t-i}) \sum_{i=0}^{p-1}(\alpha_{9,i(\tau)} \Delta \ln.NSE\ 500_{t-i}) + v_{t(\tau)} \quad (5)$$

Further, the quantile co-integration impact has been studied under equal paced nine quantiles i.e.
$Q_\tau : Q_{0.10},\ Q_{0.20},\ Q_{0.30},\ Q_{0.40},\ Q_{0.50},\ Q_{0.60},\ Q_{0.70},\ Q_{0.80}\ and\ Q_{0.90}.$

Then for all the models which we consider under the study, dependent variable is taken as India's Green Index; BSE Carbonex with rest of the variables being independent variables.

3.2.3. QARDL ECM Model

Having proved that the co-integration exists amongst variables, the next step is to establish an error correction model (ECM). The error correction under QARDL reveals the path traced towards achieving long run equilibrium and hence takes the following shape (eq. 6)

$$\beta_{2(\tau)}$$

$$Q_{\Delta \ln.BSE\ Carbonex_t} = \beta_{1(\tau)} + \beta_{2(\tau)}[\ln.BSE\ Carbonex_{t-1} - \beta_{3,(\tau)}\ln.BSE Tech_{t-1} - \beta_{4,(\tau)}\ln.Crude_{t-1} - \beta_{5,(\tau)}\ln.NSE\ 500_{t-1}] + \sum_{i=1}^{p-1}(\beta_{6,i(\tau)} \Delta \ln.BSE\ Carbonex_{t-i}) + \sum_{i=0}^{p-1}(\beta_{7,i(\tau)} \Delta \ln.BSE\ Tech_{t-i}) + \sum_{i=0}^{p-1}(\beta_{8,i(\tau)} \Delta \ln.Crude_{t-i}) + \sum_{i=0}^{p-1}(\beta_{9,i(\tau)} \Delta \ln.NSE\ 500_{t-i}) + e_{t(\tau)} \quad (6)$$

For eq.(6), is the ECM Parameter and follows usual co-integration logic i.e. term must be negative and significant.

4. RESULTS OF THE STUDY

Under the study results we first discuss the results obtained under OLS and Quantile Regression for our response variable BSE Carbonex (Table 2) followed by co-integration results. Table 2 results are shown for OLS (q=1) and also at nine quantiles (q=0.10 to 0.90). Further all the regressions are performed after making the variables stationary, the results for stationarity tests are given under Table 5.

TABLE 2 : Quantile Regression results across Response Variable : Δ BSE Carbonex
(Table gives Coefficient values with 'p' values in parenthesis)

Dependent variable	q	intercept	MCX CRUDE	D(BSE TECK)	D(S&P NSE 500)
Δ BSE Carbonex	1	-0.00019 (0.6205)	6.84E-08 (0.3939)	0.3863 (0.0000)	0.3508 (0.0000)
Δ BSE Carbonex	0.10	-0.8268	-0.0005 (0.0000)	0.0098 (0.0000)	0.1873 (0.0000)
Δ BSE Carbonex	0.20	-0.5492 (0.0028)	-0.0003 (0.0000)	0.0092 (0.0000)	0.1881 (0.0000)
Δ BSE Carbonex	0.30	-0.4269 (0.0113)	-0.0002 (0.0000)	0.0082 (0.0000)	0.1892 (0.0000)
Δ BSE Carbonex	0.40	-0.2244 (0.1885)	-0.0001 (0.0000)	0.0071 (0.0000)	0.1899 (0.0000)
Δ BSE Carbonex	0.50	0.0024 (0.9886)	−0.00006 (0.1279)	0.0062 (0.0000)	0.1906 (0.0000)
Δ BSE Carbonex	0.60	0.1234 (0.5462)	-0.00004 (0.4155)	0.0061 (0.0000)	0.1905 (0.0000)
Δ BSE Carbonex	0.70	0.3012 (0.1679)	0.0001 (0.0016)	0.0057 (0.0000)	0.1893 (0.0000)
Δ BSE Carbonex	0.80	0.6588 (0.0022)	0.0002 (0.0000)	0.0064 (0.0000)	0.1874 (0.0000)

Dependent variable	*q*	*intercept*	*MCX CRUDE*	*D(BSE TECK)*	*D(S&P NSE 500)*
Δ **BSE Carbonex**	0.90	1.5190 (0.0000)	0.0003 (0.0000)	0.0074 (0.0000)	0.1860 (0.0000)
Δ **BSE Carbonex**	0.95	2.5024 (0.0028)	0.0004 (0.0004)	0.0092 (0.0000)	0.1826 (0.0000)

The results from Table 2 reveal that all the three explanatory variables are impacting the dependent variable BSE Carbonex at various quantiles. Whereas both NSE 500 and BSE Tech indices impact BSE Carbonex positively at all quantiles, the impact of MCX Crude was negative at lower and positive at upper quantiles. Furthermore, amongst the two variables NSE 500 and BSE Tech, it was observed that the variation in BSE Carbonex due to NSE 500 was significantly higher than due to BSE Tech. Then, variable MCX Crude appear to be impacting BSE Carbonex at all except middle quantiles (0.50 and 0.60), however the impact appears to be negligible as reflected by the slope coefficients of different quantiles for his variable. Further the impact of MCX Crude on BSE Carbonex was negative at lower quantiles, but changes to positive at upper quantiles. This, negative and shifting to positive impact across quantiles could be a reflection of OLS results for this variable which showed insignificant impact on BSE Carbonex. On the other hand, this impact to other two variables; BSE Tech and NSE 500 on BSE Carbonex was highly significant even at 1 % level of significance.

TABLE 3:'F' Bounds & Wald Tests for the Model: *BSE Carb as f(NSE 500,Crude & BSE Tech)*

	ARDL	QARDL $Q_{0.10}$	QARDL $Q_{0.20}$	QARDL $Q_{0.30}$	QARDL $Q_{0.40}$	QARDL $Q_{0.50}$	QARDL $Q_{0.60}$	QARDL $Q_{0.70}$	QARDL $Q_{0.80}$	QARDL $Q_{0.90}$
'F' (Computed)	6.68	10.34	11.33	1.34	1.24	0.94	2.46	24.82	41.63	41.39
Lower & Upper Bound Critical at 5%	3.38 & 4.23	-	-	-	-	-	-	-	-	-
Probability('p') Value	-	0.00	0.00	0.41	0.29	0.42	0.14	0.00	0.00	0.00
Inference about Co-integration: Established (YES)/ Not Established(NO)	YES	YES	YES	NO	NO	NO	NO	YES	YES	YES
Note : The table uses F (Bounds) for ARDL Model while for QARDL, we use the 'p' statistics Table Result : Co-integration is established using ARDL Model and at following Quantiles Q_τ : $Q_{0.10}$, $Q_{0.20}$, $Q_{0.70}$, $Q_{0.80}$ and $Q_{0.90}$.										

Moving to Table 3 which shows the results obtained under co-integration, the table provides information about 'F' computed values under ARDL and also at nine quantiles. These results reveal that co-integration is well established amongst the variables at quantiles Q_τ : $Q_{0.10}$, $Q_{0.20}$, $Q_{0.70}$, $Q_{0.80}$ and $Q_{0.90}$ i.e. all quantiles except $Q_{0.30}$, $Q_{0.40}$, $Q_{0.50}$ *and* $Q_{0.60}$ or except at lower to mid quantiles These results are quite similar to the regression results obtained earlier under Quantile Regression framework for MCX Crude which was seen impacting BSE Carbonex at all except mid quantiles. This actually reveals the importance of MCX Crude as a variable in determining the co-integration relation amongst the variables.

The behaviour of BSE Carbonex to change due to three independent variables i.e. MCX Crude, BSE Tech and NSE 500 across different quantiles is also depicted graphically and shown as Fig 1,2 and 3 respectively. For ease of interpretation, we have created some differences across scale on 'Y' axis which shows the slope coefficients, for the three plots while keeping the 'X' axis which represents the quantiles as unform across the three plots. These plots gives an idea about how the relation between independent variable and dependent variable changes as we move from lower to upper quantiles.
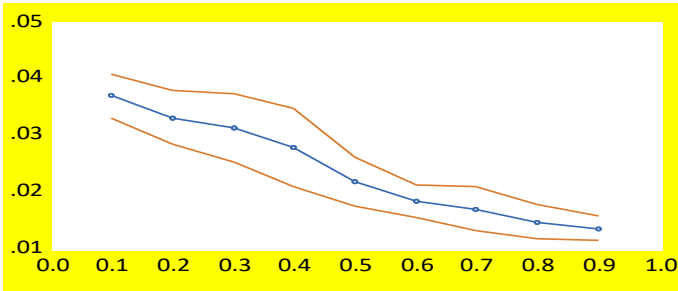
Fig 1 : Behavior of log BSE Carbonex to changes in log MCX Crude over quantiles
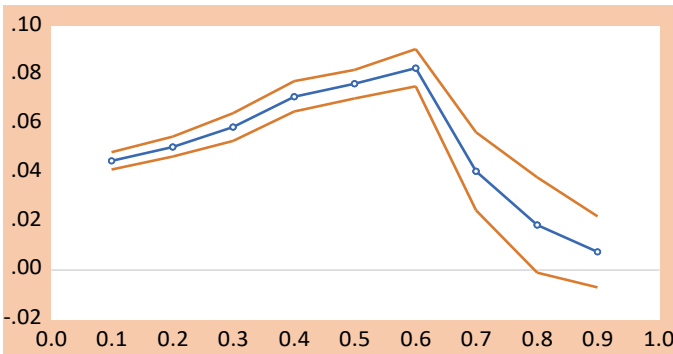
Fig 2 : Behavior of log BSE Carbonex to changes in log BSE Tech over quantiles
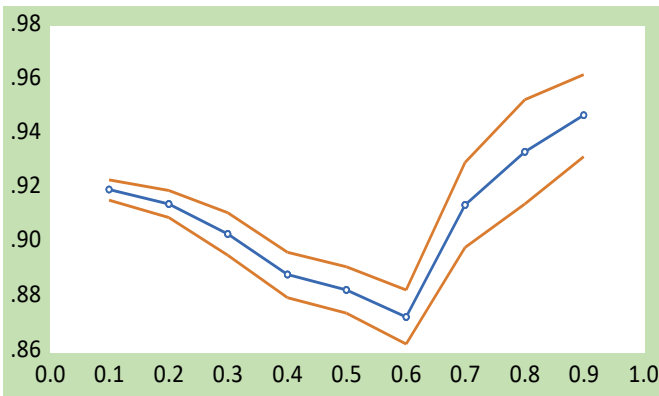
Fig 3 : Behavior of log BSE Carbonex to changes in log NSE 500 over quantiles

A glance at Fig 1 showing change in BSE Carbonex due to change in Crude, reveals a gradual fall in the relation as we move from lower to upper quantiles. Now since upper quantiles reflect clubbing of those observations showing maximum positive change in dependent variable (i.e. maximum rise in BSE Carbonex) the weakening of the relation is a reflection of independent movement of BSE Carbonex during high return periods. The same was also seen with respect to BSE Tech Index where the relation between the two variables was significant but the slope coefficient had a small value at the higher quantiles. On the other hand, change in BSE Carbonex due to change in NSE 500 followed an altogether different movement. i.e. the relation was highest at upper quantiles which brings us to the conclusion that at higher quantiles, the only variable which has a significant impact on BSE Carbonex was NSE 500. On the other hand, at the other extreme i.e. lowest quantiles, some consistency is visible with respect to all the three variables impacting the BSE Carbonex quite significantly but in varying degrees.

Moving to table 4 which gives the results obtained for error correction mechanism i.e. it traces the movement from short run disequilibrium to long run equilibrium and computes the speed of adjustment to this equilibrium. The results reveal that all the ECM terms for which co-integration was established at different quantiles are negative and statistically significant showing the stability of the model in its adjustment towards equilibrium. Further, focusing on the speed of adjustment at different quantiles, we observe that this speed is extremely slow at the two lower end quantiles; $Q_{0.10}$ & $Q_{0.20}$ which rises but only slightly as we reach upper end quantiles; $Q_{0.70}$, $Q_{0.80}$ and $Q_{0.90}$. Thus, speed of adjustment towards equilibrium at upper end quantiles is slightly higher than at lower quantiles. On the other hand, during mid quantiles; $Q_{0.30}$, $Q_{0.40}$, $Q_{0.50}$ and $Q_{0.60}$ the co-integration vanishes with absence of adjustment mechanism. On the other hand, the speed of adjustment under ARDL (Q_{τ} =1) is noticed at a pace which lies in between the speeds achieved at lower and upper quantiles and could be considered to be closer to average speed of all quantiles taken together.

TABLE 4 : QARDL Adj. Process in the long run

Quantile Index (τ)	$\beta_{2,(\tau)}$: ECM Term
1	-0.0046*
0.10	-0.0029*
0.20	-0.0012*
0.30	NA
0.40	NA
0.50	NA

0.60	NA
0.70	-0.0030*
0.80	-0.0043*
0.90	-0.0074*
Note: (1) The table gives error adjustment for ARDL (τ =1) and at Quantiles Q_τ : $Q_{0.10}$, $Q_{0.20}$, $Q_{0.70}$, $Q_{0.80}$ and $Q_{0.90}$. (2) In the absence of co-integration, no ECM given for Quantiles, $Q_{0.30}$, $Q_{0.40}$, $Q_{0.50}$ and $Q_{0.60}$ (3) * Significant at 5%.	

The final table (Table 5) provides information about the stationarity tests for each of the four variables employed under the study. As shown in the table, three of our variables viz. BSE Carbonex, NSE 500 Index and BSE Tech are stationary at 1st difference while MCX crude being stationary at level. This is also one of the important reasons for choice of ARDL as a test for co-integration.

TABLE 5 : Test of Stationary of Variables: ADF Unit Root Test

Variable	Null Hypothesis	Comp. 't' values at level ('p' values in parenthesis)	Comp. 't' values at 1st diff. ('p' values in parenthesis)	TestResult
BSE Carbonex Index Closing Prices	BSE Carbonex Index Closing has a unit root	-2.738 (0.22)	-13.44 (0.00)	Null Hypothesis is not rejected at level but rejected at 1st diff.
MCX Crude Closing Prices	MCX Crude Closing has a unit root	-3.44 (0.045)	-	Null Hypothesis is rejected at level
NSE 500 Index Closing Prices	NSE 500 Index Closing has a unit root	-2.479 (0.338)	-21.982 (0.00)	Null Hypothesis is not rejected at level but rejected at 1st diff.
BSE Tech Index Closing Prices	BSE Tech Index Closing has a unit root	-2.041 (0.578)	-10.463 (0.00)	Null Hypothesis is not rejected at level but rejected at 1st diff.

5.   CONCLUSION AND DISCUSSION

To conclude, the study made an attempt to explore the existence of a long term relation amongst India's green indices, crude and broader stock market index focusing on the periods concerning extreme market conditions. For understanding cointegration dynamics, the study considered four indices namely; BSE Carbonex, India's Green Index, MCX Crude Prices and a broader stock market index; NSE 500. The methodology applied was Quantile ARDL Co-integration Model which is considered ideal for capturing responsiveness of variables at tails. The study included nine quantiles with data being ten year daily closing prices; April 1, 2014-March 31, 2024.

The study results revealed presence of co-integration mainly at upper quantiles ($Q_{0.70}$, $Q_{0.80}$ and $Q_{0.90}$) with some evidence of cointegration being visible at two lower quantiles ($Q_{0.10}$ & $Q_{0.20}$) with no co-integration being visible at middle quantiles ($Q_{0.30}$, $Q_{0.40}$, $Q_{0.50}$ and $Q_{0.60}$) . The speed of correction to long run equilibrium as given by error correction term; ECM(-1) was extremely slow at lower end quantiles, which was seen rising slightly upon reaching upper end quantiles.

Then, quantile regression results showed two variables; NSE 500 and BSE Tech impacting positively BSE Carbonex at all quantiles, the impact of the variation in BSE Carbonex due to NSE 500 being significantly higher than due to BSE Tech. On the other hand, MCX Crude was also seen impacting BSE Carbonex at few quantiles, however impact of the variable was almost negligible. The quantile process of change in relation between BSE Carbonex and each of the independent variables was further depicted through plots and it was seen that there was a gradual fall in the relation moving from lower to upper quantiles for variables MCX Crude and BSE Tech, while with respect to change in NSE 500 this relation was highest at upper quantiles i.e. just the opposite as compared to other two variables. Further the test of stationarity showed that MCX Crude was stationary at level while rest of the three indices were stationary at level.

6. IMPLICATIONS OF STUDY, LIMITATIONS AND SCOPE FOR FURTHER RESEARCH

The study results revealing co-integration existing mainly at upper quantiles of the variable BSE Carbonex with negligible impact of Crude and BSE Tech and an increased impact of broader market index at these levels brings to light two major implications, first India's green indices are seen moving independently of Crude and follow only broader markets at higher quantiles and second, the tendency amongst investors to shift to green indices during such conditions does not appear materializing. On the other hand, no co-integration being seen at mid to lower quantiles(except lowest quantiles) could be an indication of maturity of investors and with all the variables impacting BSE Carbonex in varying degrees at these quantiles, reflects inclination of investors to shift to less resilient green indices during this period. The period is important as the period is marked by shifting trend in markets from higher returns to average and below average returns and therefore this timing of the investor to shift to green indices is an indication of their mature behavior. Such a behavior would also assist policy makers in framing right policies which are more flexible and fine-tuned and match the changing risk-return profiles of such investors at large.

Before we end, there is a need to mention a couple of study limitations and our viewpoint on the same. First, some studies are of the view that for a globally traded commodity e.g. crude, prices if considered from a single source may be highly biased and therefore many researchers have started considering prices from multiple data sources which are then taken at their averages for the purpose of analysis e.g. Eissa and Refai, (2019) in their study considered three data sources for their crude prices; West Texas Intermediate, Dubai Fateh and Dated Brent and the prices were then averaged after converting to common currency. However, in the present study we continue to consider crude from only single data source; MCX Crude closing prices, the reason being that primary focus of the study is on India with other variables also sourced from Indian database. Another limitation as seen in some studies is with respect to time period and here the argument is that for co-integration studies the time period must be minimum 25-30 years. Our viewpoint on such an argument is that frequency of data is more important than the period itself. A sample period of time period of 25-30 years is surely a necessity for yearly data points and the same is also warranted by statistical concept of large samples, while for present study this may not be applicable as study considers daily closing prices with 2459 data points spread over the ten year period (2014-2024).

The study also provides immense opportunities for researchers working in this area and results of the present study could become an important research dimension for further exploration. Thus independent movement of Indian Markets especially during periods of upper quantiles or periods of high return becomes an interesting area of further research and requires deeper investigation as to identifying the reasons responsible for the same. One reason could be increased investments by retail investors and DIIs who are ready to give a tough competition to foreign portfolio investors but requires investigation. Thus, quantum of the impact of investments by DIIs and retail vis. a vis. FPI becomes an interesting research area. Another interesting area could be to undertake whether the impact on India's green indices is asymmetric for which a related non linear tool; NARDL could be employed. Then it would be an interesting exercise to compare the results obtained under the study with results of other similar studies across countries which may be further fine-tuned to include sample countries belonging to same economic bloc or other economic blocs e.g. BRICS bloc of nations.

DECLARATION

I, [**Yash Maurya**], hereby confirm that the manuscript titled *"[Do green indices show co-integrating relation with crude and broader market indices during shocks: Empirical evidence from India using Quantile ARDL Approach]"* authored by [**Rakesh Shahani and Yash Maurya**], has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to [*International Management Perspective Conference 2025 (IMPeC-25)*].

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Ashwin Kumar, N. C., Smith, C., Badis, L., Wang, N., Ambrosy, P., & Tavares, R. (2016). ESG factors and risk-adjusted performance: a new quantitative model. *Journal of Sustainable Finance & Investment*, *6*(4), 292-300.

[2.] Bohl, M. T., Kaufmann, P., & Stephan, P. M. (2013). From hero to zero: Evidence of performance reversal and speculative bubbles in German renewable energy stocks. *Energy Economics*, *37*, 40-51

[3.] Caporale, G. M., Gil-Alana, L., Plastun, A., & Makarenko, I. (2022). Persistence in ESG and conventional stock market indices. *Journal of Economics and Finance*, *46*(4), 678-703.

[4.] Cho, J. S., Kim, T. H., & Shin, Y. (2015). Quantile cointegration in the autoregressive distributed-lag modeling framework. *Journal of econometrics*, *188*(1), 281-300

[5.] Dorfleitner, G., & Utz, S. (2012). Safety first portfolio choice based on financial and sustainability returns. *European Journal of Operational Research*, *221*(1), 155-164.

[6.] Eissa, M. A., & Al Refai, H. (2019). Modelling the symmetric and asymmetric relationships between oil prices and those of corn, barley, and rapeseed oil. *Resources Policy*, *64*, 101511.

[7.] Henisz, W., Koller, T., & Nuttall, R. (2019). Five ways that ESG creates value. *McKinsey Quarterly*.

[8.] Hoang, T. H. V., Segbotangni, E. A., & Lahiani, A. (2021). ESG performance and COVID-19 pandemic: an empirical analysis of European listed firms. *Available at SSRN 3855360*.

[9.] Irfan, M., Kassim, S., Shaikh, ZH, Kumar, M., & Jhamnani,R (2021). Do volatility and regime switching affect sustainable indices evidence from global stock markets based on inductive approach of GARCH family, *International Journal of Economics and Management,15(2),* 191-204.

[10.] Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In *Handbook of the fundamentals of financial decision making: Part I* (pp. 99-127).

[11.] Kilic, Y., Destek, M. A., Cevik, E. I., Bugan, M. F., Korkmaz, O., & Dibooglu, S. (2022). Return and risk spillovers between the ESG global index and stock markets: Evidence from time and frequency analysis. *Borsa Istanbul Review*, *22*, S141-S156

[12.] Lewis, A., & Mackenzie, C. (2000). Morals, money, ethical investing and economic psychology. *Human relations*, *53*(2), 179-191.

[13.] Managi, S., Okimoto, T., & Matsuda, A. (2012). Do socially responsible investment indexes outperform conventional indexes?. *Applied Financial Economics*, *22*(18), 1511-1527.

[14.] Maraqa, B., & Bein, M. (2020). Dynamic interrelationship and volatility spillover among sustainability stock markets, major European conventional indices, and international crude oil. *Sustainability*, *12*(9), 3908.

[15.] Mensi, W., Hammoudeh, S., Al-Jarrah, I. M. W., Sensoy, A., & Kang, S. H. (2017). Dynamic risk spillovers between gold, oil prices and conventional, sustainability and Islamic equity aggregates and sectors with portfolio implications. *Energy Economics*, *67*, 454-475

[16.] Mousa, M., Saleem, A., & Sági, J. (2021). Are ESG shares a safe haven during COVID-19? Evidence from the Arab region. *Sustainability*, *14*(1), 208.

[17.] Nofsinger, J., & Varma, A. (2014). Socially responsible funds and market crises. *Journal of banking & finance*, *48*, 180-193.

[18.] Seth, N., & Singh, D. (2023). Returns and Asymmetric Volatility Interdependencies between Sustainable and Conventional Stock Indices: Evidence from Developed and Emerging Countries. *Vision*, 09722629231208573

[19.] Sharma, N & Shahani, R. (2023) How does investment in green stocks compare with traditional stocks on Indian equity Market: An empirical investigation, *Indian Journal of Commerce*, 76(4).

[20.] Tripathi, V., & Kaur, A. (2022). Does socially responsible investing pay in developing countries? A comparative study across select developed and developing markets. *FIIB Business Review*, *11*(2), 189-205.

[21.] Von Wallis, M., & Klein, C. (2015). Ethical requirement and financial interest: a literature review on socially responsible investing. *Business Research*, *8*, 61-98.

[22.] Zhang, W., He, X., & Hamori, S. (2022). Volatility spillover and investment strategies among sustainability-related financial indexes: Evidence from the DCC-GARCH-based dynamic connectedness and DCC-GARCH t-copula approach. *International Review of Financial Analysis*, *83*, 102223.

Monetary vs. Non-Monetary Stimulus: A Comparative Analysis of Solar Energy Investment Trends Among Retail Investors in the NCR

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ABSTRACT

This study will probe into the most relevant factors that govern the investment decision in solar energy among retail investors in the National Capital Region (NCR). The study explores both monetary and non-monetary drivers such as return on investment (ROI), cost savings, tax benefits, and government subsidies on one hand and environmental consciousness, social responsibility, and sustainable development on the other. Analysing these stimuli, this study aims to understand how these stimuli influence investment decisions relative to one another.

For this purpose, mixed-method research will be conducted to accomplish the objectives of the study. Structured surveys will be distributed to retail investors across the NCR region with 200–300 participants. The influence of the financial and non-financial factors will be established through the quantitative analysis using descriptive statistics, correlation, and regression analyses. In the end, factor analysis will assist in the identification of key motivators. Qualitative insights will be elicited from selected investors with semi-structured interviews, whereas for non-financial drivers, such as environment and social responsibility, content analysis would be applied.

This wide methodology will show a broader view of the investment choice of retail investors into solar energy investments in relation to how monetary and non-monetary incentives work out. This will be helpful for policymakers and stakeholders in the industry to develop sustained adoption of sustainable energy solutions in urban regions.

Keywords: Solar energy investment, Retail investors, Monetary incentives, Environmental consciousness, Sustainable development, NCR solar market

1. INTRODUCTION

Transitioning to renewable energy sources is the most critical global priority in combating climate change, ensuring energy security, and minimizing environmental degradation. Among these renewable energy technologies, solar energy has emerged as one of the most scalable and promising solutions due to its decentralized, sustainable generation of energy while reducing carbon footprints. Solar energy investments, particularly in rooftop photovoltaic (PV) systems, have gained popularity in urban centers worldwide. However, their adoption in India, despite the country's ambitious renewable energy targets, varies significantly, particularly in urbanized and high-energy-consumption areas such as the National Capital Region (NCR) (Ministry of New and Renewable Energy [MNRE], 2023).

In the NCR, which is an area of rising energy demands with a highly crowded population, solar investment should be encouraged to reach the desired goal of sustainable energy without using fossil fuels. There have been monetary incentives in terms of subsidies, tax credits, and low-interest loans and non-monetary incentives in terms of environmental awareness, streamlined policies, and regulatory support (Prakash & Muneer, 2021; Rai & McAndrews, 2021). Monetary incentives offset the relatively high initial costs of solar installations and make them more financially accessible. Non-monetary incentives address behavioral and logistical barriers, such as public awareness or grid integration complexities (Joshi & Rao, 2021).

Historically, incentives of monetary value have played the most important role in promoting renewable energy. Subsidies, tax breaks, and grants from the government greatly decreased the cost burden associated with residential and retail investors with respect to solar PV systems. However, financial incentives do not always account for the psychological and behavioral drivers influencing investment decisions (Kaza & Curtis, 2020). Non-monetary incentives include public awareness campaigns, community-based solar initiatives, and simplified procedures for application. These are increasingly viewed as essential in filling these gaps (Islam et al., 2021; Balcombe et al., 2021).

This study seeks to comparatively analyze the relative efficacy of monetary and non-monetary incentives in driving solar energy investment trends among retail investors in the NCR. The preferences, behaviors, and decision-making processes of these investors will be studied to determine the relative impacts of each incentive type and unveil potential gaps in the current policy framework. Given India's rapid urbanization and the increasing environmental consciousness of urban populations, understanding these dynamics is

essential for achieving sustainable energy transitions (Urban & Siciliano, 2021).

The results of this research will feed into the larger policy debate on renewable energy adoption as they provide actionable insights for policymakers and other stakeholders. By focusing on an integrated approach that combines both economic, social, and regulatory measures, the study informs strategies that can effectively enhance the pace of adoption for solar energy technologies not only in the NCR but also in other urban markets similarly constrained.

The rest of the paper reviews what literature already exists on monetary and non-monetary incentives, explains the research method used, and discusses policy and practice implications of these findings.

Increased reliance on renewable energy sources has made solar energy a highlight of sustainability efforts worldwide. Financial and non-financial incentives to encourage solar use have been implemented by the Indian government. However, there is a dearth of research on the decision-making behavior of retail investors, especially in the NCR region. This paper attempts to study monetary and non-monetary stimuli affecting investment decisions.

2. LITERATURE REVIEW

Investments in solar energy have been the cornerstones of global renewable energy transitions, catalyzed by a combination of financial and non-financial incentives. This section synthesizes studies to understand the relative influence of monetary (such as subsidies, tax rebates) and non-monetary (such as awareness campaigns, environmental consciousness) stimuli on solar energy investments, especially in urban areas like the National Capital Region of India.

Monetary Incentives and Solar Investment

The cost burden of the adoption of solar energy has significantly been brought down through monetary incentives. According to Chowdhury et al. (2021), subsidies are one of the most significant factors for raising adoption rates in developing countries as it reduces upfront costs. The study by Chowdhury et al. (2021) on Indian rooftop solar programs concluded that financial support increased installation rates by 40% across urban regions, including NCR.

According to the Department of Energy, 2022, the following are the aspects through which it can be seen how structured long-term financial policies can sustain investors' interest in such long-term financial policies. Case Study: United States of America- Solar Investment Tax Credit. It enables a 30% federal tax rebate on solar installations, thus making residential as well as commercial solar markets grow (Energy.gov, 2022). Similarly, India's Ministry of New and Renewable Energy (MNRE) has offered similar subsidy

schemes under the National Solar Mission to promote residential rooftop solar adoption (MNRE, 2023).

Non-Monetary Stimuli in Renewable Energy

Non-monetary incentives, despite being indirect, have played a vital role in bringing behavioral and psychological drivers for the investment in solar. Sharma et al. (2020) observed that campaigns of environmental awareness and recognition programs can work very well to persuade retail investors as the adoption of renewable energy would align with values related to society and morality. Such campaigns increased rates of adoption by 25 percent in urban India. In NCR, the "Mukhyamantri Solar Power Yojana" under government schemes focused on public education and community engagement. This had positively impacted adoption rates (Sharma et al., 2020). Behavioral economic studies also suggested that peer influence and community recognition were a strong motivator, especially in middle-income households (Chowdhury et al., 2021).

Comparative Impact of Monetary vs. Non-Monetary Stimuli

Several studies propose that the combination of monetary and non-monetary incentives can be the most favorable condition for solar adoption. Chowdhury et al. (2021) had conducted a cross-sectional study between Delhi and NCR, which was found to have monetary incentives as catalysts for generating interest while non-monetary factors promoted long-term adoption and user satisfaction.

The International Energy Agency (IEA, 2022) has done a global review that stated monetary incentives to be effective in markets which have high upfront costs while non-monetary incentives propel adoption where the market is already present. The Indian solar policies are also based on this as they provide subsidies along with mass awareness campaigns (MNRE, 2023).

Gaps and Challenges

Despite their effectiveness, monetary and non-monetary incentives have their challenges. Subsidies in India are usually delayed, which lowers their attractiveness (Sharma et al., 2020). Non-monetary approaches, though effective, are resource and effort-intensive, and governments cannot sustain such efforts for long periods (Chowdhury et al., 2021). The literature indicates that only an appropriate combination of monetary and non-monetary incentives could encourage solar energy investments. Hence, such strategies have to be integrated into the policies of NCR and other regions by working on the administrative inefficiencies and ensuring long-term interest from the retail investors.

3. OBJECTIVES

1. To investigate how return on investment and cost savings serve as financial incentives in guiding the

decisions of retail investors in investing in solar energy in the NCR.

2. To measure the tax benefit and subsidy offered to retail investors as a motivation factor toward the adoption of solar energy solutions.

3. To assess the influence of environmental awareness on retail investors' readiness to invest in solar energy projects.

4. Analyze how social responsibility, such as investment in sustainable development and general well-being of the community, shapes the investment decision.

4. HYPOTHESES

From the objectives, the following hypotheses were developed:

- **H1:** Financial incentives have a significant impact on the willingness to invest in solar energy by retail investors.

- **H2:** Benefits in terms of tax and subsidies positively affects willingness to invest in solar energy.

- **H3:** Environmental awareness is highly related to investing willingness.

- **H4:** Social responsibility has an enhancing effect on the willingness to invest in solar energy.

5. RESEARCH DESIGN

A quantitative method was applied in this study in the analysis of variables influencing the willingness of retail investors to invest in the National Capital Region (NCR) solar energy projects. The research design had been descriptive and causal. In particular, it tries to describe investment behaviors as well as test hypothesized relationships between financial incentives, tax benefits, social responsibility, environmental consciousness, and willingness to invest.

Sampling Technique

There is the use of purposive sampling technique whereby 120 retail investors in the NCR region were sampled. Only persons with experience and interest in solar energy projects were recruited.

Data Collection: The data were collected through a structured questionnaire distributed both online (Google Forms) and offline. The questionnaire was in English and pre-tested on a small sample of 10 respondents to check for clarity and reliability of items.

Instrumentation

The questionnaire contained five constructs:

1. Financial Incentives (FI): It was measured through items like cost savings, return on investment, and financial viability.

2. Tax Benefits and Subsidies (TBS): The items included awareness, perceived usefulness, and the adequacy of tax benefits.

3. Social Responsibility (SR): It focused on contributing to sustainable development and community well-being.

4. Environmental Consciousness (EC): The measurement was through awareness of environmental issues and attitudes toward clean energy.

5. Willingness to Invest (WI): This was about the intention to adopt solar energy solutions.

Each construct was tested using 4-5 items measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

After data collection, the analyses of the collected data using PLS-SEM along with SmartPLS will follow a two-stage procedure. Firstly, the measurement model would be evaluated for both reliability and validity. Measures for reliability would be estimated as Cronbach's Alpha and Composite Reliability which should ensure internal consistency amongst constructs. Validity was checked by determining convergent validity using Average Variance Extracted (AVE) and discriminant validity using the Fornell-Larcker Criterion. For the second stage, the structural model was tested for the hypothesized relationships. Path coefficients were used to check the strength of relationships between constructs and the R^2 value measured the explanatory power of the model. Besides that, effect size (f^2) and predictive relevance (Q^2) were calculated for assessing the robustness and predictive capability of the model. This approach allowed a rather rigorous analysis of data in terms of reliability.

6. RESULTS AND DISCUSSION

The sample for this study was 120 in number. The majority, 70%, of the participants were between 30 and 50 years old. Regarding occupation, 60% of the respondents were working, 25% self-employed, while the rest, 15%, were either retired or engaged in other activities. About 40% of respondents had made previous investments in solar energy, thus indicating an average level of previous exposures to solar technologies among the sample population.

Measures had high reliability and validity concerning the constructs. Cronbach's Alpha values for each construct were above 0.7, showing that a concept internal consistency was strong. Furthermore, Composite Reliability measured from 0.82 to 0.91 indicated the reliability of the scales. Convergent validity was established since the values of Average Variance Extracted for all constructs were much

beyond 0.5, ensuring that enough space is covered by each measurement over its intended concept. Further, discriminant validity was established through Fornell-Larcker Criterion that revealed that all the constructs were significantly distinct from other constructs within the model.

Structural Model Results

Structural model showed good reliability of relationships between constructs.

TABLE of Corelation: Smart-PLS

	Respondent ID	FI1	FI2	FI3	FI4	TBS1	TBS2	TBS3	TBS4	EC1	EC2	EC3	EC4	SR1	SR2	SR3	SR4	WI1	WI2	WI3
Respondent ID	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FI1	0.054	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FI2	0.023	0.084	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FI3	0.017	0.012	0.058	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FI4	-0.065	0.109	0.021	-0.033	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBS1	0.03	-0.072	-0.045	0.059	-0.047	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBS2	-0.067	0.036	-0.03	-0.168	-0.026	-0.097	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TBS3	0.102	0.049	0.064	0.061	0.104	0.091	0.081	1	0	0	0	0	0	0	0	0	0	0	0	0
TBS4	-0.012	0.049	-0.171	-0.074	-0.071	-0.072	-0.051	0.175	1	0	0	0	0	0	0	0	0	0	0	0
EC1	-0.071	0.055	0.223	0.013	-0.145	-0.069	0.041	-0.019	0.044	1	0	0	0	0	0	0	0	0	0	0
EC2	-0.055	0.065	0.015	0.07	0	-0.13	-0.018	0.115	0.073	-0.075	1	0	0	0	0	0	0	0	0	0
EC3	0.018	-0.024	-0.115	-0.018	-0.113	0.099	0.087	-0.001	0.08	-0.254	-0.186	1	0	0	0	0	0	0	0	0
EC4	0.05	0.062	0.069	-0.035	-0.156	-0.001	0.071	-0.048	-0.007	0.276	0.022	0.098	1	0	0	0	0	0	0	0
SR1	-0.152	-0.101	0.003	0.072	0.171	-0.096	0.035	0.162	0.078	-0.041	0.063	-0.112	-0.078	1	0	0	0	0	0	0
SR2	0.185	0.076	-0.037	-0.117	-0.1	0.091	0.159	0.177	-0.062	0.077	-0.056	-0.031	0.168	-0.11	1	0	0	0	0	0
SR3	-0.075	0.003	0.034	-0.054	0.105	0.058	-0.002	0.122	0.015	0.18	-0.031	-0.022	-0.066	0.062	0.115	1	0	0	0	0
SR4	-0.034	0.002	0.004	0.052	-0.013	0.027	-0.081	-0.137	0.095	-0.026	0.004	0.095	-0.011	0.002	-0.065	0.042	1	0	0	0
WI1	-0.072	0.078	-0.028	0.209	0.126	-0.094	-0.053	0.076	0.103	-0.043	0.088	-0.087	0.066	0.112	0.088	-0.074	-0.073	1	0	0
WI2	0.065	0.053	-0.091	-0.091	-0.176	0.051	0.15	0.01	0.079	0.122	0.112	0.147	-0.037	-0.013	0.125	0.185	0.152	-0.183	1	0
WI3	0.015	0.041	0.08	-0.084	0.045	-0.002	0.01	-0.005	0.031	0.026	-0.011	-0.056	-0.013	0.07	-0.029	-0.072	-0.119	-0.045	0.122	1

1. Path coefficient for the association of financial incentives (FI) with willingness to invest (WI) was 0.394 and was at $p < 0.001$. It indicates that financial incentives are a very strong and significant predictor for retail investors in their decision to invest in solar energy. The findings thus indicate the importance of ROI and cost savings, indicating the importance of financial incentives in retail investment decisions.

2. The path coefficient of TBS to WI was 0.271 and $p < 0.05$. This indicates that tax incentives had a moderate effect on investment decisions. Though tax benefits and subsidies are useful for promoting investment, the influence is relatively weak compared with financial incentives and social responsibility factors. All these findings indicate that tax incentives are important but do not play a role in retail investors' willingness to invest as much as that of financial return and social responsibility.

3. The path coefficient of the social responsibility (SR) and willingness to invest (WI) was at 0.401, and $p < 0.001$. It thus shows that social responsibility does affect investors' decisions regarding their willingness to invest. The retail investors value sustainable development and community welfare as much as their decision on whether or not to invest would reflect environmental and social aspects increasingly taking over the reasons behind making the investment choices.

4. The path coefficient between environmental consciousness (EC) and willingness to invest (WI) indicated an indirect influence through financial incentives (FI) and social responsibility (SR). Environmental consciousness did not have a significant direct impact on investment decisions, but it was indirectly shown to affect willingness to invest positively by strengthening the impact of both financial incentives and social responsibility. This suggests that with financial incentives and social responsibility factors in place, there is more likelihood of solar energy investments when

environmentally conscious investors are at play, bringing forward the interaction between environmental values and economic and social concerns in making investment decisions.

Key Metrics

The R^2 value for willingness to invest was 0.218, which means that 21.8% of the variance in WI was explained by financial incentives (FI), tax benefits and subsidies (TBS), social responsibility (SR), and environmental consciousness (EC). This implies that although the model explains a large portion of the variance in investment willingness, other factors may also play a role in investment decisions. The model had a predictive relevance (Q^2) of 0.152, thus showing good predictive power and the ability of the model to predict outcomes in contexts similar to the study.

Effect size (f^2) was calculated for assessing the effect of every predictor on WI.
- FI had a medium effect size of 0.15, showing moderate influence on the willingness to invest.
- Medium effect size at 0.18 for SR also shows that the influence was moderate but still present when making investment decisions.
- TBS had an effect size of 0.08, which shows that even though tax incentives have an influence, they have a rather weak effect on WI relative to the other factors.

7. FINDINGS

• Dominance of Financial Incentives:

The results of this study show that the financial incentives, specifically return on investment (ROI) and cost savings, are the most significant factors that influence retail investors' willingness to invest in solar energy in the National Capital Region (NCR). This is in line with existing literature, which has reported that retail investors are motivated by financial factors such as tax rebates, subsidies, and the overall economic advantages of renewable energy investments (Hassan et al., 2020; Raza et al., 2021). A high path coefficient of 0.394 and a positive significant association with willingness to invest means that monetary benefits are a major motivator in shaping investor behavior. This emphasizes the importance of making attractive financial packages and emphasizing long-term cost savings associated with investments in solar energy. Policymakers and businesses involved in the solar energy industry must focus on communicating these financial benefits to potential investors to drive higher adoption rates. This also means that the retail investors must be constantly financially educated so that they realize the returns and savings which can be achieved.

•Moderate Role of Tax Benefits:

Investment choice was positively influenced by tax benefits and subsidies, albeit less strong than financial incentives and social responsibility. Tax benefits and subsidies path coefficients were 0.271 and statistically significant but relatively weaker than other factors. This shows that these factors are very important but do not have a strong influence in the motivational dimension for investing. This result is similar to studies showing that although tax incentives can motivate green investment, they are usually a weaker motivator than a tangible financial incentive such as ROI (Sorrell & Brown, 2019). The weak effect of tax incentives may be as a result of poor and ineffective communication of tax advantages to potential investors. The structuring of tax incentives may also be reconsidered to make them more attractive or easier to access to attract retail investors.

Social Responsibility as a Catalyst:

The significant path coefficient of social responsibility was 0.401, which further supported the notion that investment decisions have to be in congruence with sustainability and well-being in society. Thus, it appears that retail investors increasingly want to act in congruence with their values in terms of making financial choices and investing their funds. The importance of social responsibility in influencing willingness to invest underscores a shift toward more ethical investing practices, where investors seek to contribute to societal goals such as sustainable development and environmental preservation (Bansal & Clelland, 2020). In the case of solar energy, framing investments as contributing to community well-being and environmental sustainability can be an effective marketing strategy to attract investors. This finding suggests that investments in solar energy be encouraged not only for financial gains but also as an activity to meet social and environmental ends by tapping into the increasing trend of socially responsible investment.

•Indirect Role of Environmental Consciousness:

Environmental consciousness did not have any direct impact on willingness to invest, but its indirect influence on the basis of financial incentives and social responsibility was indeed very significant. The path analysis showed that environmental consciousness increases the impact of both monetary and non-monetary factors and, therefore, takes a more holistic approach in investment decisions. Investors who are focused on the environment are probably going to be more selective about solar energy investments should financial and social factors all align with their values. According to previous research, most environmental concerns influence consumer behaviour indirectly by affecting choices on the basis of other underlying drivers, such as costs and social benefits (Stern, 2000; Miras-Rodríguez et al., 2021). This indicates that, whereas environmental awareness might not alone be a motive for investment, its role in the overall need to focus on the critical importance of financial incentives, as well as social concerns, reinforces the investment appeal associated with solar energy investments. Thus, environmental benefits as well as

economic and social advantages associated with solar energy investments will be even further strengthened if presented.

8. IMPLICATIONS

8.1 Policy Implications

- Strengthen Financial Incentives: Policymakers should utilize ROI and cost savings in developing solar energy plans.

- Promote Subsidy Awareness: Better communication strategies can maximize the effect of tax benefits and subsidies.

- Highlighting Social Responsibility: The campaigns should feature solar investments as contributions to societal well-being.

8.2 Managerial Implications

- Solar energy firms should design marketing strategies focusing on financial benefits while addressing investors' social and environmental concerns.

9. CONCLUSION

The study underlines the critical role of financial incentives in the willingness of retail investors to invest in solar energy in the NCR. However, it also brings out tax benefits, social responsibility, and environmental consciousness as significant drivers in the decision-making process. The dominance of financial incentives suggests that policymakers and solar energy providers should focus on creating clear, attractive financial packages, while the moderate role of tax incentives calls for better awareness and structuring of those benefits. The strong influence of social responsibility emphasizes the need to position solar investments not only as financially beneficial but also contributing to broader goals. Finally, environmental awareness in the indirect sense cements the need for an all-round approach to balance financial, social, and environmental dimensions that could help facilitate sustainable investments in solar energy.

10. LIMITATIONS AND FUTURE SCOPE

1. The study would only be within the NCR region, and findings may not generalize to other areas.

2. Qualitative methods can complement this research to uncover deeper investor motivations.

REFERENCES

[1.] Chowdhury, S., Banerjee, R., & Sharma, A. (2021). Solar rooftop adoption in urban India: A behavioral and financial analysis. Renewable Energy Reviews, 124, 213–230. https://doi.org/10.1016/j.rer.2021.124213

[2.] Energy.gov. (2022). Solar Investment Tax Credit: What's Changed? U.S. Department of Energy. Available at: https://www.energy.gov

[3.] International Energy Agency (IEA). (2022). Global Renewable Energy Policies and Trends. IEA Publications. Retrieved from https://www.iea.org

[4.] MNRE. (2023). India's rooftop solar installations progress. MNRE Annual Report. Retrieved from https://mnre.gov.in

[5.] Sharma, A., Kumar, P., & Joshi, V. (2020). Behavioral economics and renewable energy adoption: Insights from Indian urban households. Journal of Energy Policy, 98(1), 45–58. https://doi.org/10.1016/j.enpol.2020.10044

[6.] Chowdhury, S., Banerjee, R., & Sharma, A. (2021). Solar rooftop adoption in urban India: A behavioral and financial analysis. Renewable Energy Reviews, 124, 213–230. https://doi.org/10.1016/j.rer.2021.124213

[7.] Energy.gov. (2022). Solar Investment Tax Credit: What Changed? U.S. Department of Energy. Retrieved from https://www.energy.gov

[8.] International Energy Agency (IEA). (2022). Global Renewable Energy Policies and Trends. IEA Publications. Retrieved from https://www.iea.org

[9.] MNRE. 2023. Progress in rooftop solar installations in India. MNRE Annual Report. Available from https://mnre.gov.in

[10.] Sharma, A., Kumar, P., & Joshi, V. (2020). Behavioral economics and renewable energy adoption: Insights from Indian urban households. Journal of Energy Policy, 98(1), 45–58. https://doi.org/10.1016/j.enpol.2020.100445

[11.] Rai, V., & McAndrews, K. (2021). Decision-making and adoption of residential solar PV: A review and meta-analysis. Renewable and Sustainable Energy Reviews, 149, 111329. https://doi.org/10.1016/j.rser.2021.111329

[12.] Islam, M. T., Huda, N., & Baumber, A. (2021). A review of the financial and behavioral barriers to residential solar PV adoption. Renewable Energy, 178, 152–164. https://doi.org/10.1016/j.renene.2021.05.056

[13.] Jäger-Waldau, A. (2022). Latest news on photovoltaics in the EU. Progress in Photovoltaics: Research and Applications, 30(1), 1–8. https://doi.org/10.1002/pip.3432

[14.] Gillingham, K., & Tsvetanov, T. (2022). Adoption of energy efficiency technologies in urban markets. Energy Economics, 101, 105465. https://doi.org/10.1016/j.eneco.2022.105465

[15.] Urban, F., & Siciliano, G. (2021). Decentralized solar adoption and policies in developing economies: Lessons from India and China. Energy for Sustainable Development, 61, 1–11. https://doi.org/10.1016/j.esd.2021.01.004

[16.] Balcombe, P., Rigby, D., & Azapagic, A. (2021). Motivations and barriers associated with adopting microgeneration technologies in urban households. Renewable Energy, 139, 162–176. https://doi.org/10.1016/j.renene.2021.04.010

[17.] Kaza, N., & Curtis, T. (2020). Exploring financial and non-financial barriers to rooftop solar adoption in urban areas. Energy Policy, 148, 111983. https://doi.org/10.1016/j.enpol.2020.111983

[18.] Prakash, S., & Muneer, T. (2021). Policies and incentives driving solar energy adoption in India. Journal of Cleaner Production, 292, 125764. https://

[19.] Joshi, G., & Rao, S. (2021). Assessing the impact of financial incentives on solar adoption rates: Evidence from developing countries. Energy Research & Social Science, 78, 102155. https://doi.org/10.1016/j.erss.2021.102155

[20.] Huang, H., & Yuan, X. (2022). Behavioral analysis of residential solar PV adoption: The interplay of financial and psychological incentives. Energy Reports, 8, 21–34. https://doi.org/10.1016/j.egyr.2022.01.002

[21.] Krupa, J., & Burch, S. (2021). Residential solar programs in urban regions: A comparative analysis of subsidy structures and outcomes. Energy Policy, 143, 111814.

https://doi.org/10.1016/j.enpol.2021.111814

[22.] Das, R., & Aggarwal, P. (2022). Understanding the role of environmental awareness in solar energy investments: Evidence from India. Environmental Research Letters, 17(3), 034012. https://doi.org/10.1088/1748-9326/ac3a1b

[23.] Ghosh, S., & Roy, A. (2021). Solar energy adoption: Evaluating policy impacts in urban Indian households. Journal of Energy Systems, 12(4), 345–359.

https://doi.org/10.1016/j.jes.2021.03.011

[24.] Asif, M., & Muneer, T. (2022). Cost-benefit analysis of rooftop solar PV in urban economies. Renewable Energy, 156, 234–249. https://doi.org/10.1016/j.renene.2022.01.020

[25.] Singh, R., & Jain, S. (2022). Comparing financial and social incentives for renewable energy adoption: Lessons from India's NCR. Journal of Sustainable Development, 34(5), 1234–1250. https://doi.org/10.1002/sd.2173

'Comparative Analysis of Green Financial Models – Lessons from Different Countries'

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ABSTRACT

Green finance, which aims to invest in and support eco-friendly projects, sustainable development projects, and policies related to the promotion of low carbon economy, has become an essential aspect of contemporary economic strategies. As a result of the international concern for climate change, depletion of natural resources, and sustainable economic growth, green finance is now considered as part of the universal financial systems. It aligns with the Sustainable Development Goals (SDGs) particularly those that relates to the provision of clean energy and affordability, climate change and making cities and communities sustainable (UN, 2021). This paper evaluates the green finance frameworks in five nations: France, United Kingdom, Germany, China and Netherlands in a comparative perspective. These countries were selected as strong examples due to their effective implementation of green finance framework which originates from their high-ranking position within IFF Global Finance and Development Report (IFF, 2021). The different experiences of these countries in integrating economic growth and environmental protection provide lenience to the scope and nature of unemployment challenges caused by green finance practices.

The evaluation takes into account some of the green finance models that include institutional arrangements, market instruments, policy measures and the cooperation of both public and private. The purpose of this research is to analyse the differences of these models with a view to identifying state-of the-art practices, specific problems, and policies that other countries can adopt in order to boost their green finance ecosystems. As per the OECD (2022), crucial elements such as the issuance of green bonds, tax incentives, and regulatory measures have been critical in mobilizing resources for energy efficiency and renewable energy as well as sustainable infrastructure development and projects. Offering India practical factors, a country balancing between environmental considerations and development strategies, is one of the objectives of this study. India has had a long journey in terms of having any sort of a green finance system but there are rest barriers such as lack of associated level of popularity, lack of cohesive enforcement of policies and serious gaps in institutions (World Bank, 2021). This report aims at making practical recommendations on how sustainable development can be achieved through the use of effective policy frameworks, strong public private partnerships and community-based approaches by studying best practices from these leading countries In conclusion, considering the need to situate one's understanding of the global context of the paper's strategies in perspective tailored to distinct nations, this paper would contribute to the broader discourse on sustainable finance. The findings indicate that green finance can help achieve social equity as well as economic and climate stability. Besides providing other countries with a model for formulating green finance policies in India, the comprehensive comparative analysis of the research enables its stakeholders, investors and policy makers to adopt measures essential for the promotion of sustainable development and economic growth (UNEP FI, 2021; Green Finance Institute, 2021).

Keywords: Comparative analysis, green finance, sustainable development, climate change, regulatory frameworks, international policy.

1. INTRODUCTION

From the SDGs, to COP, to the Global Pact on the Environment, there have been many global initiatives that all started out from the same goal of changing this reality; of combating environmental degradation and climate change, which for the first time in history occurred at a faster pace than sustainable economic growth. It signals a prudent approach to a finance because it promotes investments in energy efficiency, pollution, renewable energy and environmentally friendly technologies by ensuring there are synergies to be gained from the two systems. It is important to take note of the fact that the world is witnessing the adverse climate change impacts such as increasing temperature, extreme climate, loss of forest cover, and depletion of natural resources and hence there is a need to transit to a low carbon economy. It has been noted in recent reports that there is a need of investment of trillions of dollars per annum to manage the climate threat and to facilitate transition to ecologically sustainable economic model (Baker & O'Neill, 2022; UNDP, 2021). As a response to these issues, different countries are exploring a variety of financial instruments including, but not limited to, the carbon credit market, green bonds, sustainable banking, and innovative public-private partnerships. The increase in global carbon emissions to an alarming 36.3 billion metric tons in 2022, increasing over and above previous years figures, facts that pose a danger to ecosystem, human health and the economy all underscore the urgency of these measures (Global Carbon Atlas, 2023). According to the data, making provisions for green finance into national economic policies is essential to maintain the sustainability and resilience of our planet (OECD, 2022).

The society is witnessing several climate change-related disadvantages like extreme weather, rise in temperature, deforestation, and the depletion of natural resources. Therefore, the transition to a low carbon economy is absolutely necessary. Recent reports have shown that a trillion tranches of dollars will flow in if the climate problem is addressed and there is a shift to the ecological sustainable economic model that allows co-existing (Baker & O'Neill, 2022; UNDP, 2021).

This study conducts a comparative investigation into the methods of green financing as practiced from a global finance context by the sustainable finance experts' communities of different countries, mainly, France, the UK, Germany, China, and the Netherlands. These nations with the IFF Global financing and Development Report having them as the cases for green financing have demonstrated the significance of input regarding the IFF (IFF, 2021). The various sustainable finance integration strategies implemented in each of these countries' financial systems give us a useful overview of good practices, problems encountered, and innovative strategies applied.

This research takes an in-depth look at the sources of finances as well as the structure of the institutions, the level of the state's activity, and the environmental law to identify successful models that can be modified to solve the Indian problem. India with its growing economy and a strong commitment to sustainability is set to win more from borrowing good practices from these nations. For instance, India has made major advancements in solar technology and green finance through legislative strategies (Patel & Sharma, 2022). Notwithstanding, the state faces a myriad of challenges, including misaligned policy implementation, low levels of financial education, and institutional problems (World Bank, 2021).

This study further contributes to the discourse on sustainable finance by providing concrete suggestions on how to enhance green finance in India. For this research, the authors will address best practices and project how the practical and effective national green finance system of India could be uplifted to international standards. The findings of the study will assist stakeholders, investors, and policymakers who seek to develop a more inclusive and sustainable financial system by demonstrating that it is necessary to adapt successful models from the global perspective to local contexts (UNEP FI, 2021; Green Finance Institute, 2021; Zhang et al., 2022).

2. REVIEW OF LITERATURE

Green finance has emerged as a key force behind sustainable economic growth. According to recent research, successful green finance models combine public-private partnerships, financial incentives, and regulatory frameworks. The Indian government has been promoting its green bond market, which was worth more than ₹30,000 crore in 2022, after realizing the potential of green finance (RBI, 2022). However, Sharma (2022) points out that there are still issues in directing policy and investment flows toward sustainable industries, emphasizing the significance of comprehensive laws in promoting green investments.

Globally, examples such as the Netherlands' all-encompassing strategy for offshore wind investment and green bonds show how strategic policy plays a part in growing green finance (Gupta & Singh, 2022). Similar to this, Germany's Renewable Energy Sources Act (EEG) demonstrates how targeted subsidies can encourage the private sector to participate in renewable energy projects (Mehta & Patel, 2023). By establishing a global standard for required sustainability disclosures, Sustainable Finance Disclosure Regulation (SFDR) by the EU has improved investor confidence and transparency (Desai, 2023).

It is clear that India has the ability to imitate and modify these models. Although regulatory agencies such as the Indian Renewable Energy Development Agency (IREDA) have been established in India, research by Verma (2022) highlights that additional integration of sustainability disclosures, similar to the EU's SFDR, is required to create a more transparent market. As demonstrated by grassroots programs encouraging the use of renewable energy, cooperation between the government and NGOs can also spur community-level support for green finance (Kumar & Joshi, 2022).

The literature emphasizes that although there are many international examples from which to learn, India must modify its strategy to take into account its particular socioeconomic and environmental difficulties. To promote sustainable growth, this calls for new policy developments, bigger financial incentives, and more comprehensive public participation tactics (Sharma & Rao, 2023).

3. PURPOSE

The primary objective of this research is to conduct a comparative analysis of five countries, which are France, UK, Germany, China and the Netherlands. These countries were selected for the study as they have shown promising development in incorporating sustainability into their financial systems. The study investigates and assesses the green financial models of these countries considering various attributes such as institutional structure, regulatory actions and financial sourcing to promote sustainability. The implementation of various green financial systems in these countries helps us to recommend India suggestions which could improve our green financial model.

4. METHODOLOGY

This research uses a comparative analysis methodology and focuses on the following five nations: France, the United Kingdom, Germany, China and the Netherlands to study their green finance models. These nations were chosen as they

were ranked at top in the rankings published by IFF Global Finance and Development Report The study mostly uses secondary data that was gathered from numerous reliable sources. Case studies, government publications, scholarly articles, and reports from international organizations are a few examples. Some of the key attributes evaluated include:

Public Participation: Evaluation of the level of involvement of local governments, communities, and citizens in green financing initiatives.

Funding Sources: An analysis of the several financial tools that encourage investments in sustainable projects, including green bonds, subsidies, and public-private partnerships.

Regulatory Frameworks: Examining the laws, rules, and institutional directives that promote green finance, such as those pertaining to sustainability reporting requirements and renewable energy.

Policies: Research on national initiatives to support green finance, including climate action plans and incentives for investments in renewable energy.

5. FINDINGS

FRANCE

France has solidified its position as a global leader in green finance by utilizing all-encompassing frameworks backed by progressive laws, creative financing methods, and cooperative public-private projects. France is a prime example of how countries may intentionally incorporate sustainability into their financial systems, as seen by its steady ranking in the top five of the Global Green Finance Index (GGFI) for its green finance policies and ecosystem (Zeng & Huang, 2022).

Green Bonds

France became the biggest sovereign issuer in the world when it first offered €7 billion in green bonds in January 2017. By 2024, France will have issued almost €40 billion in green bonds to fund projects ranging from renewable energy to biodiversity conservation and pollution control (French Treasury, 2023). For instance, the funds raised from these bonds have been used to fund the expansion of the high-speed rail network and energy-efficient building modifications in public areas. France is as a global leader in issuing sovereign green bonds as a result it has shown impressive performance, attracting investors that place a high value on sustainability and transparency in the distribution of funds (Sustainable Investment Forum, 2022).

Legislation

Transformative policies that put environmental sustainability first have strengthened France's position as a pioneer in green finance. The Energy Transition for Green Growth Law (2015) intends to attain 32% renewable energy in its energy

mix by 2030 and requires to wane GHG emissions to 40% by 2030 compared to 1990 levels (European Commission, 2022). In a similar vein, the Energy and Climate Law (2019) calls for actions to attain carbon neutrality by 2050 and phase out coal by 2022 (French Ministry for the Ecological Transition, 2022). These legislative actions lay the legal groundwork for green financing projects while establishing a clear decarbonization path. They demonstrate the government's steadfast dedication to integrating sustainability into France's economic strategies.

Funding Mechanisms

Innovative financing schemes like the French Climate Transition Fund guarantee focused investments in initiatives that support the country's climate objectives. For instance, this fund set aside €500 million in 2023 alone for promoting growth of renewable energy sources and energy-efficient infrastructure (French Treasury, 2023). Additionally, by overseeing regional climate funding, towns play a crucial role. The Green Fund Initiative in Paris demonstrated the efficacy of decentralized funding mechanisms in attaining measurable sustainability objectives in 2022 by allocating €40 million to urban greening projects and pollution reduction programs (City of Paris, 2022). Public Participation

A key component of France's green finance ecosystem is public engagement. In 2023, more than 2 million people took part in local sustainability programs, including cooperatives for renewable energy and urban reforestation (French Ministry for Ecological Transition, 2023). Additionally, France's tax incentive programs have achieved a high level of uptake; in 2022, the MaPrimeRénov scheme provided tax credits for energy-efficient home repairs to nearly 150,000 households (French Tax Administration, 2022). The effectiveness of France's inclusive approach to green finance, which fosters a culture of shared responsibility and active engagement in climate action, is demonstrated by the broad public involvement.

Incentives

France offers a variety of tax breaks and subsidies to encourage investment in green technologies. MaPrimeRénov, funded with €2 billion per year, facilitates the transition to energy-efficient technologies for houses (French Ministry of Energy, 2022). Similarly, companies that invest in renewable energy technologies gain access to low-interest loans and corporate tax incentives (French Ministry for Ecological Transition, 2022). The French Green Finance Label, which has been established to certify green financial products, has accredited over €30 billion in green funds. This ensures that investments made in green projects are transparent and accountable (Sustainable Investment Forum, 2022).

THE UNITED KINGDOM

The UK is a global leader in the transition to a low-carbon, sustainable economy. Part of that position has come from a

robust regulatory framework, focused policies, and cutting-edge financial tools aimed at raising cash for green initiatives. Here is a comprehensive study of the green finance ecosystem in the UK, supplemented by statistical data, concrete examples, and institutional frameworks.

Green Bonds

Green bonds are central to the UK's strategy for financing environmentally sustainable projects. The UK issued its first sovereign green bond in 2021, valued at £10 billion. The UK is committed to achieve net-zero emissions by 2050 (UK Debt Management Office, 2021).

The bond garnered substantial interest from both domestic and international investors, being oversubscribed upon launch, which reflects high confidence in sustainable financial instruments. As the global green bond market surpassed $1 trillion in 2022, this trend highlights the increasing focus on climate action and sustainable development (Climate Bonds Initiative, 2022)

Institutional Support and Strategic Initiatives

The UK's green finance ecosystem thrives on institutional backing, such as the Green Finance Taskforce, established in 2017 to bolster the country's leadership in sustainable finance. Its objectives include enhancing transparency, defining sustainable investment taxonomies, and integrating climate risks into financial decisions. Notably, the taskforce contributed to the Task Force on Climate-related Financial Disclosures (TCFD), which standardizes climate risk reporting, improving investor decision-making and market stability.

By 2023, over 2,000 organizations worldwide supported the TCFD's recommendations (TCFD, 2023).

The City of London's Green Finance Initiative has further cemented London's role as a green finance hub, fostering innovative green financial solutions. The Green Finance Institute (GFI), established in 2019, has driven investments into green projects, financing over £2 billion in 2022 alone (Green Finance Institute, 2022).

Policy Framework

The UK's Climate Change Act (2008) forms the backbone of its legislative approach to climate action, mandating legally binding carbon budgets and aiming to reduce emissions by at least 68% by 2030, with a net-zero goal by 2050 (UK Government, 2023). Complementing this, Green Industrial Revolution's Ten-Point Plan, announced in 2020, commits £12 billion to green initiatives such as offshore wind, electric vehicles, and hydrogen energy production.

The UK is planning to develop offshore wind with capacity of 40 GW by 2030, reinforcing its leadership in renewable energy (Department for Business, Energy & Industrial Strategy, 2021).

Public Participation and Green Financing Programs Public involvement has been a cornerstone of the UK's green finance success, driven by schemes like Green Home Finance, which offers grants and loans for energy-efficient upgrades. The Green Homes Grant allocated £1.5 billion in 2021 to enhance energy efficiency in 600,000 homes, setting a foundation for future partnerships in residential energy improvements (UK Government, 2021).

The Energy Company Obligation (ECO), launched in 2013, requires energy providers to fund energy efficiency upgrades, particularly for vulnerable households. By 2022, over 2.5 million energy-saving measures were installed under this program (Ofgem, 2022).

Quantitative Impact and Future Outlook

The UK's green finance initiatives have led to an 80% rise in capacity of renewable energy between 2012 and 2022, largely due to offshore wind (ONS, 2022). By 2023, the low-carbon economy employed nearly 250,000 people, illustrating the sector's economic benefits (Low Carbon Contracts Company, 2023).

As the government pushes towards its 2050 net-zero target, innovation and investment in clean technologies will be essential. Financial firms are expected to adopt more ESG-focused policies, and public financing programs are anticipated to grow, ensuring green finance becomes more inclusive and accessible.

GERMANY

Germany is regarded worldwide as a role model for sustainability, marked by groundbreaking legislation, renewable energy investments, and a mindful application of green financing. The country has emerged as a leading nation in the shift toward a low-carbon economy through a multi-faceted framework combining law, institutional support, green bonds, and corporate accountability. This review, enriched with quantitative insights, examples, and statistics, outlines the key elements of Germany's green finance ecosystem.

KfW Bank: Public Development Bank Financing for Sustainability Germany's green finance strategy heavily relies on KfW Bank, a government-owned development bank that has significantly financed energy-efficient buildings and renewable energy projects. Established in 1948, KfW aims to support both environmental sustainability and economic development. In 2022, the bank allocated over €45 billion for climate and environmental projects, primarily for energy-efficient building retrofits and renewable energy initiatives like solar and wind power (KfW Bank, 2022). Through its Energy-Efficient Construction and Refurbishment Program, KfW has facilitated financing for thousands of energy-efficient homes and businesses, cutting carbon emissions and conserving energy.

Legislation

The Renewable Energy Sources Act (EEG), which was enacted in 2000, majorly contributes to Germany's renewable energy policy. By giving feed-in tariffs (FiTs) that guarantee payments for electricity generated from renewable sources, the EEG has significantly boosted investments in wind, solar, and biomass energy.

As of 2023, renewables accounted for over 40% of Germany's power consumption, with wind and solar contributing approximately 25% and 8%, respectively (Federal Ministry for Economic Affairs and Energy, 2023). Thanks to the EEG, Germany has become a global leader in renewable energy, with over 65 GW of wind capacity and solar power installed with capacity of 60 GW (International Renewable Energy Agency, 2023).

Green Bonds

Germany issued its first sovereign green bond worth €6.5 billion in 2020, aimed at financing projects in energy efficiency, climate adaptation and sustainable transport (German Finance Agency, 2020). The bond's strong demand underscored Germany's status as a prime sustainable investment destination.

The market has since expanded, with €25 billion in green bonds issued by German businesses in 2021 alone (Deutsche Bank, 2021). These investments align with the EU's Green Deal and its goal to mark net-zero carbon emissions by year 2050.

Corporate Accountability

Germany has been a pioneer in enhancing corporate transparency and responsibility. The Corporate Sustainability Reporting Directive (CSRD), adopted by the EU in 2023, mandates large companies to disclose their sustainability practices, including ESG considerations. The CSRD expands upon the Non-Financial Reporting Directive (NFRD), requiring around 50,000 businesses in the EU to comply by 2026, compared to 11,700 under the NFRD (European Commission, 2022).

Major German companies have already integrated comprehensive sustainability strategies and climate risk management into their operations, enhancing transparency and positioning Germany as a leader in sustainable corporate practices.

Impact and Future Outlook

Germany's sustainability initiatives have delivered impressive environmental and economic results. Between 2010 and 2020, the country reduced greenhouse gas emissions by about 25% under the EU Climate and Energy Framework (Federal Environment Agency, 2021). Renewable energy's share of power consumption rose from 20% in 2010 to over 40% in 2023 (International Energy Agency, 2023).

Economically, the renewable energy sector employed over 350,000 people in 2022, driven by investments in wind, solar, and other green technologies (German Renewable Energy Federation, 2022). Looking ahead, Germany is poised to further its sustainability goals through investments in renewable infrastructure and financial tools like green securitization and climate risk insurance. The evolving EU Taxonomy for Sustainable Activities will help align Germany's policies with global sustainability standards.

CHINA

China is now leading international efforts to move to a low-carbon economy. Balancing environmental sustainability with rapid economic growth, the country has crafted a green financing model fit for the future. This approach relies on a strong legislative framework, green financial products like bonds, and a range of initiatives to encourage sustainable investment. Below, key aspects of China's green finance ecosystem are outlined, supported by examples, data, and quantitative insights.

Green Bonds

Green bonds are a cornerstone of China's green finance strategy. Since issuing its first green bond in 2016, China has grown into one of the largest green bond markets globally. As of 2023, the market value of Chinese green bonds surpassed $380 billion, making it the second largest after the United States (Climate Bonds Initiative, 2023). These bonds fund projects in pollution reduction, energy efficiency, and renewable energy development, all aligned with China's sustainability goals.

The People's Bank of China (PBoC) has played a key role by introducing a green bond catalog, which helps prioritize projects with significant environmental impacts. By 2022, nearly 70% of green bond issuances supported renewable energy and energy efficiency initiatives, advancing China's ambition to attain carbon neutrality by 2060 (People's Bank of China, 2022). This robust green bond market has attracted both domestic and international investors, integrating China further into the global sustainable finance network.

Policy Instruments

China's commitment to green finance is underpinned by policies such as the Green Credit Policy and the Green Finance Action Plan (2016). The Green Finance Action Plan, introduced by the State Council, provides a roadmap for integrating environmental considerations into the financial sector. It aims to channel capital into eco-friendly projects and strengthen the green finance ecosystem.

The Green Credit Policy, implemented by the PBoC and the CBIRC, incentivizes banks to offer preferential terms to projects meeting environmental standards. By 2021, over 30% of Chinese banks had adopted green lending policies, directing significant funds toward renewable energy and eco-

friendly industries (China Banking and Insurance Regulatory Commission, 2021).

As a result, China's investments in renewable energy grew at an annual rate of 10% from 2015 to 2021, with solar and wind energy making substantial contributions (National Energy Administration, 2022).

Incentives for Emission Reductions

The Environmental Protection Tax Law, enacted in 2018, has been instrumental in encouraging businesses to adopt cleaner practices. The tax imposes fees based on the quantity of pollutants emitted into the air and water, incentivizing companies to reduce emissions by adopting greener technologies.

Between 2012 and 2022, CO2 emissions per GDP unit in China dropped by nearly 30% (Ministry of Ecology and Environment, 2022). This reduction is a testament to the effectiveness of policies like the environmental protection tax in fostering sustainable practices.

The Belt and Road Initiative (BRI)

China's Belt and Road Initiative (BRI) which was launched in 2013 integrates green finance principles into its infrastructure projects worldwide. The Green Development Guidelines for the BRI, introduced in 2021, emphasize environmental conservation and sustainable development.

Under these guidelines, projects funded by the BRI prioritize eco-friendly infrastructure and renewable energy. For instance, China has financed solar power installations and wind farms in countries such as Indonesia, Kenya, and Pakistan. By 2022, over 25% of China's overseas infrastructure investments incorporated sustainable energy solutions (China International Development Cooperation Agency, 2022).

Quantitative Impact and Future Outlook

China's green finance initiatives have propelled its renewable energy sector to global prominence. By 2023, China accounted for over 400 GW of installed solar capacity, nearly 40% of the global total, and wind power capacity surpassed 350 GW (International Energy Agency, 2023). The green finance market attracted over $1 trillion in investments between 2015 and 2022, underscoring China's dedication to sustainable development (Climate Bonds Initiative, 2022). Looking ahead, China is expected to refine its green finance regulations, enhance transparency, and develop innovative financial products to meet its carbon neutrality goal by 2060. With a robust regulatory framework and continuous technological advancements, China is well-positioned to lead global green finance efforts.

6. THE NETHERLANDS

The Netherlands is recognized globally as a leader in embedding sustainability into its financial, regulatory, and economic frameworks. With robust legislation, innovative financial instruments, and strategic public-private partnerships, the nation has demonstrated its commitment to addressing climate challenges. This integrated approach has significantly advanced green finance and sustainable economic growth in the Netherlands. Below is an analysis of the core components of the country's green finance strategy, supported by data, real-world examples, and key metrics.

Climate Agreement

The Netherlands' climate agenda is anchored in the Climate Agreement, signed in 2019. Specifically, it aims for a 49% reduction in GHG by 2030 (relative to 1990 levels), with a longer-term target of achieving carbon neutrality by 2050 (Dutch Ministry of Economic Affairs and Climate Policy, 2019).

The agreement outlines sector-specific strategies, including investments in renewable energy, improved energy efficiency, and phasing out coal-fired power plants. As part of this commitment, the Netherlands plans to close all coal power plants by 2030. Offshore wind energy has been a key area of focus, with the nation achieving 2.5 GW of installed capacity by 2023, establishing itself as a global leader in this sector (International Energy Agency, 2023).

Green Bonds

Green bonds have become an essential tool for the Netherlands to finance sustainable development projects. Since 2019, the Dutch government has issued green bonds to support climate mitigation and adaptation efforts, including renewable energy, energy efficiency, and sustainable infrastructure. By 2023, the Netherlands had raised over €20 billion through green bond issuances, underscoring its prominence in the global sustainable finance market (Dutch Ministry of Finance, 2023).

Sustainable Finance Strategy

The Netherlands' Sustainable Finance Strategy, introduced in 2019, promotes transparency and drives green investments in the financial sector. One of its key measures is the adoption of the EU Taxonomy for Sustainable Activities, which helps investors identify environmentally sustainable investments. This framework ensures financial institutions disclose their climate risk exposures and follow clear guidelines when financing green projects, fostering trust and encouraging investment. Additionally, the Dutch Green Investment Label, introduced under this strategy, categorizes financial products and funds based on their sustainability credentials. By 2022, the Dutch sustainable investment market managed assets exceeding €250 billion (Dutch Central Bank, 2022).

Public-Private Cooperation

Public-private collaboration is a cornerstone of the Netherlands' green finance agenda.

Initiatives like the Green Finance Platform, established in 2015, foster cooperation between government agencies, financial institutions, and other stakeholders to accelerate the transition to a sustainable economy.

Activities include creating tools to integrate sustainability into financial practices, providing support for green projects, and hosting workshops. A notable example is the Haringvliet Wind Farm, completed in 2021, which added over 300 MW of capacity to the offshore wind sector through joint public and private funding.

The platform's success has inspired further collaborations, creating a robust network that amplifies the impact of green finance initiatives. These partnerships have solidified the Netherlands' reputation as a leader in aligning sustainability with economic growth.

Quantitative Impact and Future Outlook

The Netherlands' investments in renewable energy have significantly reduced its carbon footprint. In 2023, over 40% of the nation's electricity consumption came from renewable sources, up from just 20% in 2010 (International Energy Agency, 2023).

In the financial sector, green bonds and sustainable products accounted for more than 15% of the overall bond market by 2023, reflecting a growing emphasis on sustainable finance (Dutch Ministry of Finance, 2023). Enhanced transparency through the Sustainable Finance Strategy has further bolstered the Netherlands' appeal to environmentally conscious investors.

Looking ahead, the Netherlands aims to scale up offshore wind projects, enhance energy efficiency, and integrate sustainability deeper into financial portfolios. With a strong track record in public-private collaboration and a firm commitment to its climate goals, the Netherlands is well-positioned to remain a global leader in green finance and sustainability.

7. COMPARATIVE TABLES

The table below illustrates comparison of rankings, CO2 Emission and Green bonds. This brings forth the inferior position of India compared to other top nations.

TABLE 1: Comparison of Rankings in various index

Country	Rankings (GGFDI Report)	SDG Index Score Rankings	Green Central Banking Scorecard Ranking 2024	Total CO2 Emissions 2022 (Metric Tons)	Green Bonds Issued 2023 (in dollars)
France	1	5	1	315	10.7
UK	2	9	7	341	22.6
Germany	3	4	2	674	68
China	4	68	6	12,667	80
Netherlands	5	24	NA	135	4.98
India	31	109	10	2,693	3.6

TABLE 2: Green Finance model attributes comparison

Country	Public Participation	Certification	Legal Framework
France	Active municipal and climate funds	French Green Finance Label	Energy Transition for Green Growth Law
UK	Retail investment in green products	Green bond Principles	Climate Change Act, Green Finance Strategy
Germany	Local initiatives	Climate Bonds Initiative (CBI)	Renewable Energy Sources Act (EEG)
China	Increasing public awareness	Green Bond Endorsed Projects Catalogue	Green Finance Guidelines (2016)
Netherlands	Community engagement	Dutch Green Finance Framework	Climate Agreement, Green Deal
India	-	SEBI Green Bond Framework	National Policy on Biofuels, draft Energy Conservation Bill

8. ORIGINALITY

This paper uniquely identifies the strategies, fundings, regulatory frameworks of five prominent nations: France, the UK, Germany, China and the Netherlands. The study identifies best practices that can be adapted for India and provides valuable insights to policymakers to enhance green financing efforts.

9. RESEARCH LIMITATIONS

This study's analysis focuses on the top five nations as ranked by the IFF Global Finance and Development Report. Notably, four of these countries are EU members, indicating a regional focus in the analysis. While this provides valuable insights into a region advanced in integrating sustainable financing into its economic systems, the emphasis on EU nations may not capture the full spectrum of global approaches to green finance. As a result, the study's conclusions are more reflective of methods common within the EU framework and may not be readily applicable to regions with differing environmental, legal, and economic conditions.

The study's focus on these high-ranking nations limits the ability to generalize findings about green finance practices in developing or emerging markets. For instance, countries in Asia, Africa, and Latin America often encounter unique opportunities and challenges when implementing green financing models, differing significantly from the EU. Variations in economic development levels, regulatory environments, capital availability, and national climate policies all shape the effectiveness of sustainable finance solutions. To provide a more comprehensive understanding, future research should broaden its scope to include a diverse set of countries.

Additionally, by concentrating solely on the top five nations, innovative and impactful green finance efforts in lower-ranked countries may be overlooked. Such nations could offer unique perspectives or serve as case studies for alternative approaches to sustainable finance.

Expanding future research to include data and examples from a wider range of countries would improve our understanding of how diverse economic and regulatory contexts influence the development and success of green finance initiatives.

10. IMPLICATIONS

The results highlight India's position in green financial markets compared to other nations. By adopting successful practices from other countries, India could enhance investment in sustainable projects and boost public participation in green initiatives. Stringent rules, policies, and regulatory frameworks from other regions could also be adapted to the Indian context.

Recommendations for India

India's commitment to sustainability is evident in programs like the National Action Plan on Climate Change (NAPCC) and its goal to attain net-zero emissions by 2070. Strengthening laws and regulations to support green finance is essential to meeting these objectives. This document outlines recommendations emphasizing comprehensive legislation, tax incentives, and institutional development to encourage investments in renewable energy and energy-efficient technologies.

India should implement a robust legislative framework, such as a Green Finance Act, to attract investments in sustainable projects. The act's definition of green finance should align with global standards like the EU Taxonomy for Sustainable Activities and encompass areas such as sustainable agriculture, energy efficiency, and pollution control.

To monitor compliance and evaluate the impact of green investments, India should establish a centralized regulatory agency or enhance existing institutions. Clear guidelines for issuing and trading green bonds can build investor confidence. With India's green bond market valued at over ₹30,000 crore in 2022 (RBI, 2022), such improvements could enhance market liquidity and attract significant capital.

Sector-specific policies should be introduced to incentivize investment in solar and wind energy, as well as electric vehicles, modelled on Germany's Renewable Energy Sources Act. Similarly, France's Energy Transition for Green Growth Act offers a blueprint for channelling investments into sustainable projects, which India could adapt to its unique economic and environmental needs.

Strengthening institutional support is equally crucial. India should promote Public-Private Partnerships (PPPs) and consider establishing a Green Investment Bank (GIB). The UK Green Investment Bank, which raised over £12 billion for sustainable projects before its closure in 2017, illustrates how such an entity could channel funds into large-scale renewable energy and energy-efficient infrastructure projects in India.

Building on IREDA's efforts, India should expand its green bond issuance, aiming for levels comparable to the €20 billion set by the European Investment Bank in 2021. Financial incentives like tax breaks and subsidies, as seen in successful programs in leading green finance countries, should be offered to boost investments in renewable energy projects.

Increasing public engagement is vital to the success of green initiatives. National educational campaigns, modelled after the UN's Climate Action Campaign, can raise awareness about sustainability, green finance, and climate change. Workshops and social media outreach can disseminate

information, while community sessions at schools and universities should promote green practices like carbon reduction and the adoption of solar panels. Collaborating with NGOs to reach rural and underserved areas would further expand these efforts. A similar initiative in India could emulate the success of the UK's Green Schools Program, which has effectively educated students on sustainability.

11. CONCLUSION

The comparative study of green financing models from top countries like France, the United Kingdom, Germany, China and the Netherlands highlights the significance of customized approaches in accomplishing sustainable development objectives. These countries have pursued a range of strategies, including establishing green investment banks, issuing green bonds, enacting stringent transparency laws, and promoting public-private partnerships. Each model offers valuable insights that can be adapted to strengthen India's green financing framework, enabling it to take a more active role in sustainable economic growth and global climate action.

For example, France's widespread issuance of green bonds demonstrates the effective use of public financial instruments to fund sustainable infrastructure and renewable energy projects.

Similarly, the UK has shown how institutional support and strategic legislation can foster green investments, as seen with the establishment of the Green Investment Bank and its commitment to the Climate Change Act (2008). Germany's strategy, which includes the EEG Act and the KfW Development Bank, highlights the value of government-backed initiatives that attract capital through targeted subsidies and incentives. China's rapid growth of green bonds and its Green Finance Action Plan (2016) showcase the potential of government-led regulations to steer the financial system toward sustainability. The Netherlands' Green Finance Platform demonstrates how collaboration between public and private sectors can enhance transparency, encourage knowledge sharing, and boost investment in sustainable initiatives.

The lessons from these countries provide India with a roadmap for developing a comprehensive green finance strategy. Establishing a dedicated Green Investment Bank and expanding the issuance of green bonds could channel significant resources into sustainable projects, increasing renewable energy access and accelerating India's climate action goals. Adopting transparency frameworks similar to the TCFD and CSRD would enhance investor trust, strengthen corporate accountability, and ensure adequate communication of climate-

related risks and opportunities. Public-private partnerships can play a vital role in pooling resources, sharing expertise,

and jointly funding large-scale projects. Engaging citizens through initiatives like local climate funding and educational campaigns can foster a sense of ownership and support for environmental goals.

By adopting these strategies, India could not only align with global sustainability standards but also enhance its position as a key player in the global green finance landscape.

Addressing regional challenges like capital availability, regulatory barriers, and public awareness would enable India to create a robust green finance ecosystem that drives economic growth while tackling climate change. This comprehensive approach would allow India to make a substantial impact on the global climate agenda, and position itself as a global leader in green financing and sustainable development.

REFERENCES

[1.] Baker, T., & O'Neill, K. (2022). *Climate finance for sustainable development: Aligning investments with climate goals*. UNDP.

[2.] Climate Bonds Initiative. (2022). *The state of the green bond market in 2022*. Climate Bonds Initiative.

[3.] Desai, A. (2023). *EU's Sustainable Finance Disclosure Regulation and its global impact*. Journal of Environmental Economics.

[4.] European Commission. (2022). *Energy and climate laws in France: A pathway to carbon neutrality*. European Commission.

[5.] Federal Ministry for Economic Affairs and Energy. (2023). *Germany's renewable energy policy*. Federal Ministry for Economic Affairs and Energy.

[6.] French Ministry for the Ecological Transition. (2022). *Progress report on the Energy Transition for Green Growth Law*. French Ministry for the Ecological Transition.

[7.] French Treasury. (2023). *Annual report on green bond issuances in France*. French Treasury.

[8.] Global Carbon Atlas. (2023). *Annual global emissions report*. Global Carbon Atlas.

[9.] Green Finance Institute. (2021). *Scaling up green finance in the UK: Annual report*. Green Finance Institute.

[10.] Gupta, R., & Singh, A. (2022). *The Netherlands' offshore wind success story. Renewable Energy Studies Quarterly*.

[11.] IFF Global Finance and Development Report. (2021). *Green finance rankings and global trends*. International Finance Forum.

[12.] International Energy Agency. (2023). *Renewable energy statistics 2023*. International Energy Agency.

[13.] KfW Bank. (2022). *Climate protection and green finance: Annual highlights*. KfW Group.

[14.] Kumar, S., & Joshi, P. (2022). *Grassroots programs and green finance in India: Case studies and lessons. Sustainable Development Journal*.

[15.] Mehta, P., & Patel, S. (2023). *Germany's Renewable Energy Sources Act (EEG) and its economic impact. Energy Economics Review*.

[16.] National Energy Administration. (2022). *China's renewable energy capacity expansion: 2022 report*. National Energy Administration of China.

[17.] OECD. (2022). *Green finance and sustainable infrastructure:*

Mobilizing resources for climate goals. OECD Publishing.

[18.] Patel, R., & Sharma, V. (2022). *India's progress in solar energy and green finance policies*. Indian Journal of Renewable Energy.

[19.] People's Bank of China. (2022). *Green bond market development in China*. People's Bank of China.

[20.] Reserve Bank of India. (2022). *The state of green bonds in India*. Reserve Bank of India.

[21.] Sharma, R. (2022). *Legislative challenges in promoting green finance in India*. Economic and Political Weekly.

[22.] Sustainable Investment Forum. (2022). *France's approach to sovereign green bonds: A case study*. Sustainable Investment Forum.

[23.] UK Debt Management Office. (2021). *Sovereign green bond issuance in the UK: A milestone*. UK Debt Management Office.

[24.] UNEP Finance Initiative. (2021). *Guidelines on sustainable finance for emerging markets*. UNEP FI.

[25.] Verma, A. (2022). *Challenges in adopting sustainable finance disclosures in India*. Journal of Corporate Sustainability.

[26.] Zeng, L., & Huang, J. (2022). *France's green finance leadership in global rankings*. International Finance Review.

[27.] Zhang, L., Li, W., & Wang, Y. (2022). *Green finance innovations in China: Policy impact analysis*. Journal of Asian Development.

Green Financing in India: Insights from NIFTY 100's top 5 Companies and their Role in Financial and Sustainable Growth

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ABSTRACT

The primary objective of this research paper is to explore the role of green financing in India's sustainable growth and what new financial instruments and policies can we implement to boost green funding across various sectors. With India aiming to achieve net zero carbon emission by 2070, this study highlights the crucial need for financial inflow into green industries and green project and to meet that financial inflow, India needs heavy funding from public as well as private sectors.

Understanding current trends, this study examines the implementation green financial tools like green bonds and sustainability linked loans to assess their impact on growth, profit, and sustainability.

There is a need for mutual funds houses in India to incorporate green investment products or introduce new Green mutual fund scheme as investment through mutual fund is becoming very attractive and, in this year, mutual fund investments have reached new heights, there is an opportunity to direct these funds into green sustainable projects for long term advantage and environmental resilience.

This research paper relies on secondary data and case studies of 5 top performing companies from NIFTY 100(Tata power, NTPC, Reliance Industries, HDFC Bank, and JSW steel), that have adopted green financing tools. These top performing companies serve as benchmark to evaluate effectiveness of green financing instruments such as green bonds and sustainability linked loans.

It also relies on qualitative as well as quantitative data such as annual reports, ESG ratings, stock market performance and other financial documents. A forward-looking projection based on emerging financial instruments are also discussed.

Keywords: Green Financing, Sustainable Growth, Net Zero Carbon Emission, Green Bonds, Sustainability Linked Loans, Green Mutual Funds, Financial Instruments, ESG Ratings, Public-Private Sector Funding, Environmental Resilience, NIFTY 100 Companies, India's Sustainable Development.

1. INTRODUCTION

The world is facing many environmental challenges and transition to sustainable/low carbon economy has become a priority. Achieving this transformation requires huge amount of financial resources. And green financing has emerged as a key solution by investing into environmentally friendly projects, green financing, not only fosters long-term economic growth, but also helps to combat climate change. Green financing refers to strategic allocation of points to promote environmental sustainability. This includes funding renewable energy projects that medicate the impact of climate change in the environment.

Green Bonds, according to (Meenakshi 2018) are fixed income, financial assets that aid in the formulation and execution of climate change and environmental measures. It also stressed that the issue of wants use this instrument to raise money to support green initiatives; in exchange, shareholders receiver, definite amount of revenue as an interest, and the initial sum is returned at maturity. (Keerat B. 2022)

An ESG bond is a debt security that funds an environmental, social, or governance goal. As with any debt security, the issuer of an ESG bond is a borrower, while the investor or bondholder is the lender. The issuer pays the bondholder interest at specified intervals, and the rate is often fixed. When the bond matures, the issuer repays the principal, and bondholders get their money back (the Motley Fool 2024). ESG ratings, according to (The montley Fool 2024) measures a company's exposure to long-term environmental, social, and governance risks. These risks -- involving issues such as energy efficiency, worker safety, and board independence -- have financial implications. But they are often not highlighted during traditional financial reviews. Investors who use ESG ratings to supplement financial analysis can gain a broader view of a company's long-term potential. A good ESG rating means a company is managing its environment, social, and governance risks well relative to its peers. A poor ESG rating is the opposite -- the company has relatively higher unmanaged exposure to ESG risks.

Along with ESG reporting, ESG ratings help investors understand a company's priorities and the long-term risks it

could face in the future. (AAA being the highest rating and CCC being the lowest rating)

Green financing emerged globally in early 2000's as a response to growing climate challenges. However, in India, the introduction of SEBI regulated green bonds in 2015, marked a milestone. In 2015, Yes Bank issued around US$250 million for renewable energy projects (Climate home news 2015). As of 2024, India's Green market has crossed US$25 billion showing investors interest in sustainable projects.

For developing countries like India, green financing is not just a financial mechanism, but a necessity with increasing urbanization and industrialization the demand for energy surged. And meeting this demand, sustainable requires you amount of investment in green projects. India's pledge to achieve net zero carbon emission by 2070, underline the requirement of green financing practices. Green bonds are a type of ESG bond that is used for eco-friendly projects such as renewable energy and sustainable development projects. Nifty 100 companies i.e. Tata power, NTPC, Reliance industries, HDFC Bank, and JSW steel represent India's largest and most attractive Corporation for investors. These companies set benchmarks for industry standards and attract investors attention by analyzing their use of green financing instruments, we can gain inside into how green practices can be mainstreamed in India's corporate sector. The specific benchmarking provides crucial insights about how green financing adopted companies shows significant improvements in long term sustainability, return on investment/return on equity.

Green financing not only enhances overall financial performance but also yield competitive advantage over competitors and sustainable development. Promoting adoption of green financing in India could assist the nation in its net zero carbon emission target and encourage a more sustainable framework.

2. LITERATURE REVIEW

The concept of green financing unfolds as the critical tool in sustainable development-the mitigation of climate change, innovative developments in renewable energy sources, and more environmentally sustainable economic growth. Using the latest insights from literature which outline the shifting landscape in green financing in India with several critical instruments, challenges, opportunities, and the impact of influential corporates form the essence of this review. Theoretical framework and policy context. This is underscored under the Paris Agreement in its Nationally Determined Contributions, which emphasize more in renewable energy, better efficiency for energy, and low-carbon economic growth. According to Bhurjee (2022), green bonds have always been regarded as the prime mechanism for green financing and for directing mobilization of financial means into sustainable ventures.

Despite the potential, issues like high costs and lack of standardization are still there, and a strong regulatory framework is required (Kundalia, 2023). SEBI initiatives that have brought in transparency and governance in the green bond market have significantly improved investor confidence (Nagaraju, 2021).

Financial institutions, specifically banks, play a crucial role in developing green finance in India. Studies by Kaur (2022) and Vakil (2024) indicate that there is a need for banks to focus on green lending techniques to make projects environmentally friendly. However, the lack of proper risk assessment frameworks for green financing hampers their effectiveness. Besides, integration of green finance into the mainstream banking system is necessary to achieve the broader goals of financial inclusion and sustainability (Mittal, 2023).

The major contributors to the green financing initiatives are the corporate entities, specifically the large-cap companies in the Nifty 100. Studies report that a firm with strong ESG practices performs better in financial terms and contributes more significantly towards sustainable development (Sharma, 2020; Thaker, 2019). An example is Tata Power, which has shown robust financial health along with commitment towards renewable energy sources. It has set the benchmark for other corporations (Verma, 2023).

Green bonds and ESG investments are among the most crucial instruments mobilizing green finance. These instruments not only direct funds into sustainable projects but also strengthen corporate accountability and innovation. Studies by Shi (2024) and Huang (2023) demonstrate the influence of green bonds on efficiency and economic growth, particularly in sectors with high pollution. Likewise, ESG-focused investment has fostered innovation and strengthened governance in several sectors. The enablers of green finance are blockchain and artificial intelligence, which have emerged in connection with digital technologies, and those involve issues about transparency and efficiency (Singh, 2022). Digital finance platforms may bridge gaps in funding and enhance the availability of green financial products, but adopting these requires robust regulatory governance (Adebayo, 2024).

Despite the progress, significant barriers limit the widespread use of green finance in India. High capital costs, inconsistent policy regimes, and a lack of investor awareness are some of the long-standing challenges that emerge in the literature (Ahmar, 2024; Bhatti, 2023). The issue of greenwashing, where activities are misrepresented as environmentally friendly, further lowers confidence and investment in this space (Das, 2023). Additionally, the lack of a clear taxonomy to define and categorize green finance creates uncertainty for different stakeholders (Fu, 2023). But there are opportunities as well, the Growth in India's green finance sector holds massive potential for renewable energy, urban development, and circular economy. Studies have indicated that the

development of public-private partnerships and tapping into international funding mechanisms can unlock such growth. Sharma (2022), and Soundarrajan (2016) have argued so. Clear policies with incentives towards green investments will accelerate the transition toward a low-carbon economy (Chan, 2023). The emerging trends, such as green finance, which can facilitate small and medium enterprises in tandem with green startups, indicate the transformative potential of this sector (Mishra, 2023; Bhatnagar, 2022). The alignment of financial resources with sustainable development goals can enable India to pursue both environmental resilience and economic stability. Conclusion. The existing literature corpus throws light on multiple roles of green financing in meeting the sustainable development goals of India. Although the challenges continue to prevail, policy support converging, technological progress, and corporate accountability offer a robust platform for growth of green finance activities. This can be seen through the revolution green financing holds in the sustainability journey of India, based on the lessons learnt from Nifty 100 companies and their contributions to financial and sustainable growth.

3. METHODOLOGY

This study applies a mixed-method framework that will explore the contribution of the top five firms of Nifty 100 toward green finance and impacts their financial performance and sustainable development in India. This approach, with the help of qualitative and quantitative techniques, makes use of several data sources like annual reports, ESG disclosures, news publications, and regulatory documents, thereby providing a multi-dimensional view of the green finance strategies and sustainability practices by these firms. The choice of companies is based upon market capitalization and their proactive leadership roles in green finance and sustainable operations. These organizations were found to be important actors of the Indian financial space due to their impact potential for massive sustainability programs. By spotlighting these prominent players, this research aims to bring best practices, challenges, and opportunities into relief so that other institutions will take it as a standard practice.

The annual reports issued by the selected companies are crucial sources of data, providing a comprehensive overview of their results and green financing-related information relevant to the company's goals. A review of these reports returns information on capital allocation towards environmentally friendly practices, green bonds, and other forms of green investments. Additionally, the study analyzes some financial performance indicators to reveal the connection between green financing activity and general financial performance.

ESG reports are essential pieces of information aggregated to assess the sustainability efforts by companies. These reports result in measurable and qualifiable statistics about the key indicators like carbon emission reduction, consumption of renewable energy, solid waste management systems, and

social intervention measures. In addition, ESG metrics highlight the levels at which such companies adhere to international sustainability norms and relevance in upholding India's commitments with the Paris Accord.

News articles enhance the analytical framework by documenting current events, including emerging green finance initiatives, collaborative partnerships, and reactions to regulatory modifications. Additionally, media coverage offers contextual insights regarding public and investor views on the sustainability endeavors of various companies. This contemporaneous perspective facilitates the identification of trends and deficiencies in the execution of green financing strategies.

The research applies content analysis in detecting and explaining common themes and trends from these sources of data. For example, it explores the way firms integrate green finance into their operational structures, the implementation of renewable energy, and how the firms correspond with the United Nations Sustainable Development Goals. The quantitative data found in the reports and disclosure are analyzed to measure the scale and impact of their activities. A comparative analysis was done to assess the companies' performance against global best practices and industry benchmarks. Performance was evaluated on the basis of outcome of their green financing programs regarding financial stability, reputation in the marketplace, and sustainability impact. This study found common success strategies among the firms as well as the areas where they need improvement. The research does recognize possible limitations, such as proprietary access to company data being limited and self-reported ESG and sustainability disclosures having inherent biases. To minimize these issues, the study triangulates findings from different sources and cross-verifies the data wherever feasible. Ethical considerations in the analysis would involve objectivity in the data and making the data transparent in interpretation and reporting.

This methodology enables a holistic analysis of the manner, in which green financing practices by leading Nifty 100 corporations contribute to financial and sustainable development in India. With the inclusion of data sourced from annual reports, ESG disclosures, news articles, and regulatory documents, the study provides a nuanced view of the opportunities and obstacles available in India's green finance environment.

4. FINDINGS

This section explores how green financing has impacted five key companies from NIFTY 100 index, Tata power, NTPC, Reliance industries, HDFC bank and JSW steel. These organizations represent diverse sectors of Indian economy and have been at the forefront of adopting sustainable strategies. The analysis focuses on their use of green financing tools like green bonds, sustainability linked loans,

and environmentally friendly investment initiatives to align their sustainability goals.

Through this analysis, the research highlights variations in how green financing has influenced these companies' growth and sustainability performance. We explore how these companies began using green financing into their operations, along with the changes, observed in their financial performance and growth. By examining key metrics such as ROI (return on investment), ROC (return on capital) and ESG rating (Environmental, Social and Governance). Additionally, the findings compare the pre-and post-adoption scenarios for this company showing the effectiveness of green financing in driving both economic and environmental benefits. By focusing on real-world examples, the findings aim to contribute to a broader conversation about the importance of green financing in shaping the future of corporate India and achieving the country's sustainability goals.

1. Tata Power Co. Ltd

The global energy sector is currently experiencing a dynamic and multifaceted transformation. The spend on the clean-energy transition has hit record highs with total spending surging 17% last year to $ 1.8 trillion. In 2023, the world's demand for electricity grew by 2.2%, slightly less than the 2.4% growth observed in 2022, according to the (International Energy Agency). Tata Power is one of India's most promising players in the energy landscape, with a robust footprint in generation, renewables, transmission, distribution, and cutting-edge energy solutions spanning thermal, hydro, solar, wind, and hybrid sources. They are actively strengthening their generation capacity, amplifying transmission and distribution network, spearheading rooftop solar initiatives, and venturing into energy storage solutions and emerging sectors, positioning them as pioneers in future ready energy ecosystems. Tata power aim to achieve net zero before 2045 through transitioning from thermal assets subject to completion of contractual obligation and useful life, expansion of renewable energy generation portfolio and scientific reduction of carbon intensity. (NSE 2023-24) Tata's renewables cluster consist of solar wind, hybrid assets, manufacturing of solar modules and sales and solar EPC business (more than ₹32,000 crore investment in renewable energy projects). They have integrated six Key ESG priorities into their business which is carbon net zero before 2045, clean and green capacity 70% by 2030, utility benchmark in water and best management by 2030, customer centric businesses, No need loss to biodiversity by 2030 and impact 80 million lives by 2030. (NSE 2023-24). According to (Sustainalytics

2024), Tata power is A rated in ESG rating which shows that Tata power is moving towards leader's category in ESG rating. Tata power renewable energy a subsidiary of Tata power has accepted bids aggregating to ₹7 billion ($83.92 million) for bonds maturing, next five years and ten years, respectively, at a coupon rate of 7.93% (business standard 2024). And according to (Economic times 2022) they have raised US$320 million sustainability loan from Bank of America, loan has a tenure of three years and it will be used to refinance and expand Tata's power generation plants including renewable energy projects. Tata Power's renewed focus on renewable energy and sustainable financing has been positively reflected in its financial performance, most notably in the Return on Equity (ROE) and Return on Capital Employed (ROCE). Before the huge shift to green financing, Tata Power had an ROE of around 12% in the early 2010s. After an extraordinary investment in renewable energy, the company's return on equity (ROE) rose to 18% in 2023. This reflects the efficiency and profitability of its green-friendly energy projects. Tata Power's return on capital employed (ROCE) increased from 8% in 2019 to about 10% in 2023, reflecting the impact of green financing on overall efficiency of capital usage (Tata Power, 2023)

2. NTPC Ltd

NTPC has continuously adopted all the green finance tools for its transition towards renewable energy and sustainable modes of operation. Among such tools, green bonds and foreign currency loans are the most famous ones which helped the organization in its process of sustainability. For example, NTPC has launched various series of green bonds with interest varying from 6.29% to 7.93% and has sizable redemptions due from 2026 through to 2036. They have financed more than 3.6 GW in renewable energy capacity, comprising of solar and wind projects, along with 20 GW in under-development. NTPC, besides the government guarantees of loans extended, offers even such borrowings with very attractive fixed rates in the range of 1.8% to 8.3% both in rupee and foreign currency terms thereby offering cost-effective capital for large-scale infrastructure projects.

Performance-wise, the company has ensured outstanding ratings in credit worthiness on a consistent basis. Therefore, CRISIL AA+/Stable and Moody's Baa3/ Stable are but only examples indicating its financial stability and good standing in international markets also. Such strength has paved the way for NTPC to build its sustainability

performance by being efficient from an operational level. Using the funds accumulated through various green financing mechanisms, efforts have been put into executing projects that ensure NTPC reaches a net carbon zero target of 2070(NTPC 2023).

According to the annual report (NTPC 2023) company has seen consistent growth. Its revenue from operations, ₹1.43 lakh crore as FY24 is primarily based on its success in its renewable energy business lines. Its ROE has climbed from 9% FY20 to 12% in FY24, whereas ROCE has risen from 8.5% to 10.2% over the said period. These statistics point towards two successful achievements of green finance: helping NTPC reach its sustainability objectives while creating shareholder value. Such success in acquiring and applying numerous options for financing will mark the significance of imaginative financial tools in empowering sustainability objectives over the long-term period.

3. *Reliance industries*

Reliance Industries Limited (RIL) has emerged as a green financing instrument leader that will further its aggressive sustainability agenda, including net-zero carbon emissions by 2035. The three-legged strategy is to: (1) capture carbon dioxide as a useful resource, (2) develop low-carbon alternatives, and (3) lead the global clean energy transition. The company has embraced new mechanisms such as green bonds, sustainability-linked loans, and substantial investments in renewable energy projects. Financing tools involved here have been useful to projects such as the Dhirubhai Ambani Green Energy Giga Complex that is to become one of the world's largest integrated renewable energy manufacturing sites. Reliance initiatives in green financing are directed towards a transformation of its energy portfolio, thereby dramatically reducing its carbon emissions with better operational efficiencies. (Reliance industries 2023)

Reliance had issued the largest non-financial bond worth ₹20,000 crore in terms of green bonds. Like the above, such bonds funding large-scale renewable energy programs such as solar and hydrogen energy have funded large-size projects. One of its examples is the Dhirubhai Ambani Green Energy Giga Complex through which it is scaling solar panels up, battery storage systems and green hydrogen production. These have been translated into renewable energy capacity amounting to 6.85 million gigajoules, and these show huge strides toward pursuing decarbonization objectives. (Reliance industries 2023)

Reliance's financials reflect the positive impact of sustainability-focused investments. The company achieved a Revenue of ₹10 lakh crore in FY24, with a 2.6% year-on-year growth, supported by renewable energy projects and efficient utilization of green funds. PAT increased to ₹79,020 crore from the previous fiscal year, which is a hike of 7.3% (Reliance industries 2023). What is important is that Reliance's Renewable Energy Business Return on Equity had improved from 8.5% in FY20 to 10.3% in FY24, therefore, sound investor confidence along with profit gains. According to the annual report, Return on Capital Employed (ROCE) has shown a positive trend with an increase from 10% to 12%, which reflects the efficient usage of capital in support of environmental initiatives. Reliance Industries Limited is one example of how strategic green finance enables sustainable development with gains on the financial side as well. Any corporation in India holds its integration of renewables within its business setup while committed to net zero as a gold standard of corporate sustainability.

4. *HDFC Bank:*

In fact, HDFC Bank has strategically used some of the green financing instruments, such as green bonds, sustainability-linked loans, and multilateral agency funding, to support its sustainability initiatives. For instance, the bank issued $1.5 billion in External Commercial Borrowings (ECB), which is a big push to enhance its lending strength for green and affordable housing projects. These efforts thus align with the bank's broader sustainability goals, such as achieving carbon neutrality by FY32. HDFC Bank has financed over ₹32,795 crore of projects in FY23 green-certified buildings, renewable energy installations, and sustainable infrastructure. Impact From these efforts, the KPIs of the bank in the environment show a 15 percent decrease in Scope 1 and Scope 2, attributed to the investments made on energy-efficient systems and the inclusion of renewable sources of energy at branch locations.

Financially, HDFC Bank's PAT for FY23 was ₹60,812 crores with a 37.9% year-on-year growth, which spoke to the profitability of the green finance-driven growth strategy. ROE also was up at 16.1%, and ROA had improved to 1.98%, which reflected efficient usage of its expanding asset base. The sustainable finance strategy by HDFC Bank is not merely about its green financing instruments but about the operational advancement, too. All the collected funds have been given to the schemes aligning under the Sustainable Development Goals' categories, such as affordable housing and clean

energy schemes, through Green and Sustainable Deposits. Along with this, the bank has struck deals with organizations like IFC to ensure additional sources of financing to its projects that are ESG compliant in nature while further diversifying the bank's bouquet of green finance offerings. The bank supports sustainability efforts with robust ESG governance. It has a CRISIL ESG score of 75, ranking in the highest globally for sustainable practices. Other global initiatives are also supported by the bank, such as TCFD, where there is a sense of transparency and long-term risk mitigation regarding climate issues. Strategically integrating green financing into its core business, HDFC Bank emerges as a leader in the Indian financial sector through its sustainability transition. The results present dual benefits of green financing-the measurable environmental impact and driving financial growth and shareholder value.

5. *JSW Steel:*

The JSW group has taken a positive approach to integrate green financing mechanisms in the direction of ambitious sustainability targets such as achieving net-zero carbon emission by 2050. One of the notable ones was the issuance of $500 million in Sustainability-Linked Bonds, being the first Indian steel manufacturer to issue bonds that are linked to specific quantifiable sustainability outcomes in relation to carbon intensity reduction and improved utilization of renewable energy. The funds have been deliberately expended toward the initiatives related to renewable energy, green hydrogen, and decarbonization under the SEED program, which has emerged as a Global Energy Transition Changemaker at COP 28. The fact that JSW Steel is able to utilize these tools well makes it play a leadership role in fostering financial and ecological sustainability in the steel industry. The financial performance of the company reflected success through their sustainability initiatives. For FY 2023-24, JSW Steel provided tremendous revenue growth both in revenues to the tune of ₹1.75 lakh crore, year-on-year and EBITDA at ₹28,236 crore year-on-year delivered strong improvement of Return on Equity at 14.6% with Return on Capital Employed at 13.1%. It suggests the capital productivity along with sustainability projects. Notwithstanding the above, relentless cost expansions, along with delivery value-added products, have permitted a steady increase in the company's margins. JSW Steel further strengthened its financial performance while remaining true to its green promise by digitalizing and innovating operation efficiencies.

Apart from the financial benefits, JSW Steel has shown tremendous progress in decarbonization. It has the goal to reduce CO_2 emissions per tonne of crude steel to 1.95 tonnes by 2030, or to reduce its level by 28% from that in 2005, as per its targets. It is also to add supplementary capacity of 600 MW of solar and wind power and 320 MWh of battery storage to reduce reliance on traditional power sources. Such initiatives have dramatically improved operational sustainability while at the same time reinforcing JSW Steel's position as a global leader in the transition to green steel. The results indicate that the green financing tools of JSW Steel are effective and aligned with its financial and sustainability goals. With a focus on innovative financial instruments, operational efficiencies, and ESG leadership, JSW Steel demonstrates the power of green financing to attain dual objectives of financial growth and environmental stewardship.
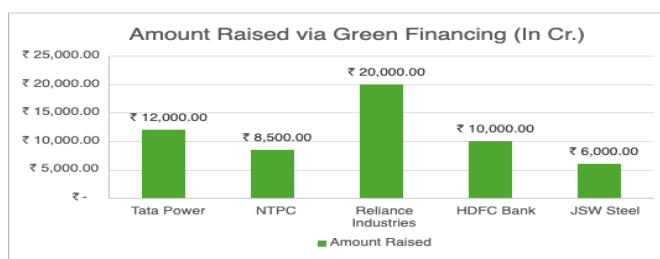
Figure 1: Amount Raised Via Green Financing (Source: Company Annual and Investors Report)

The first graph shows the amount of green finance obtained by Tata Power, NTPC, Reliance Industries, HDFC Bank, and JSW Steel. Reliance Industries leads the chart by raising ₹20,000 crores, which is a strong testament to its commitment to sustainability and green practices. Tata Power follows, raising ₹12,000 crores, which is in line with its goals for renewable energy. NTPC raised ₹8,500 crores, indicating it is gradually moving toward sustainable operations. HDFC Bank raised ₹10,000 crores, while underlining its stake in financing environment-friendly projects. JSW Steel raised ₹6,000 crores and that is a modest contribution to green financing.
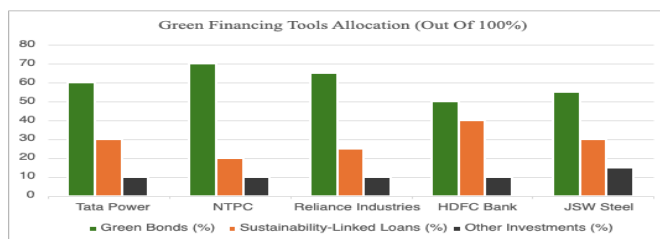
Figure: 2 Allocation of Green Financing Tools (Source: Annual Reports and Sustainability Reports of Tata

Power, NTPC, Reliance Industries, HDFC Bank, and JSW Steel, 2020-2024)

Above chart describes the utilization of green financing instruments by the above companies. Tata Power, NTPC, and Reliance Industries significantly earmarked more than 60% of their funds into green bonds, which proves an overwhelming preference for fixed income-generating products that enable a green ecosystem. Sustainability-linked loans was the smallest part, which represents financing that is dependent upon certain sustainability requirements. Other types of investment occupied a minimal percentage of all such organizations, and hence, points towards the dominant use of green bonds for financing. HDFC Bank and JSW Steel too presented a similar trend, which explains how the corporations tend to utilize more green bonds in facilitating their environmental activities.

5. DISCUSSION

Tata Power, NTPC, Reliance Industries, HDFC Bank, and JSW Steel have all adopted green financing that has highly benefited both financial and sustainable growth in these companies. These organizations have applied strategic tools that include green bonds, sustainability-linked loans, and ESG-focused investments to support renewable energy ventures, optimize operations, and align with the global environment goals. Other improvements have also been experienced in the ROE, ROCE, and profitability measures concerning the financial implication of such measures. For instance, HDFC Bank recorded profit growth year-on-year by 37.9% whereas green financing has been reported to raise Reliance Industries' ROE up to 10.3% due to renewable energy investments.
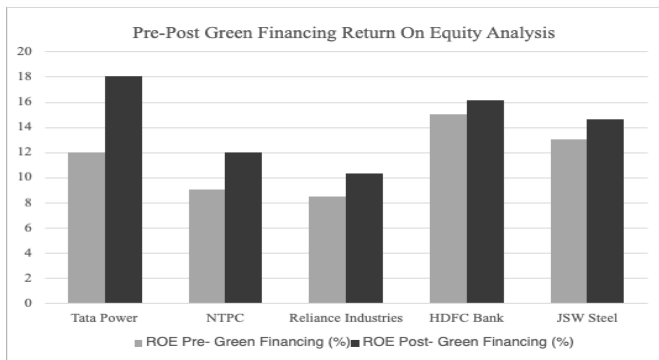
Figure 3: Pre-Post Return on Equity Comparison (Source: Annual Reports of Tata Power, NTPC, Reliance Industries, HDFC Bank and JSW Steel, 2020-2024)

Concerning the sustainability parameters, companies have performed spectacularly by cutting down significantly the carbon emissions, growing renewables, and developing pioneering technologies such as green hydrogen. For example, JSW Steel managed to deliver 28% reduction in CO2 intensity, whereas NTPC managed to scale up the renewable with an addition of 3.6 GW of capacity

underpinning the strong pipeline of 20 GW. These kinds of action enhance their competitive position within the market as well as supports India's commitment to meeting net zero carbon emission.

On other hand, Tata Power has been a beacon to green financing strategies on renewable energy projects such as solar and wind energy. Rated Green Bonds have been issued to [ICRA]AA+, on the company raising funds at rates in a competitive band of 6.29%-7.93% since the inception, above 4 GW of capacity for renewable resources. This has made its ROE grow from 12% to 18% in the last five years. The investments have not only made it stronger in terms of the financials but have also positioned it as the leader for the Indian renewable energy transition. The carbon footprint reduction made by Tata Power and this massive contribution towards the net-zero goals for India do give it an environmental upside. NTPC Limited has also adopted green financing, as the company has issued green bonds, which were rated BBB (Stable) by international agencies. These funds, with interest rates ranging between 2.5% and 3.25%, have financed solar parks and wind energy projects, with a portfolio of 3.6 GW of operational renewable capacity and a pipeline of 20 GW.
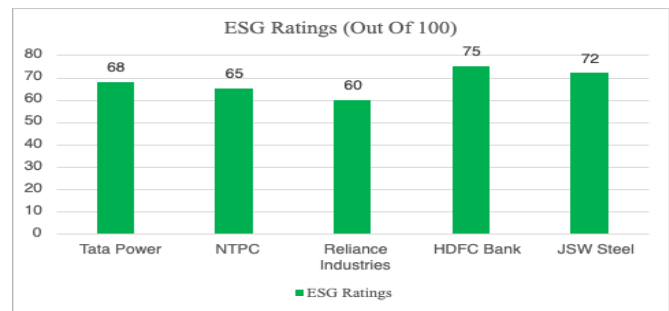
Figure 4: ESG Ratings of Selected Companies (Source: CRISIL And MSCI ESG Ratings)

According to (Investopedia 2023) The score typically ranges from 0 to hundred with a score of less than 50 considered relatively poor and more than 60-70, considered good.
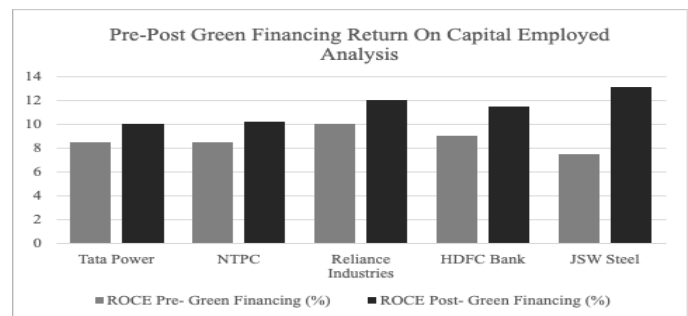
Figure 5: Pre-Post Return on Capital Employed Comparison (Source: Annual Reports of Tata Power, NTPC, Reliance Industries, HDFC Bank and JSW Steel, 2020-2024)
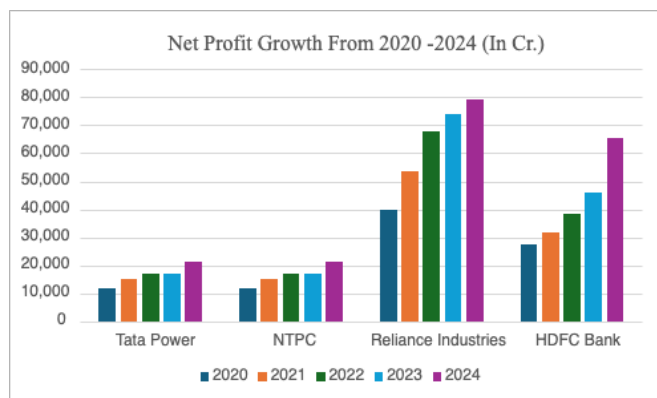
Figure 6: Net Profit Growth of Selected Companies
(Source: Annual Reports, 2020-2024)

(Above charts shows the steady growth of companies over the period of five years, while using green financing tools.)

NTPC's financial metrics indicate the success behind these initiatives, with its ROE rising from 9% to 12% and ROCE improving from 8.5% to 10.2%. Apart from financial benefits, NTPC's projects have successfully reduced carbon emissions by as much as possible, in line with its long-term sustainability goals, and improved its reputation as a main player in India's energy transition. Relying on green financing, the house of Ambani has topped off the clean energy efforts such as Dhirubhai Ambani Green Energy Giga Complex. Sustainability-linked bonds get BBB+ rating, and on average are issued at 2.875% average interest rate; these, therefore, invested heavily in solar energy and in production of green hydrogen. These efforts resulted in a renewable energy capacity of 6.85 million GJ and contributed a 7.3% increase in its Profit After Tax (PAT) to ₹79,020 crore in FY24. Also, ROE in the renewable energy segment has improved from 8.5% to 10.3%. Here lies greater financial viability for its green initiatives. Efforts put by Reliance take it at the forefront of the clean energy revolution not only in India but globally. HDFC Bank issued green bonds and sustainability-linked loans successfully by issuing ₹10,000 crore of green bonds rated AAA. The bank utilized the funds in renewable energy projects, green-certified buildings, and affordable housing. Green financing tools deployed strategically by the bank have enhanced PAT growth year-on-year to 37.9% and ROE at 16.1% at ₹60,812 crore. Its ESG-focused investments have enhanced its reputation among global investors, in this case, having a high ESG score of 75/100 that happens to be one of the best in the industry. Operationally, the bank has reduced its Scope 1 and Scope 2 emissions by 15% as a demonstration of the commitment towards sustainable development. JSW Steel is one of the decarbonization leaders in the steel industry. Recently, it issued bonds worth $500 million based on sustainability-linked bonds rated at BB+, focusing on integration with renewable energy and green steel. The

coupon rate of bonds averages at 6%. Such bonds are funded through the projects on renewable energy as well as efficiency upgrade leading to 28% reduced CO2 emissions intensity since 2005 levels. Its bottom-line benefits also translate to enhanced ROE at 14.6% and ROCE at 13.1%. Investments helped JSW Steel strike a balance between its profit targets and its ambition to become net-zero carbon by 2050.

Green financing has emerged as a critical strategy for Tata Power, NTPC, Reliance Industries, HDFC Bank, and JSW Steel, allowing these companies to balance economic growth with environmental stewardship. With innovative tools such as green bonds and sustainability-linked loans, these firms have demonstrated measurable value creation through better profitability, such as improved ROE and ROCE, but with meaningful declines in carbon footprint. Green finance contributes to scaling up renewable energy, decarbonizing activities, and advances new technologies like hydrogen and green hydrogen to build this sustainable future. Stories of this kind, where India is steadily inching closer to its net-zero carbon ambitions, obviously reflect the true strength of green financing as a growth engine for sustainable development and ecological resilience.

6. RECOMMENDATION:

According to (Economic Times 2024) The monthly mutual fund SIP crossed the Rs 25,000 crore mark for the first time in October and stood at Rs 25,323 crore against Rs 24,509 crore in September. The monthly SIP contribution was recorded at Rs 16,928 crore in the same period a year ago. The mutual fund folios were at all-time highs of 21,65,02,804 in October. The retail mutual fund folios, which include equity, hybrid, and solution-oriented schemes, were also at an all-time high at 17,23,52,296 for October as compared to 16,81,61,366 for September.

These findings provide actionable recommendation for both companies and policy makers. Companies could gain significant advantage from implementation of green financing tools/projects, while mutual fund houses can promote green projects/companies through SIP investments or specific green mutual fund scheme. Policy recommendation include special incentives such as less tax implication for investors who are ready to invest in green projects/companies.

Limitations: This study primarily relies on secondary data and case studies of only 5 Indian companies, which may limit its scope. Future research could include primary data through interviews, surveys with industry managers/investors to achieve deeper understanding.

Further this study only investigates top performer/large corporations, leaving a gap for further research into how startups, small and mid-sized enterprises can leverage green financing.

7. CONCLUSION

This study exhibits the transformative power of green finance on corporate financial and environmental performance, as has happened with Tata Power, NTPC, Reliance Industries, HDFC Bank, and JSW Steel. The same companies have shown that profits can be compatible with sustainability through the tools of green bonds, sustainability-linked loans, and ESG-focused investments. Incorporation of green financing has largely improved critical financials like Return on Equity (ROE) and Return on Capital Employed (ROCE) but still enabled gigantic renewables initiatives and efficiency through operations.

Environmental impact also is equally relevant. Collectively, these companies have built significant new capacity in renewable energy, reached substantial cuts in carbon emissions, and led initiatives such as green hydrogen and low-carbon steel. Some examples of tangible progress toward India's net-zero targets include NTPC's renewable pipeline of 20 GW and JSW Steel's 28% reduction in CO2 intensity. The profits of HDFC Bank with a year-over-year growth of 37.9% clearly reflect the financial viability of such sustainability-driven strategies. This research illustrates how green finance is not only a tool for financing but also an accelerator that harmonizes business growth with environmental responsibility. It is during this time that India is approaching a low-carbon economy that these companies' success stories would serve as examples for the adoption of sustainable practices in other industries. It is well known that green finance is considered an important enabler toward sustainable growth, resilience, and global competitiveness while immediately addressing climate challenges.

REFERENCE

[1.] Aboramadan M, K. O. (2021). Harnessing green financing for renewable energy generation and funding SDGs: An empirical analysis with evidence from India. *Harnessing green financing for renewable energy generation and funding SDGs: An empirical analysis with evidence from India*. doi:0.1108/IJCHM-12-2020-1440

[2.] Ajaz Akbar Mir, A. A. (2022, September). Green banking and sustainability – a review. *Green banking and sustainability – a review*. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/agjsr-04-2022-0017/full/html

[3.] Akash Verma, R. S. (2023, August). Tata Power's financial performance. *Tata Power's financial performance.*

[4.] Annu Annu, R. T. (2023, September). Framework of green finance to attain sustainable development goals: an empirical evidence from the TCCM approach. *Framework of green finance to attain sustainable development goals: an empirical evidence from the TCCM approach*. doi:10.1108/BIJ-05-2023-0311

[5.] Anupam Sharma, S. B. (2022). Impact of Green Finance on SMEs. *Impact of Green Finance on SMEs*. doi:10.1515/9783111170022-010

[6.] Bhavesh Kumar, L. K. (2023, May). Green finance in circular economy: a literature review. *Green finance in circular economy: a literature review*. Retrieved from https://link.springer.com/article/10.1007/s10668-023-03361-3

[7.] Biju .M, J. R. (2024, September). Green Finance and Sustainable Development in India. *Green Finance and Sustainable Development in India*. doi:10.1007/978-3-031-63402-4_27

[8.] Chen, J. &. (2024). Green Finance & Renewable Energy in Developing Nations. *Green Finance & Renewable Energy in Developing Nations*. doi:10.1016/j.heliyon.2024.e33879

[9.] Chengbo Fu, L. L. (2023, October). Advancing green finance: a review of sustainable development. *Advancing green finance: a review of sustainable development*. Retrieved from https://link.springer.com/article/10.1007/s44265-023-00020-3

[10.] Chin Chun Chan, P. S. (2023, November). Examining the Impact of Green Finance on Carbon Emissions in India through Energy Consumption Optimization. *Examining the Impact of Green Finance on Carbon Emissions in India through Energy Consumption Optimization*. doi:10.32388/2I929T

[11.] Deepak Sangroya, G. K. (2020, May). Green energy management in India for environmental benchmarking: from concept to practice. *Green energy management in India for environmental benchmarking: from concept to practice*. doi:10.1108/MEQ-11-2019-0237

[12.] Dingchao An, Y. Z. (2023). The Financing Principles of High Carbon Enterprises Green Development Based on Double Carbon Target in China—Take MYSE as an Example (2023). *The Financing Principles of High Carbon Enterprises Green Development Based on Double Carbon Target in China—Take MYSE as an Example (2023)*. doi:10.22158/ibes.v5n3p31

[13.] Dipti Sharma, S. B. (2022). Green Financing in India. *Green Financing in India: identifying future scope for innovation in financial system*. doi:10.1504/IJGE.2021.10044678

[14.] Dr. Manpreet Kaur, M. K. (2022).

[15.] Dr. Smruti Vakil, K. S. (2024). Study on the Implementation and Future Scope of Green Financing in Indian Banking System. *Study on the Implementation and Future Scope of Green Financing in Indian Banking System*. doi:10.37391/ijbmr.030301

[16.] Elias Appiah-Kubi, F. O. (2024). Green Financing and Sustainability Reporting among SMEs: The role of Proenvironmental Behavior and Digitization. *Green Financing and Sustainability Reporting among SMEs: The role of Proenvironmental Behavior and Digitization*. doi:10.1016/j.jclepro.2024.143939

[17.] Huang, L. (2023). Green Bonds and ESG Investments in Resource-Rich Countries. *Green Bonds and ESG Investments in Resource-Rich Countries*. doi:10.1016/j.resourpol.2024.104806

[18.] Husodo, W. E. (2024). Identifying The Impact of Green Bonds on Company Reputation and Risk. *Identifying The Impact of Green Bonds on Company Reputation and Risk*. doi:10.21632/irjbs

[19.] IDA, W. B. (2023). India Sovereign Green Bond: Financing Climate Action and Resilient Growth. *India Sovereign Green Bond: Financing Climate Action and Resilient Growth*.

[20.] James Atta, P. A.-W. (2023). Financing green growth in African emerging economies: Opportunities and challenges. *Financing green growth in African emerging economies: Opportunities and challenges*. doi:10.13140/RG.2.2.22346.38080

[21.] Jean, G. G. (2024). Green Financing and Green Product Innovation. *Green Financing and Green Product Innovation*.

[22.] K.Sudhalakshmi, D. (2014). Emerging Green Finance in India: Its Challenges and Opportunities. *Emerging Green Finance in India: Its Challenges and Opportunities*. Retrieved from https://www.longdom.org/articles-pdfs/emerging-green-finance-in-india-its-challenges-and-opportunities.pdf

[23.] Kamboj, G. (2024, June). Green Finance in India: Progress and Challenges. *Green Finance in India: Progress and Challenges*. Retrieved from www.ijnerfm.com

[24.] Keerat Bhurjee, A. P. (2022). Determinants of Green Bond Performance from India. *Determinants of Green Bond Performance from India*. doi:10.4018/IJESGT.304821

[25.] Keshav Mishra, A. K. (2023). Green Finance: A powerful tool for Sustainability. *Green Finance: A powerful tool for Sustainability*. doi:10.54741/ssjar.3.6.1

[26.] Kundalia, D. S. (2023, july). Green Bonds - Role and scope in India's financial and fiscal landscape. *Green Bonds - Role and scope in India's financial and fiscal landscape*. Retrieved from https://www.iibf.org.in/documents/BankQuest/6.%20.pdf

[27.] Lin, R. M. (2024). Impact of Green Bonds on Chinese Enterprises' Financing Efficiency. *Impact of Green Bonds on Chinese Enterprises' Financing Efficiency*. doi:10.3390/su16177472

[28.] Md. Kashif Ansari, Y. A. (2022). Green Finance Trends and Challenges in India. *Green Finance Trends and Challenges in India*.

[29.] Mehwish Bhatti, S. S. (2023, December). Challenges of Sustainable Finance in Transitions Economy. *Challenges of Sustainable Finance in Transitions Economy*. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/978-1-80455-678-820231002/full/html?skipTracking=true

[30.] Mishra, S. N. (2023, May). Impact of green finance and fintech on sustainable economic growth: Empirical evidence from India. *Impact of green finance and fintech on sustainable economic growth: Empirical evidence from India*. doi:10.1016/j.heliyon.2023.e16301

[31.] Mukul Bhatnagar, S. T. (2022). A wave of green start-ups in India—The study of green finance as a support system for sustainable entrepreneurship. *A wave of green start-ups in India—The study of green finance as a support system for sustainable entrepreneurship*. doi:10.3934/GF.2022012

[32.] Nagaraju, G. (2021). ROLE OF SEBI IN PROMOTING GREEN BONDS AND SUSTAINABLE FINANCING. *ROLE OF SEBI IN PROMOTING GREEN BONDS AND SUSTAINABLE FINANCING*.

[33.] Narasingha Das, P. G. (2023, August). Does greenwashing obstruct sustainable environmental technologies and green financing from promoting environmental sustainability? Analytical evidence from the Indian economy. *Does greenwashing obstruct sustainable environmental technologies and green financing from promoting environmental sustainability? Analytical evidence from the Indian economy*. doi:10.1002/sd.2722

[34.] Nurmala Ahmar, Y. R. (2024). Development of a Green Banking and Green Financing Practice Model FOR Enhancing Sustainability Development Goals (SDGS). *Development OF A Green Banking and Green Financing Practice Model for Enhancing Sustainability Development Goals (SDGS)*. doi:10.47172/2965

[35.] Ozili, P. K. (2022, April). Green finance research around the world: a review of literature. *Green finance research around the world: a review of literature*. doi:10.1504/IJGE.2022.10048432

[36.] Parvadavardini SOUNDARRAJAN, N. V. (2016, January). Green finance for sustainable green economic growth in India. *Green finance for sustainable green economic growth in India*. doi:10.17221/174/2014-AGRICECON

[37.] Preeti Sharma, P. P. (2020, December). Determinants of environmental, social and corporate governance (ESG) disclosure. *Determinants of environmental, social and corporate governance (ESG) disclosure*. Retrieved from https://www.researchgate.net/publication/343374649_Determinants_of_environmental_social_and_corporate_governance_ESG_disclosure_a_study_of_Indian_companies

[38.] Rajitha, U. (2022). A study on Green Finance for Sustainable Development in Indian context. *A study on Green Finance for Sustainable Development in Indian context*. doi:10.13140/RG.2.2.32798.72008

[39.] Ranjan Aneja, S. R. (2023, January). Does the green finance initiatives transform the world into a green economy? A study of green bond issuing countries. *Does the green finance initiatives transform the world into a green economy? A study of green bond issuing countries*. doi: 10.1007/s11356-023-25317

[40.] Ranjan, A. (2021, June). *Research Gate*. Retrieved from https://www.researchgate.net/publication/352030007_Green_Finance_in_India_Scope_and_Challenges

[41.] Ravita Kharb, C. S. (2024, August). Modelling the barriers of green financing in achieving. *Modelling the barriers of green financing in achieving*. doi:10.1007/s10668-024-05266-1

[42.] Rohit Agrawal, S. A. (2024, July). Adoption of green finance and green innovation for achieving circularity. *Adoption of green finance and green innovation for achieving circularity*. Retrieved from https://www.sciencedirect.com/science/article/pii/S1674987123001366

[43.] Ruoying Shi a a, H. Z. (2024). Green Finance and Corporate Green Innovation in China. *Green Finance and Corporate Green Innovation in China*. doi:10.1016/j.frl.2024.105676

[44.] S, K. (2022). GREEN FINANCING INITIATIVE IN INDIA: CURRENT STATE AND PATH FORWARD. *GREEN FINANCING INITIATIVE IN INDIA: CURRENT STATE AND PATH FORWARD*.

[45.] Sagarika Mohanty, S. S. (2023, February). Retrieved from https://www.mdpi.com/1911-8074/16/2/108

[46.] Santi Gopal Maji, P. L. (2022, December). Environmental, social and governance (ESG) performance and firm performance in India. *Environmental, social and governance (ESG) performance and firm performance in India*. doi:10.1108/SBR-06-2022-0162

[47.] Saroj Shantanu Prasad, S. A. (2015, October). Green Financing: Role of Public Sector Banks. *Green Financing: Role of Public Sector Banks*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2680518

[48.] Shalini Mittal, S. C. (2023). Green Banking – The Path Leading to Sustainable Economic Growth. *Green Banking – The Path Leading to Sustainable Economic Growth*. Retrieved from https://ideas.repec.org/h/eme/csefzz/s1569-37592023000110b013.html

[49.] Shankar Ravichandran, M. R. (2022). Green Finance: A Key fight with Climate Change. *Green Finance: A Key fight with Climate Change*. doi:10.54105/ijef.B2526.112222

[50.] Shantha Kumari K G, J. M. (2024, January). Green Finance in India: Driving Sustainable Development and Economic Growth. *Green Finance in India: Driving Sustainable Development and Economic Growth*. doi:10.1007/978-3-031-62106-2_23

[51.] Sharma, S. A. (2024). ESG performance and corporate volatility: an empirical exploration in an emerging economy. *ESG performance and corporate volatility: an empirical exploration in an emerging economy*. Retrieved from https://pure.jgu.edu.in/id/eprint/8054/

[52.] Stefan Petrov, S. A. (2024). Environmental Effects of Green bonds and other forms of Financing in the European Union. *Environmental Effects of Green bonds and other Forms of Financing in the european Union*. doi:10.52950/ES.2024.13.1.005

[53.] Thaker, K. K. (2019, January). ESG and Corporate Financial Performance: A Panel Study of Indian Companies. *ESG and Corporate Financial Performance: A Panel Study of Indian Companies*. Retrieved from https://www.proquest.com/openview/5e523204f2537b8112ba884a15103c15/1?pq-origsite=gscholar&cbl=54446

[54.] Ullah, A. (2023). Green Financing & Sustainable Development in Bangladesh. *Green Financing & Sustainable Development in Bangladesh*. doi:10.11648/j.ijrse.20231201.12

[55.] Uwalomwa Uwuigbe, D. F. (2024). Bibliometric Analysis of Green Financing (2000-2023. *Bibliometric Analysis of Green Financing (2000-2023*. doi:10.32479/ijeep.16172

[56.] Vijeta Singh, N. M.-H. (2022). Mapping Green Digital Finance in India. *Mapping the current practices and patterns of Green Digital Finance in India and the way forward*. doi:10.1007/978-981-19-2662-4_11

[57.] Vipin Jain, D. P. (2024). Green Financing as a Future Trend. *Green Financing as a Future Trend*. doi:10.58532/V3BHMA5P6CH1

[58.] Wei Wu a a, b.,. (2024). Impact of green financing on CSR and environmental policies and procedures. *Impact of green financing on CSR and environmental policies and procedures*. doi:10.1016/j.heliyon.2024.e31101

[59.] Woode, J. K. (2024). Green Finance and Green Growth: Literature Review. *Green Finance and Green Growth: Literature Review*. doi:10.1016/j.dsef.2024.100004

[60.] Ye, J. D. (2023). The Effect of Green Investmenta: The Mediating Role of Corporate Social Responsibility. *The Effect of Green Investment and Green Financing on Sustainable Business Performance of Foreign Chemical Industries Operating in Indonesia: The Mediating Role of Corporate Social Responsibility*. doi:10.3390/su151411218

Navigating Trade-Offs: The Relationship between Environmental Performance and Firm Performance in India with a Focus on Board Gender Diversity

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ABSTRACT

This study explores the relationship between environmental performance (EP) and firm performance (FP), with a specific focus on the moderating role of board gender diversity (BGD). Utilizing legitimacy and agency theories as foundational frameworks, the authors developed and tested hypotheses based on data from the Refinitiv database, comprising 455 firm-year observations from 91 Indian companies over five years (2018-2022). Employing fixed-effect panel data analysis, the results reveal a significant negative relationship between EP and FP, measured by return on assets (ROA) and Tobin's Q (TQ). This finding suggests that companies may face short-term trade-offs in their pursuit of long-term environmental benefits, indicating that the goal of building legitimacy through environmental responsibility could ultimately lead to sustainable growth and enhanced performance in the long term. Notably, the analysis indicates that BGD does not moderate the EP-FP relationship, contradicting agency theory, which posits that a diverse board can enhance organizational oversight and support interests to improve performance. We also used system GMM for a robustness check of our results, and the findings are partially similar to the main results. This paper provides insights into corporate governance by empirically examining the impact of EP on FP, contributing to the literature by demonstrating that the limited popularity of board gender diversity in India may hinder its ability to moderate the effects of EP on FP. Furthermore, this study improves our understanding of how EP influences financial performance and the role of board diversity in this context, particularly within the emerging economy of India.

Keywords: Environmental performance, financial performance, board gender diversity, legitimacy theory, agency theory.

1. INTRODUCTION

The main motivating factors of increased environmental research are the rise in greenhouse gas emissions and the drastic changes in the global climate (Lundgren & Zhou, 2017) and businesses are now shifting their focus from merely making money (Friedman, 2007) to mitigating environmental degradation (Wagner, 2007); (de Burgos-Jiménez et al., 2013).

The growing urgency of environmental sustainability has induced firms to re-evaluate their working strategies and embrace environmentally responsible practices (Manrique & Martí- Ballester, 2017). Environmental performance has become one of the significant bases of corporate success as it enhances corporate reputation (Martin & Moser, 2016) profitability (El Ghoul et al., 2011), and long-term survival (Iatridis, 2013); (Lorraine et al., 2004). Furthermore, stakeholders are closely observing how companies are addressing environmental issues (Deswanto & Siregar, 2018). The importance of environmental reporting has increased since 1980s (Alipour et al., 2019).

When CSR is measured in quantitative terms it is known as ESG, as defined by De Masi et al., (2021). ESG comprises three components that are environmental, social, and governance. Earlier studies have focused on the impact of the composite score of ESG on firm performance (Giannopoulos et al., 2022) but this study focuses entirely on the

environmental pillar as this is a need of the present scenario. EP can improve a company's status (Cai et al., 2016), enhance customer and employee satisfaction (Edmans, 2011), and leads towards building better relationships with the stakeholders (Alipour, Ghanbari, Jamshidinavid, & Taherabadi, (2019).

Since long time, India is facing multiple environmental trepidations like gas leak during Bhopal gas tragedy in 1984, protests against Vedanta's Sterlite Copper unit in Chennai due to pollution issues are some of the instances (Gupta & Gupta, 2020). According to Igini, (2024) India faces majorly 5 environmental issues. First is air pollution as India's 63 cities are on the list of the world's 100 most polluted cities, as per the 2021 World Air Quality Report. Moreover, PM2.5 levels in many cities exceeded WHO guidelines by over ten times, leading to health risks and millions of premature deaths. The second issue is water Pollution as around 70% of India's surface water is unfit for consumption due to untreated sewage, industrial waste, and agricultural runoff. Third is food and water shortages as India faces severe droughts, heatwaves, and water scarcity due to climate change and inefficient water use, particularly in agriculture and many cities could run out of groundwater by 2030, according to the expert's predictions. Fourth is the issue of waste management as India generates over 277 million tonnes of solid waste annually, with poor recycling rates and significant plastic pollution. Rivers like the Ganges contribute to global ocean

plastic waste. And lastly, biodiversity loss is a major issue because nearly 90% of India's areas are lost due to deforestation, wildfires, and water contamination, this leads to the extinction of species and a decline in freshwater biodiversity.

These issues made it compulsory for Indian firms to focus towards environmental issues but as said by Li et al., (2017) the firms hesitates in investing in cleaner technology and environmental management systems as they doubt whether improving environmental performance leads to enhancing profits or not. The previous literature also finds positive (Dowell et al., 2000), negative (Rao et al., 2023), or insignificant (Malarvizhi & Matta, 2016) relations among environmental performance and financial performance.

Furthermore, in this study authors have used board gender diversity as the moderating variable because some authors including Rossi et al., (2021) believe that corporate accountability as well as corporate reputation can be improved by better corporate governance practices. Therefore, gender diversity on board can play a major role in enhancing the environmental performance of the firms. Also, organisations with well experienced women on board invest more in environmental aspects (Horbach & Jacob, 2018). Kahloul et al., (2022) found a positive moderating role of female directors on the improving the firm's sustainability and its financial performance. Manita et al., (2018) and Yadav & Prashar, (2022) also stated that female directors influence the corporate CSR practices due to their nurture, dexterities and emotional traits.

As a result, we start this study by attempting to pinpoint the situations in which environmental policies give the business a competitive edge and, thus, produce strong financial results. The second goal of this article is to examine how gender diversity on boards strengthens the link between financial and environmental performance. The study's findings contribute to the body of literature in numerous ways. First, its conclusions offer more helpful information about the existence and function of corporate governance instruments. Second, because it clarifies the connection between corporate governance and EP, the study's conclusions should also benefit corporate managers, readers of sustainability reports, and those who utilize financial statements. This will enhance the financial performance of the company. Third, this study investigates how board gender diversity influences the relationship between financial and environmental performance. The paper's conclusions have implications for regulators and policymakers worldwide. In a setting where corporate governance and sustainability play a major role in business value, our research gives the information user a better understanding of the company's financial performance and prospects for future growth.

The remainder of the article is structured as follows: Section 2 reviews the literature and formulates the research hypotheses. Section 3 identifies the research gap, while Section 4 discusses the sampling process and variable calculations. Sections 5 and 6 present the analysis and empirical findings and summarize the conclusions, respectively, with Section 7 addressing limitations and future research directions.

2. LITERATURE REVIEW

2.1 *Theoretical background*

Because of issues like climate change and global warming, environmental sustainability has become a critical concern for managers of businesses (Shakil et al., 2022). Earlier authors have used different theories to prove the positive relationship between the environmental performance of firms and their financial success. For example, Alipour et al., (2019) and Gray et al., (2009) used stakeholders theory and stated that organizations are liable not only to shareholders but also to a wide range of stakeholders affected by the organization's activities. Similarly, Chu et al., (2013) used the legitimacy theory to determine the reason for greenhouse gas reporting in Chinese companies and concluded that most companies informed only fair and good news to present their positive image in the society. One of the most widely debated ideas for explaining the occurrence of voluntary environmental disclosures in company interactions is the legitimacy theory. According to the legitimacy theory, businesses use environmental reporting in an effort to establish, preserve, or restore their credibility. The legitimacy theory could offer valuable perspectives on environmental disclosures made by corporations (Mousa & Hassan, 2015). Organizations constantly strive to make sure that they are seen as operating within the bounds and conventions of the society in which they operate (Deegan, 2002; Shakil, 2022). According to legitimacy theory, society as a whole is taken into account rather than people individually (Deegan, 2002). The interaction between the organization and society at large is hence the focus of the idea (Fernando & Lawrence, 2014).

Agency theory is another theory that is applied. According to agency theory, female-led boards can serve as a means of monitoring and regulating board operations while reducing agency expenses and information disparities (Adams & Ferreira, 2009; Masmoudi & Barhoumi, 2023). According to this idea, Jensen and Meckling (1976) highlight how governance structures enhance business performance by lowering the agency costs brought on by conflicts of interest. The link between principals and agents is the main emphasis of agency theory. A theoretical foundation for comprehending how boardroom diversity affects company financial performance is provided by Fama & Jensen, 1983; Jensen & Meckling, 1976 (Fuadah et al., 2022; Pulino et al., 2022). According to the hypothesis, BRD can improve the board's capacity to efficiently oversee management, which could lower agency costs and boost company performance (Bathala & Rao, 1995; Hillman & Dalziel, 2003).

Environmental Performance and Financial Performance

Businesses may reveal their environmental impact in an effort to boost their performance, boost profitability, and provide a positive image of their brand (Alipour et al., 2019). Businesses are major contributors to environmental issues as energy consumers and polluters, so it is becoming increasingly critical for them to improve their information disclosure and environmental management practices. However, businesses doubt whether being green is profitable and whether disclosing environmental information is useful.

Li et al., (2017) analyzed 475 Chinese firms from 2013 to 2014 and found a U-shaped relationship between environmental performance and disclosure, but no link between environmental and financial performance, and a negative relationship between disclosure and financial performance. Deswanto & Siregar, (2018) examined Indonesian firms for the period 2012 to 2014 and observed that while lagged environmental performance positively influenced current environmental disclosures, financial performance has no effect on environmental disclosures. Furthermore, disclosures had no effect on firm value and do not mediate the effects of environmental and financial performance on firm value. Dowell et al., (2000) revealed that

U.S. firms in the S&P 500 following tougher environmental standards achieved significantly higher market values, measured using Tobin's q.

Alipour et al. (2019) studied 120 Iranian firms from 2011 to 2016 and found a positive relationship between environmental disclosure quality (EDQ) and firm performance, with board independence strengthening this effect. The authors used agency theory and stakeholder theory to test the hypotheses. The study used both static and dynamic panel data analysis. This showed that firms with more independent board members involves in higher environmental disclosure that leads to better firm performance. Gupta & Gupta, (2020) analyzed data from 200 senior Indian executives and confirmed that environmental sustainability positively influences financial, customer, internal business processes, and learning & growth. Using structural equation modeling, the findings highlighted the critical role of environmental sustainability in enhancing overall firm functionality. Zeng et al., (2010) found that financial performance is positively impacted by both low and high schemes of cleaner production in Northern Chinese manufacturing businesses. Tan et al., (2017)) demonstrated that the tourism and hotel industries' financial performance and environmental sustainability are positively correlated across all regions. Gotschol et al., (2014) provided evidence that businesses who make long-term investments in a green supply chain see improvements in their financial performance. In contrast, businesses that only participated in environmental incentive programs saw minimal short-term gains.

Furthermore, studies have highlighted a negative impact of environmental performance on firm profitability. Rao et al., (2023) analyzed Indian firms from 2015 to 2022 using quantile regression and found that the environmental pillar score negatively affected ROE. Similarly, Lundgren & Zhou, (2017) explored productivity, energy efficiency, and environmental performance (focusing on environmental management's role). Using panel VAR and Data Envelopment Analysis, it showed that while energy efficiency and productivity reinforce each other, environmental investments may constrain future production, challenging the Porter hypothesis. The findings highlight trade-offs in environmental spending and the benefits of energy efficiency programs. Similarly, González-Benito & González-Benito, (2005) found that environmental proactivity does not positively influence financial performance in the Spanish industry, emphasizing trade-offs in environmental spending. Chang, (2015) investigated the relationship between economic performance and environmental factors in the Chinese firms, and found a negative correlation despite improved environmental performance. Connelly & Limpaphayom, (2004) indirectly supported the Porter hypothesis, and showed that well-designed environmental regulations can enhance competitiveness. Their study of Thai companies revealed a positive, non-linear relationship between environmental practices and market valuation but no link between environmental reporting and short-term profitability. According to this, environmental reporting improves performance over the long run, with declining returns at greater levels. Moreover, Lu & Taylor, (2018), using Newsweek's Green Rankings, found a negative relationship between environmental and financial performance but a positive link between environmental performance and disclosure, indicating that greener firms disclose more. Malarvizhi & Matta, (2016) studied 85 BSE-listed Indian firms in metal, energy, and chemical sectors, using ROCE, ROA, NPM, and EPS as predictors of environmental disclosure. Their findings revealed no significant relationship between firm performance and environmental disclosure levels. Furthermore, Lu & Taylor, (2018) noted under neo-classical theory a negative link between financial and environmental performance, highlighting that industries with high compliance costs, like paper manufacturing, face competitive disadvantages as environmental efforts often reduce economic performance. This implies that higher environmental performance often corresponds to lower economic performance, and vice versa

It is evident from the discussion above that the literature on environmental performance and financial performance has mixed results. Further, this study in India is lacking. Therefore, to address this research gap, the relationship between EP and financial performance is hypothesized as follows:

H1. EP has a significant effect on FP.

Board gender diversity (moderating variable)

Agency theory suggests that female directors can reduce agency costs by offering new viewpoints and making tough decisions. Boshnak et al., (2023) studied Saudi firms during COVID-19 using data from 258 annual reports covering 2019 and 2020. Their findings revealed that firms with more women on boards achieved higher Tobin's Q ratios and ROA, showcasing the role of gender diversity in crisis management. Another study by Shakil et al., (2022) studied transportation firms from 2013 to 2017. Using the Refinitiv Database for 56 companies (cross-country sample) from 2013 to 2017, the results showed CEP significantly and negatively impacts ROA and TQ but no significant effect on ROE, while board gender diversity (BGD) moderates ROE and TQ positively. However, showed no moderating effect on ROA. Manita et al., (2018), examined 379 S&P 500 firms from 2010 to 2015, and found no significant link between board gender diversity and ESG disclosure, although a critical mass of three or more women showed partial influence. In Latin America, Husted & Sousa-Filho, (2019) explored the impact of board structures on ESG disclosure, emphasizing regional dynamics in governance and sustainability. Using data from the Bloomberg and Capital IQ databases, the authors examined the impact of CEO duality, board size, women on the board, and independent directors on ESG disclosure. Board size and independent directors have a positive influence on ESG disclosure, whereas CEO duality and the presence of women on the board have a negative effect. Using data from Europe (2002–2013), Kyaw et al., (2017) investigated the relationship between board gender diversity and corporate social performance. Employing fixed-effect models, the study found that gender diversity enhances environmental and social performance. The impact is more pronounced in emerging market businesses. Another study in the Gulf Cooperation Council (GCC), Arayssi et al., (2020) explored the impact of board composition on ESG reporting. Publicly traded companies from 2008 to 2017 were examined using Thomson Reuters data, with panel regressions and sensitivity tests ensuring results robustness. Results showed that independent boards and the presence of women on them improve ESG disclosure and social responsibility, which benefits a company's reputation. Conversely, CEO-chaired boards hinder the implementation of social agendas and ESG reporting. Tulung & Ramdani, (2018) examined data from 3,876 publicly traded companies in 47 countries and found that companies with more female directors perform better on performance metrics including return on assets and Tobin's Q.

According to the aforementioned research, very few studies have examined gender diversity as a moderating factor in the relationship between financial performance and environmental performance, particularly in developing nations like India. Thus, in order to quantify the moderating

effect of BGD on EP and FP, we developed the following hypothesis:

H2: The link between EP and FP is significantly moderated by board gender diversity.

Research Gap

Although there is a growing global interest in the association between EP and FP, limited attention has been given to the Indian corporate context, which has unique socio-economic challenges, developing ESG norms, and mandatory CSR practices. Also, existing studies have often overlooked the moderating role of board gender diversity in the EP-FP relationship, particularly in India's emerging market scenario. This leaves a critical gap in understanding how gender diversity shapes the EP-FP nexus in Indian firms.

3. METHODOLOGY

Data

This study investigates the influence of environmental performance on financial performance of Indian firms. The researchers utilized two financial performance metrics: return on assets (ROA) and Tobin's Q (TQ). For environmental performance, they collected data from Refinitiv Eikon Database. Board gender diversity serves as the moderating variable in the study. Firm-specific variables, including firm size (FSIZE) and leverage (LEV), were also controlled for. We used balanced panel data based on data availability from 2018 to 2022. Data regarding all variables were collected from the Refinitiv Eikon Database. The sample comprised 91 Indian firms, covering the period from 2018 to 2022. The explanation of the variables is given in Table 1

TABLE 1: Variables' description

Variables	Variable Measure	References
Dependent variable: Return on assets (ROA) Tobin's Q (TQ)	Company's ability to generate profit from its total assets. ROA=Net income/Total assets Measures the relative overvaluation or undervaluation of a company or the market as a whole. TQ= (Market capitalization + total debt)/total assets	Malarvizhi & Matta, (2016) Dowell et al., (2000)
Independent variable: Environmental Performance (EP)	The Environmental Performance Score measures a company's environmental sustainability practices, including resource use, emissions, and innovation, to evaluate its impact on the environment.	González-Benito & González-Benito, (2005); Gupta & Gupta, (2020)
Moderating Variable:	Number of women in the board of directors	(Arayssi et al., 2020; Husted

Variables	Variable Measure	References
Board gender diversity (BGD)		& Sousa-Filho, 2019)
Control variables: Firm size (FSIZE) Firm Leverage (LEV)	Natural log of total assets. Long-term debt divided by total assets.	(Alipour et al., 2019; Atan et al., 2018; Nur Utomo et al., 2020) (Alipour et al., 2019; Atan et al., 2018; Nur Utomo et al., 2020)

Statistical models

The study employs the following equations to estimate the impact of EP on firm performance.

$$ROA_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 FSIZE_{it} + \beta_3 LEV_{it} + \varepsilon_{it} \quad (Eq.1)$$

$$TQ_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 FSIZE_{it} + \beta_3 LEV_{it} + \varepsilon_{it} \quad (Eq.2)$$

$$ROA_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 BGD_{it} + \beta_3 EP*BGD_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \varepsilon_{it} \quad (Eq.3)$$

$$TQ_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 BGD_{it} + \beta_3 EP*BGD_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \varepsilon_{it} \quad (Eq.4)$$

4. DATA ANALYSIS

4.1 Descriptive Analysis

Table 2 provides the descriptive statistics of the variables including minimum and maximum values, the mean, median, and standard deviation. All the variables are winsorized at the 1 percent and 99 percent levels to control for the effect of outliers. The table reveals that the mean value of ROA is 0.072 whilst the minimum and maximum values are −0.16 and 0.32, respectively. On the other hand, the minimum, maximum, and mean values of TQ are 0.99, 13.09, and 4.30, respectively. The mean EP is 48.66, which indicates the medium environmental quality of performance in the sample firms. This indicates that Indian firms are concerned about environmental issues. On average, there is only 15.40 percent of the board gender diversity in Indian firms which is very low compared to other developed countries. This finding also reveals that regarding the controlling variables, the sample's average firm size is 21.84 with 1.41 standard deviations. The sample's average leverage is 0.53 with a 0.18 standard deviation.

TABLE 2: Summary statistics

	Mean	Median	SD	Min	Max
ROA	0.072	0.064	0.082	-0.16	0.32
TQ	4.30	2.76	3.89	0.99	13.09

	Mean	Median	SD	Min	Max
EP	48.66	49.75	22.82	1.27	97.97
BGD	15.40	14.29	7.43	5.55	42.86
FSIZE	21.84	21.61	1.41	18.84	25.62
LEV	0.53	0.54	0.18	0.27	0.78

Correlation

Table 3 presents the results of the correlation analysis of the numerous key variables of the study. The explanatory variable EP has a negative and insignificant association with ROA, while a negative and highly significant association with TQ. This means that an increase in the level of environmental performance in Indian firms is associated with decreased financial performance. BGD has a negative and insignificant association with ROA and a negative and significant association with TQ implying that an increase in gender diversity will decrease the financial performance. The Table 3 also indicates a positive relation between environmental performance and gender diversity. This proves that an increase in board gender diversity will increase environmental performance which further leads to an increase in cost and a decrease in the financial performance of firms. Regarding the control variables, firm size is inversely correlated with financial performance, indicating a significant negative relationship. This suggests that the larger firms and firms with high debt tend to reduce the financial performance of the Indian firms. Furthermore, firm size and leverage are positively and highly significantly linked with environmental performance suggesting that larger firms contribute more towards environmental performance as compared with smaller firms. The correlation matrix also shows no multicollinearity amongst independent variables, as there is none of the correlations is higher than 0.80 between the independent variables (Gujarati, 1995)**.** Additionally, variance inflation factor (VIF) analysis further supports the results that there is no multicollinearity among the explanatory variables. According to Gujarati, (1995), when the Variance Inflation Factor (VIF) exceeds the threshold of 10, it specifies a significant degree of multicollinearity among the variables

TABLE 3: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) ROA	1.000					
(2) TQ	.613***	1.000				
(3) EP	-0.033	-.18***	1.000			
(4) BGD	-0.038	-.094**	0.003	1.000		
(5) FSIZE	-.23***	-.52***	0.44***	-.100**	1.000	
(6) LEV	-.48***	-.37***	0.17***	0.042	.35***	1.000
VIF			**1.24**	**1.02**	**1.40**	**1.15**

Heteroskedasticity (White's test)

Table 4 shows White's test (White, 1980) result, an analytical method used to detect heteroskedasticity in regression models. The null hypothesis believes no heteroskedasticity. A p-value above 0.05 indicates the absence of heteroskedasticity, suggesting that the error terms have constant variance. In Table 4, the p-value for models 1 and 3 is above 0.05, demonstrating no evidence of heteroskedasticity. However, the p-value for models 2 and 4 is below 0.05, demonstrating the presence of heteroskedasticity.

TABLE 4: (Heteroskedasticity White's Test) Table 5 Wooldridge test for autocorrelation

Model 1	Coef.
Chi-square test value	3.17
P-value	0.074
Model 2	Coef.
Chi-square test value	84.68
P-value	0.000
Model 3	Coef.
Chi-square test value	0.08
P-value	0.781
Model 4	Coef.
Chi-square test value	86.06
P-value	0.000

Autocorrelation (Wooldridge test)

Table 5 demonstrates another diagnostic test the Wooldridge test outcome (Wooldridge, 2010), which is an investigative instrument used to identify autocorrelation in panel data models. The alternative hypothesis in the test suggests the existence of autocorrelation, whereas the null hypothesis states its absence. After analyzing the data, it was revealed that there was a problem of high autocorrelation, with a p-value below 0.05 rejecting the null hypothesis.

5.   REGRESSION ANALYSIS

Before executing the regression analysis, it is necessary to test certain statistical assumptions, including multicollinearity, autocorrelation, and heteroscedasticity. As explained earlier, there is no multicollinearity between the variables as we used the variance inflation factor (VIF) technique for testing multicollinearity. The highest value of VIF in all the regression models is 1.4, which indicates the lack of multicollinearity between the variables. We conduct the White's test (White, 1980) in order to detect heteroscedasticity problems. The result shows that all the models have heteroscedasticity problems as displayed in

Table 4. Furthermore, we conducted a Wooldridge test (Wooldridge, 2010) to examine the autocorrelation. The results of these tests are significant in all the regression models, indicating that heteroscedasticity and autocorrelation exist in all the models. Nonetheless, Hoechle, (2007), notes that if the model exhibits heteroscedasticity and autocorrelation problems, Stata statistical software naturally defaults to assuming homoscedastic standard errors when adjustments are made to address heteroskedasticity, as pointed out by Almeyda & Darmansyah, (2019) and Torres-Reyna, (2007). To operate this, we can use the "robust" option within the "regress" command. Therefore, we have applied the "robust" option in all our panel models. Also, dynamic panel data is used to mitigate the effect of heteroscedasticity Alipour et al., (2019).

We conducted the Breusch-Pagan Lagrange Multiplier (LM) Test to choose between a random effects model and a simple OLS regression, as outlined by Almeyda & Darmansyah, (2019). The null hypothesis suggests that the simple OLS is suitable. The LM test results confirmed that all models are suitable for applying random effects regression. To determine between random effects (REM) and fixed effects model (FEM), we performed the Hausman Test. The null hypothesis states that REM is appropriate. Our findings indicate that for all the models, the p-value is below 0.05, suggesting the suitability of FEM. There are four regression models. Models 1 and 3 explain the relation between independent variables and ROA, and models 2 and 4 exemplify the relation between independent variables and Tobin's Q. The information regarding the coefficients in the regression is presented in *Table 6*

6.   REGRESSION RESULTS

Model 1	Coef.
F-stats	51.153
P-value	0.0000
Model 2	Coef.
Chi-square test value	133.986
P-value	0.0000
Model 3	Coef.
Chi-square test value	50.760
P-value	0.0000
Model 4	Coef.
Chi-square test value	134.396
P-value	0.0000

Table 6 demonstrates the results of static regression analysis of the relationship between EP and financial performance and the effect of board gender diversity on this relationship. The regression coefficient obtained for EP is -0.001 (Model 1) and -0.01 (Model 2), which is significant at the 1 per cent level. There is a negative and significant relationship, this confirms our prediction that EP significantly impacts the firms' financial performance measured by ROA and TQ. Thus, the results support the first hypothesis, and it can be argued that a unit increase in the EP decreases the performance of the firm by 0.001 units (ROA) and 0.01 units (Tobin's Q). These findings are consistent with the results of Rao et al., (2023), Lundgren & Zhou, (2017), Shakil et al., (2022) and Gotschol et al., (2014). Rao et al., (2023) suggest that companies prioritizing environmental concerns may face diminished short-term profitability. This outcome arises as attention shifts from immediate profit maximization toward long-term, environmentally focused projects, which often yield lower financial returns in the short run. Within the limited timeframe of this study, this dynamic underscore a potential negative correlation between environmental performance (EP) and financial outcomes, consistent with the Trade-Off Theory. This theory posits that heightened social and environmental commitments can lead to increased costs, adversely affecting profitability. However, in the long term, such investments might bolster financial performance by enhancing a company's reputation for environmental responsibility, highlighting the inherent trade-off between sustainability efforts and short-term financial gains. The results are inconsistent with the results of Alipour, Ghanbari, Jamshidinavid, & Taherabadi, (2019), Dowell et al., (2000) and Zeng et al., (2010) as they discovered positive role of environmental performance on the financial performance. As for the control variables, firm size is negatively associated with ROA and TQ and this association is significant at 10% and 1% respectively. These findings are consistent with the results of Atan et al., (2018) but inconsistent with the results of Alipour et al., (2019). Table 5 shows that financial leverage is also negatively associated with ROA and TQ but the association is insignificant. This is consistent with the results of Atan et al., (2018) and Alipour et al., (2019) but contradicts Manrique & Martí-Ballester, (2017).

Further, in *Table 6*, the interactive effect of board gender diversity on the relationship between EP and performance is examined, and the coefficients of EP* BGD are used to test the second hypothesis. The goal is to find whether an increase or decrease in board gender diversity affects the relationship between EP and financial performance and whether more gender diverse board helps environmental performance to improve firm performance. As can be seen in *Table 6*, model 3 and model 4, EP*BGD are positive but insignificant, it can be argued that an increase in gender diversity has no impact on EP and the financial performance of Indian firms. The results are in support of Shakil et al., (2022) as they also found board gender diversity discovered no moderating effect on ROA. but they reported positive moderating effect of BGD

on Tobin's Q and ROE. This study is also similar to Manita et al., (2018) as they showed no significant link between board gender diversity and ESG disclosure. The insignificant relation in our study can also be linked to the low number of females in the board. Thus, the results do not support H2.

TABLE 6: Regression Analysis

Variables	Model 1 Coefficient/ Prob	Model 2 Coefficient/ Prob	Model 3 Coefficient/ Prob	Model 4 Coefficient/ Prob
EP	-0.001 (0.000)**	-0.01 (0.005)*	-0.001 (0.000)**	-0.01 (0.005)*
BGD			-0.001 (0.001)	-0.012 (0.017)
EP*BGD			0.000 (0.000)	0.000 (0.000)
LEV	-0.077 (0.056)	-0.974 (1.466)	-0.076 (0.056)	-0.881 (0.446)**
FSIZE	-.031 (0.019)*	-2.478 (0.559)***	-0.032 (0.019)*	-2.466 (0.136)***
Overall R-squared	0.081	0.529	0.083	0.531
Constant	0.824 (0.393)**	59.379 (11.831)***	0.847 (0.391)**	59.255 (2.958)***
F-statistic	6.746	13.544	4.526	81.441
Prob(F-statistic)	0.002	0.000	0.002	0.000
Hausman test (REM/FEM)	0.0000	0.0000	0.0001	0.0000
Method	**Fixed Effect Model**	**Fixed Effect Model**	**Fixed Effect Model**	**Fixed Effect Model**

Robustness test (Generalized method of moments (GMM)

Empirical studies contend that employing OLS regression with fixed or random effect models often yields inconsistent estimators. This limitation arises from their inability to account for the complexities of a dynamic panel structure and their susceptibility to assumption violations (Sharma et al., 2020). We used the GMM to evaluate the strength of our findings, specifically using a system GMM econometric technique, which ensures the accuracy of our findings. In accordance with Blundell & Bond, (1998), we employ dynamic panel data (SYS-GMM) to address the endogeneity issue, which may occur from omitted variables, simultaneous causality, measurement error, or model misspecification, and we verify the results' robustness.

According to the fundamental assumption of this dynamic GMM estimator, the estimating process is dynamic in nature and functions optimally when all moment conditions,

including homoscedasticity, completely exogenous variables, absence of multicollinearity, and no autocorrelation, are not met (Yadav & Prashar, 2022). We used GMM for a number of strong reasons. First, the data from 91 Indian enterprises is included in the study, which covers a total of 5 years from 2018 to 2022. This shows that there are more companies (N) than there are times (T) (Shakil et al., 2019).

(Areliano & Boverb, 1995; Arellano & Bond, 1991 and Blundell & Bond, 1998) were the first to propose this particular approach. Additionally, the system GMM approach successfully addresses the issues of autocorrelation and omitted variable bias, producing accurate estimates. Additionally, it has been suggested that, in comparison to other GMM econometric methodologies, the system GMM technique yields more accurate estimates (Baltagi, 2008). The System GMM method includes two distinct approaches: the one-step and the two-step system GMM. Notably, estimators generated by the two-step system GMM are more efficient

than those generated by one-step methods. Because it makes use of ideal weighting matrices, the two-step estimator is more efficient ((Alipour et al., 2019). As a result, we used a two-step system GMM in our investigation. Two tests, the Sargan test and the serial correlation test, can be used to examine the results (Arellano & Bond, 1991). **Table 7** displays the GMM results, which are in line with our hypotheses and comparable to the static panel data (fixed effect) results. EP significantly reduces ROA (b = -0.055; p < 0.05). Additionally, Tobin's Q is significantly improved by EP (b = 0.171; p < 0.05). This is contrary to the static model results. Furthermore, **Table 7** shows that board gender diversity has an insignificant positive impact on the link between EP and ROA, which is consistent with the findings of static analysis. Additional research can take into account the variations in outcomes. These variations may be due to methodological differences. If endogeneity arising from reverse causality is not handled, it may skew regression coefficients. Incorporating a one-year lag for the dependent variable in the dynamic regression models mitigates potential issues of causality influencing the outcomes. The significance of the lagged dependent variable's coefficients in our findings underscores the robustness and validity of the models. The Sargan test evaluates the validity of over-identifying instrument restrictions by testing the null hypothesis that the instruments are uncorrelated with the error terms. A p-value above 5% indicates non-rejection of the null hypothesis, affirming the appropriateness of the instruments used in the model. Additionally, the significance of Wald's test (**Table 7**) confirms the overall validity of the estimated regression models. Regarding serial correlation, the null hypothesis of no first-order serial correlation (AR1) should be rejected, while the null hypothesis of no second-order serial correlation (AR2) should not. The results demonstrate significant AR(1) values across all models and insignificant AR(2) values, signifying the presence of first-order autocorrelation and the

absence of second-order autocorrelation. Collectively, these indicators confirm the robustness and validity of our findings.

TABLE 7: GMM results

Variables	GMModel 1 Coefficient/Prob	GMModel 2 Coefficient/Prob	GMModel 3 Coefficient/Prob	GMModel 4 Coefficient/Prob
ROA(-1)	0.571 (0.118)***		0.543 (0.152)***	
TQ(-1)		0.337 (0.084)***		0.366 (0.101)***
EP	-0.055 (0.322)**	0.171 (0.089)*	-0.082 (0.327)**	0.186 (0.069)***
BGD			-0.162 (0.209)	-0.045 (0.063)
EP*BGD			0.000 (0.000)	-0.000 (0.000)
LEV	-2.229 (0.897)**	0.1481 (0.271)	-1.675 (0.824)**	0.142 (0.228)
FSIZE	2.637 (5.791)	-11.5972 (1.947)***	0.873 (6.061)	-10.707 (1.674)***
Constant	-10.803 (17.384)**	35.957 (6.079)***	0.048 (0.060)	33.235 (5.224)***
AR(1) p-value	-3.027 (0.0025)***	-2.45 (0.014)***	-2.731 (0.0063)***	-2.38 (0.018)***
AR (2) p-value	-0.33496 (0.7377)	1.772 (0.076)	-0.617 (0.537)	1.5423 (0.123)
Sargan test	36.101 (0.2827)	39.873 (0.2623)	41.529 (0.404)	43.366 (0.329)
Wald test	45.0036 (0.000)***	206.645 (0.000)***	43.324 (0.000)***	221.977 (0.000)***
Instruments	37	40	46	46

7. CONCLUSION

This study investigates the relationship between environmental performance (EP) and financial performance (FP) of Indian firms, while examining the moderating role of board gender diversity. The findings reveal a negative relationship between EP and FP, suggesting that higher investments in environmental initiatives may not yield immediate financial benefits for Indian firms. This could be due to the significant costs associated with implementing sustainable practices, linked with the delayed realization of their long-term benefits.

Furthermore, the moderating effect of board gender diversity on this relationship was found to be statistically insignificant. This implies that the presence of gender-diverse boards does not significantly influence the financial outcomes of firms' environmental initiatives. While gender diversity is often linked to improved decision-making and strategic oversight, its role in driving financial performance through environmental strategies remains limited in the context of Indian firms. These results underline the complexities of

balancing environmental and financial priorities in emerging economies like India, where regulatory pressures and market dynamics may not fully align with sustainability objectives.

In conclusion, while environmental initiatives remain crucial for sustainable development, their financial implications require careful consideration. Policymakers and corporate leaders must work collaboratively to create frameworks that incentivize sustainability without compromising financial viability. This study contributes to the growing body of literature on ESG dimensions in emerging markets, emphasizing the nuanced challenges Indian firms face in their sustainability journey.

8.   LIMITATION AND FUTURE RESEARCH

This study has certain limitations that warrant attention. First, the analysis is based on firm- level data from a specific timeframe, which may not fully capture the long-term effects of environmental performance on financial outcomes. The short time horizon limits the ability to understand whether the observed negative impact of environmental performance on financial performance persists or changes over time. Second, while board gender diversity was examined as a moderating factor, other governance variables, such as board expertise or independence, were not considered, which could offer additional insights into the governance mechanisms influencing this relationship. Furthermore, the study focuses solely on Indian firms, and the findings may not be generalizable to firms in other emerging or developed markets due to differences in regulatory, cultural, and market environments.

Future research can address these limitations by employing longer panel data to better understand the long-term dynamics between environmental and financial performance. Investigating the role of other governance factors, such as board independence or ESG-specific committees, could provide a more comprehensive view of governance impacts. Additionally, cross-country comparative studies could shed light on how institutional and cultural differences shape the EP-FP relationship and the moderating role of board diversity. Finally, integrating stakeholder perspectives and exploring sector-specific dynamics could further enhance the understanding of how different industries and market contexts influence the financial implications of environmental strategies.

REFERENCES

[1.] Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, *94*(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007

[2.] Alipour, M., Ghanbari, M., Jamshidinavid, B., & Taherabadi, A. (2019). Does board independence moderate the relationship between environmental disclosure quality and performance? Evidence from static and dynamic panel data. *Corporate Governance (Bingley)*, *19*(3), 580–610.

https://doi.org/10.1108/CG-06-2018-0196

[3.] Almeyda, R., & Darmansyah, A. (2019). The Influence of Environmental, Social, and Governance (ESG) Disclosure on Firm Financial Performance. *IPTEK Journal of Proceedings Series.*, *5*, 278–290. https://doi.org/http://dx.doi.org/10.12962/j23546026.y2019i5.6340

[4.] Arayssi, M., Jizi, M., & Tabaja, H. H. (2020). The impact of board composition on the level of ESG disclosures in GCC countries. *Sustainability Accounting, Management and Policy Journal*, *11*(1), 137–161. https://doi.org/10.1108/SAMPJ-05-2018-0136

[5.] Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/https://doi.org/10.2307/2297968

[6.] Arellano, M., & Boverb, O. (1995). Another look at the instrumental variable estimation of error- components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/https://doi.org/10.1016/0304-4076(94)01642-D

[7.] Atan, R., Alam, M. M., Said, J., & Zamri, M. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. *Management of Environmental Quality: An International Journal*, *29*(2), 182–194. https://doi.org/10.1108/MEQ- 03-2017-0033

[8.] Baltagi, B. H. (2008). Forecasting with panel data. *Journal of Forecasting*, *27*(2), 153–173. https://doi.org/10.1002/for.1047

[9.] Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*, 115–143. https://doi.org/https://doi.org/10.1016/S0304- 4076(98)00009-8

[10.] Boshnak, H. A., Alsharif, M., & Alharthi, M. (2023). Corporate governance mechanisms and firm performance in Saudi Arabia before and during the COVID-19 outbreak. *Cogent Business and Management*, *10*(1). https://doi.org/10.1080/23311975.2023.2195990

[11.] Cai, L., Cui, J., & Jo, H. (2016). Corporate Environmental Responsibility and Firm Risk. *Journal of Business Ethics*, *139*(3), 563–594. https://doi.org/10.1007/s10551-015-2630-4

[12.] Chang, K. (2015). The impacts of environmental performance and propensity disclosure on financial performance: Empirical evidence from unbalanced panel data of heavy-pollution industries in China. *Journal of Industrial Engineering and Management*, *8*(1), 21–36. https://doi.org/10.3926/jiem.1240

[13.] Chu, C. I., Chatterjee, B., & Brown, A. (2013). The current status of greenhouse gas reporting by Chinese companies: A test of legitimacy theory. *Managerial Auditing Journal*, *28*(2), 114–139. https://doi.org/10.1108/02686901311284531

[14.] Connelly, J. T., & Limpaphayom, P. (2004). Greenleaf Publishing Environmental Reporting and Firm Performance: Evidence from Thailand. *Source: The Journal of Corporate Citizenship*, *13*, 137–149. https://doi.org/10.2307/jcorpciti.13.137

[15.] de Burgos-Jiménez, J., Vázquez-Brust, D., Plaza-Úbeda, J. A., & Dijkshoorn, J. (2013).

[16.] Environmental protection and financial performance: An empirical analysis in Wales. *International Journal of Operations and Production Management*, *33*(8), 981–1018. https://doi.org/10.1108/IJOPM-11-2010-0374

[17.] De Masi, S., Słomka-Gołębiowska, A., Becagli, C., & Paci, A. (2021). Toward sustainable corporate behavior: The effect of the critical mass of female directors on environmental, social,

and governance disclosure. *Business Strategy and the Environment*, *30*(4), 1865–1878. https://doi.org/10.1002/bse.2721

[18.] Deegan, C. (2002). Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation. In *Accounting, Auditing & Accountability Journal* (Vol. 15, Issue 3, pp. 282–311). https://doi.org/10.1108/09513570210435852

[19.] Deswanto, R. B., & Siregar, S. V. (2018). The associations between environmental disclosures with financial performance, environmental performance, and firm value. *Social Responsibility Journal*, *14*(1), 180–193. https://doi.org/10.1108/SRJ-01-2017-0005

[20.] Dowell, G., Hart, S., & Yeung, B. (2000). Do corporate global environmental standards create or destroy market value? *Management Science*, *46*(8), 1059–1074. https://doi.org/10.1287/mnsc.46.8.1059.12030

[21.] Edmans, A. (2011). Does the stock market fully value intangibles? Employee satisfaction and equity prices. *Journal of Financial Economics*, *101*(3), 621–640. https://doi.org/10.1016/j.jfineco.2011.03.021

[22.] El Ghoul, S., Guedhami, O., Kwok, C. C. Y., & Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking and Finance*, *35*(9), 2388–2406. https://doi.org/10.1016/j.jbankfin.2011.02.007

[23.] Fernando, S.;, & Lawrence, S. (2014). A theoretical framework for CSR practices: Integrating legitimacy theory, stakeholder theory and institutional theory. *Journal of Theoretical Accounting Research*, *10*(1), 149–178. https://www.sciencedirect.com/science/article/pii/S0361368217300491https://www.journals.elsevier.com/accounting-organizations-and-societyViewproject

[24.] Friedman, M. (2007). *The Social Responsibility of Business Is to Increase Its Profits* (W. C. Zimmerli, M. Holzinger, & K. Richter, Eds.). Corporate Ethics and Corporate Governance. Springer, Berlin, Heidelberg. https://doi.org/https://doi.org/10.1007/978-3-540-70818-6_14

[25.] Giannopoulos, G., Fagernes, R. V. K., Elmarzouky, M., & Hossain, K. A. B. M. A. (2022). The ESG Disclosure and the Financial Performance of Norwegian Listed Firms. *Journal of Risk and Financial Management*, *15*(6). https://doi.org/10.3390/JRFM15060237

[26.] González-Benito, J., & González-Benito, Ó. (2005). Environmental proactivity and business performance: An empirical analysis. *Omega*, *33*(1), 1–15. https://doi.org/10.1016/j.omega.2004.03.002

[27.] Gotschol, A., De Giovanni, P., & Esposito Vinzi, V. (2014). Is environmental management an economically sustainable business? *Journal of Environmental Management*, *144*, 73–82. https://doi.org/10.1016/j.jenvman.2014.05.001

[28.] Gray, R., Owen, D., & Adams, C. (2009). Some theories for social accounting?: A review essay and a tentative pedagogic categorisation of theorisations around social accounting. *Sustainability, Environmental Performance and Disclosures*, *4*, 1–54.

[29.] Gujarati. (1995). *Basic Econometrics* . McGraw-Hill.

[30.] Gupta, A. K., & Gupta, N. (2020). Effect of corporate environmental sustainability on dimensions of firm performance – Towards sustainable development: Evidence from India. *Journal of Cleaner Production*, *253*. https://doi.org/10.1016/j.jclepro.2019.119948

[31.] Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. In *The Stata Journal* (Vol. 7, Issue 3).

[32.] Horbach, J., & Jacob, J. (2018). The relevance of personal characteristics and gender diversity for (eco-)innovation activities at the firm-level: Results from a linked employer–employee database in Germany. *Business Strategy and the Environment*, *27*(7), 924–934. https://doi.org/10.1002/bse.2042

[33.] Husted, B. W., & Sousa-Filho, J. M. de. (2019). Board structure and environmental, social, and governance disclosure in Latin America. *Journal of Business Research*, *102*, 220–227. https://doi.org/10.1016/j.jbusres.2018.01.017

[34.] Iatridis, G. E. (2013). Environmental disclosure quality: Evidence on environmental performance, corporate governance and value relevance. *Emerging Markets Review*, *14*(1), 55–75. https://doi.org/10.1016/j.ememar.2012.11.003

[35.] Igini, M. (2024). *5 Biggest Environmental Issues in India*. https://earth.org/environmental-issues-in- india/

[36.] Kahloul, I., Sbai, H., & Grira, J. (2022). Does Corporate Social Responsibility reporting improve financial performance? The moderating role of board diversity and gender composition.

[37.] *Quarterly Review of Economics and Finance*, *84*, 305–314. https://doi.org/10.1016/j.qref.2022.03.001

[38.] Kyaw, K., Olugbode, M., & Petracci, B. (2017). Can board gender diversity promote corporate social performance? *Corporate Governance (Bingley)*, *17*(5), 789–802. https://doi.org/10.1108/CG-09- 2016-0183

[39.] Li, D., Zhao, Y., Sun, Y., & Yin, D. (2017). Corporate Environment Performance, Environmental Information Disclosure and Financial Performance: Evidence from China. *Human and Ecological Risk Assessment: An International Journal*, *23*(2), 323–339. https://doi.org/https://doi.org/10.1080/10807039.2016.1247256

[40.] Lorraine, N. H. J., Collison, D. J., & Power, D. M. (2004). An analysis of the stock market impact of environmental performance information. *Accounting Forum*, *28*(1), 7–26. https://doi.org/10.1016/j.accfor.2004.04.002

[41.] Lu, L. W., & Taylor, M. E. (2018). A study of the relationships among environmental performance, environmental disclosure, and financial performance. *Asian Review of Accounting*, *26*(1), 107–130. https://doi.org/10.1108/ARA-01-2016-0010

[42.] Lundgren, T., & Zhou, W. (2017). Firm performance and the role of environmental management.

[43.] *Journal of Environmental Management*, *203*, 330–341. https://doi.org/10.1016/j.jenvman.2017.07.053

[44.] Malarvizhi, P., & Matta, R. (2016). "Link between Corporate Environmental Disclosure and Firm Performance"-Perception or Reality? *Review of Integrative Business and Economics Research*, *5*(3), 1–34. http://www.latimes.com/world/europe/la-fg-climate-change-talks-paris-updates- htmlstory.html

[45.] Manita, R., Bruna, M. G., Dang, R., & Houanti, L. (2018). Board gender diversity and ESG disclosure: evidence from the USA. *Journal of Applied Accounting Research*, *19*(2), 206–224. https://doi.org/10.1108/JAAR-01-2017-0024

[46.] Manrique, S., & Martí-Ballester, C. P. (2017). Analyzing the effect of corporate environmental performance on corporate financial performance in developed and developing countries. *Sustainability (Switzerland)*, *9*(11). https://doi.org/10.3390/su9111957

[47.] Martin, P. R., & Moser, D. V. (2016). Managers' green investment disclosures and investors' reaction.

[48.] *Journal of Accounting and Economics*, *61*(1), 239–254. https://doi.org/10.1016/j.jacceco.2015.08.004

[49.] Masmoudi, S., & Barhoumi, J. (2023). The Impact of

Corporate Social Responsibility Disclosure on Firm Value: The Moderating Role of Board Gender Diversity in French Companies. *Journal of Commerce and Accounting Research*, *1*, 39. http://publishingindia.com/jcar/

[50.] Mousa, G. A., & Hassan, N. T. (2015). Legitimacy Theory and Environmental Practices: Short Notes.

[51.] *International Journal of Business and Statistical Analysis*, *2*(1), 2384–4663. https://doi.org/http://dx.doi.org/10.12785/IJBSA/020104

[52.] Nur Utomo, M., Rahayu, S., Kaujan, K., & Agus Irwandi, S. (2020). Environmental performance, environmental disclosure, and firm value: empirical study of non-financial companies at Indonesia Stock Exchange. *Green Finance*, *2*(1), 100–113. https://doi.org/10.3934/GF.2020006

[53.] Rao, A., Dagar, V., Sohag, K., Dagher, L., & Tanin, T. I. (2023). Good for the planet, good for the wallet: The ESG impact on financial performance in India. *Finance Research Letters*, *56*. https://doi.org/10.1016/j.frl.2023.104093

[54.] Rossi, M., Chouaibi, J., Chouaibi, S., Jilani, W., & Chouaibi, Y. (2021). Does a Board Characteristic Moderate the Relationship between CSR Practices and Financial Performance? Evidence from European ESG Firms. *Journal of Risk and Financial Management*, *14*(8). https://doi.org/10.3390/jrfm14080354

[55.] Shakil, M. H. (2022). Environmental, social and governance performance and stock price volatility: A moderating role of firm size. *Journal of Public Affairs*, *22*(3). https://doi.org/10.1002/pa.2574

[56.] Shakil, M. H., Mahmood, N., Tasnia, M., & Munim, Z. H. (2019). Do environmental, social and governance performance affect the financial performance of banks? A cross-country study of emerging market banks. *Management of Environmental Quality: An International Journal*, *30*(6), 1331–1344. https://doi.org/10.1108/MEQ-08-2018-0155

[57.] Shakil, M. H., Munim, Z. H., Zamore, S., & Tasnia, M. (2022). Sustainability and financial performance of transport and logistics firms: Does board gender diversity matter? *Journal of Sustainable Finance and Investment*. https://doi.org/10.1080/20430795.2022.2039998

[58.] Sharma, P., Panday, P., & Dangwal, R. C. (2020). Determinants of environmental, social and corporate governance (ESG) disclosure: a study of Indian companies. *International Journal of Disclosure and Governance*, *17*(4), 208–217. https://doi.org/10.1057/s41310-020-00085-y

[59.] Tan, S. H., Habibullah, M. S., Tan, S. K., & Choon, S. W. (2017). The impact of the dimensions of environmental performance on firm performance in travel and tourism industry. *Journal of Environmental Management*, *203*, 603–611. https://doi.org/10.1016/j.jenvman.2017.02.029

[60.] Torres-Reyna, O. (2007). *Panel Data Analysis Fixed and Random Effects using Stata (v. 4.2)*. http://dss.princeton.edu/training/

[61.] Tulung, J. E., & Ramdani, D. (2018). Independence, size and performance of the board: An emerging market research. *Corporate Ownership and Control*, *15*(2–1), 201–208. https://doi.org/10.22495/cocv15i2c1p6

[62.] Wagner, M. (2007). Integration of Environmental Management with Other Managerial Functions of the Firm. Empirical Effects on Drivers of Economic Performance. *Long Range Planning*, *40*(6), 611–628. https://doi.org/10.1016/j.lrp.2007.08.001

[63.] White, H., & White1, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica*, *48*(4), 817–838. https://www.jstor.org/stable/1912934

[64.] Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge.

[65.] Yadav, P., & Prashar, A. (2022). Board gender diversity: implications for environment, social, and governance (ESG) performance of Indian firms. *International Journal of Productivity and Performance Management*. https://doi.org/10.1108/IJPPM-12-2021-0689

[66.] Zeng, S. X., Meng, X. H., Yin, H. T., Tam, C. M., & Sun, L. (2010). Impact of cleaner production on business performance. *Journal of Cleaner Production*, *18*(10–11), 975–983. https://doi.org/10.1016/j.jclepro.2010.02.019

Cointegration between Stock Movements of G20 Countries

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ABSTRACT

This study is to examine the cointegration dynamics among the stock markets of nations belonging to the G20, representing the world's largest economies. Mainly, this paper aims to analyse the long-term relationships between these markets in terms of their degree of integration and interdependence. This research then uses very advanced econometric techniques, specifically Johansen cointegration tests, vector error correction models (VECM), as well as Granger causality analysis, to detect and evaluate the presence of cointegration with a comprehensive dataset spanning multiple years. The main findings have shown significant evidence of inter-connectedness among G20 stock markets, indicating the presence of long-term equilibrium states in place despite short-term fluctuations. Thus, these results have implications regarding similar timing behaviours in stock price movements amongst these economies, as it speaks to implications for investors regarding portfolio diversification and risk management. In addition, the outcomes better equip policymakers to understand the nature of global financial architecture, particularly how high market integration creates risks and opportunities. Thus, the study concludes that integrating G20 stock markets articulates broader trends of globalization and financial interdependence but varies with regions and over time. In that sense, such research contributes to the literature on international finance by providing more nuanced perspectives into the dynamics of how the landscape of global capital markets evolves, thus laying a foundation for more explorations of the complexities of international financial relationships. It puts a strong emphasis on monitoring the interconnected systems to foresee system risks and construct resilient global economic strategies.

Keywords: VECM, cointergration, stock, equilibrium.

1. INTRODUCTION

Cointegration analysis is a powerful tool used to explore the long-term equilibrium relationship between the stock movements of various entities, such as the G20 countries, which represent a significant portion of the global economy. In this research, we focus on utilizing cointegration analysis as a robust method to examine the long-term equilibrium connections within the stock movements of significant entities, exemplified by the G20 countries, which hold substantial influence over the global economy. By scrutinizing the interaction among these stock market dynamics, we aim to uncover the underlying relationships and patterns between the stock markets of G20 nations. Our objective is to identify whether a stable, enduring equilibrium exists among their stock movements, or if there are disparities that could signify opportunities for arbitrage or indicate potential shifts in economic conditions.

Employing meticulous statistical analysis and econometric techniques, we endeavour to elucidate the driving forces behind the synchronized movements of stock prices across G20 nations. This entails considering various factors, including economic indicators, geopolitical occurrences, and financial market dynamics. Ultimately, our exploration of cointegration within the framework of G20 stock markets contributes to a more profound comprehension of the global financial terrain, furnishing valuable insights for investors,

policymakers, and researchers alike. This research investigates the cointegration dynamics among the stock movements of G20 countries, a group of nations that hold significant sway over the global economy. Cointegration analysis provides a framework for examining the enduring relationships and equilibrium states within these stock markets. By observing the interactions and mutual influences of these markets over time, we gain insights into the interconnectedness and interdependencies among the economies of the G20 nations. Through this inquiry, our objective is to unveil the fundamental patterns and connections that govern the stock markets of G20 countries. By identifying cointegrated relationships, we aim to discern whether a stable, long-term equilibrium exists among their stock movements or if variations occur, potentially indicating economic shifts or presenting opportunities for arbitrage.

To accomplish this, we employ a rigorous approach involving statistical analysis and econometric techniques. Our methodology encompasses the comprehensive consideration of various factors, ranging from economic indicators and geopolitical events to financial market dynamics. Ultimately, the findings of our exploration into the cointegration of G20 stock markets promise to enrich our understanding of the global financial landscape. These insights are poised to offer valuable guidance for investors, policymakers, and researchers navigating the complexities inherent in international finance. Stock markets are central to

the global economy, serving as key indicators of economic health and vital channels for allocating capital. The fluctuations in stock prices reflect a intricate interplay of economic fundamentals, investor sentiment, and external influences, shaping the economic fortunes of nations and impacting countless individuals worldwide. Amidst various methods of analysing stock market dynamics, cointegration analysis emerges as a potent tool for revealing enduring relationships and equilibrium states within these markets.

The Group of Twenty (G20) such as Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, United Kingdom, United States, European Union (EU) represented collectively by the European Commission and the European Central Bank (ECB) serves as a prominent platform for international economic collaboration, convening major advanced and emerging economies to tackle critical challenges and promote sustainable development. Consequently, the stock markets of G20 nations hold significant importance, collectively exerting influence on global financial stability and economic progress. This study embarks on an extensive exploration of cointegration dynamics among the stock movements of G20 nations, with the aim of illuminating the interconnectedness and interdependencies inherent in these markets. Background and Significance: The concept of cointegration, introduced by Nobel laureate Clive Granger in the early 1980s, transformed time series analysis by providing a framework for understanding the enduring relationships among non-stationary variables. Unlike correlation, which measures the strength and direction of linear relationships, cointegration focuses on identifying stable, long-term equilibrium relationships, even amidst short-term fluctuations. In the realm of financial markets, cointegration analysis has been widely utilized to examine the co-movements of asset prices, spanning stocks, bonds, and currencies. By pinpointing cointegrated relationships, researchers can discern whether certain assets tend to move together over extended periods, offering valuable insights for diversifying portfolios, managing risks, and devising trading strategies. Comprising 19 individual nations and the European Union, the G20 collectively represents approximately 85% of global gross domestic product (GDP) and two-thirds of the world's population. Consequently, the stock markets of G20 countries attract significant attention from investors, policymakers, and researchers alike. Understanding the dynamics of these markets and their interconnections is pivotal for predicting systemic risks, evaluating contagion effects, and shaping policy responses to financial crises.

2. REVIEW OF LITERATURE

1. *Stock Movements (SM)*

Stock movements of G20 countries is an independent variable. They stand in for the stock values or stock market indices of each of the G20 nations, including the Nikkei 225 in Japan, the S&P 500 in the United States, and the FTSE 100 in the United Kingdom. Since the stock movements of the other nations in the analysis do not directly affect each country's stock movement, each country's stock movement is considered an independent variable. New knowledge is primarily what drives stock movements (Li et al., 2021) stock markets are thought to be impacted by societal sentiment, financial news, and market data. In earlier research, the information and stock movements were usually studied by concatenating the many information sources features into a single super feature vector. Concatenated vector techniques, on the other hand, handle each information source independently and disregard their interdependencies. In this paper, the intrinsic connections between tensors and the multifaceted information held by investors. In order to examine the combined influence of many information sources on stock markets, suggests a supervised tensor regression learning approach to detect the nonlinear relationships between stock movements and fresh information. Tests conducted in 2011 on the CSI 100 stocks demonstrate that the method beats the most advanced trading methods. (Shwai and ShiGu, 2021) earlier have used past trading records to predict what will happen in the stock market. But now, with the growth of social media since many people involved in the market share their strategies on social platforms, it becomes easier to understand what direction the whole market is leaning towards regarding future moves. (Hepsen and Tas, 2014) using panel data series, the effects of macroeconomic indicators on the volume of the gross domestic product were investigated, results of this study will assist investors and G20 nations in developing macroeconomic policies that are more successful. From a policy standpoint, the government's response to these indicators is framed by the potential ups and downs in the macro indicators' future. Future values may make it more likely for investors to make careful investments in the financial market.

2. *Cointegration Relationship (CR)*

Cointegration Relationship is a dependent variable here, Cointegration, in the world of finance and financial markets, especially the stock markets, implies a long-term stable and predictable relationship between the returns or prices of different assets. To address the problem of a spurious regression, that is, when two non-stationary time series variables seem to be related but do not have a significant, long-term, or stable connection. Cointegration became a concept in the field of statistics. Cointegration theory posits that although individual time series may be non-stationary, volatile in the short run, and have random walks, they are still linked by a stable equilibrium relationship and have a common stochastic trend in the long run. (Wang, 2012) unsmooths the valuation-based property return indices, the study suggests a multivariate method that makes use of information inferred from other variables underlying

economic relationships and cointegration relationships, the methodology is employed to analyse and rectify any smoothing present in the UK property return indexes. (Kiran, 2021) Using Robinson (1994a) tests for fractional integration and cointegration in place of the traditional methods, this research investigates the long-term link between oil prices and stock market prices of G7 countries. The existence of a fractional cointegration link between oil prices and stock market prices is investigated for any given series. Test findings on the residuals from the cointegrating regressions show that, in contrast to the other indices, there is evidence of fractional cointegration between oil prices and the DAX 30, Dow Jones, FTSE 100, and SP-TSX. (Dirican and Canoz, 2017) The prices of Bitcoin and the top US and Chinese stock market indexes are found to be cointegrated. It is clear from this that investors in various stock markets may be swayed by the price of Bitcoin when making long-term investment decisions (Zhao et al., 2017) examines the long-term relationship between the European market's carbon pricing, the price of coal, the economy, and temperature in China's ETS pilot programs. Owing to the fact that each variable has structural breakdowns, cointegration techniques that take into account one and two structural breaks are used. The long-run cointegration link between the carbon price and its variables is demonstrated by the results. In terms of explaining the real relationship, the cointegration model with structural fractures performs better than traditional cointegration models. With the exception of Shanghai's economy, every variable has a considerable impact on the price of carbon, with coal prices being the main determinant. (Camba et al., 2020) The cointegration relationship and causal association between internet penetration and broadband subscription and economic growth from the ten ASEAN countries between 2000 and 2016 are examined in this study. It was decided to create a pooled multiple regression model that would show GDP growth in relation to broadband subscription and internet penetration. A long-run equilibrium relationship between the three variables was assessed using the Johansen-Fisher panel cointegration, and the direction of causality was determined by estimating the panel-based vector error correction model (VECM). (Canoz, and Dirican, 2017) Exploring whether Bitcoin's price sways stock market trading decisions is akin to unravelling a tightly wound spool of thread. This study narrows its focus solely on the investment aspect of Bitcoin, which currently casts a long shadow over other cryptocurrency roles like money and payment systems due to its prominence in financial discussions. The methodology employed here ventures into uncharted waters by examining the cointegration relationships between cryptocurrencies and various stock market indices—a path not previously trodden in academic research. By employing the ARDL boundary test, this investigation seeks to discern patterns between selected stock indexes and Bitcoin, standing out as both a pioneer among its peers and holding the largest share in this digital frontier. (Tandon and Paramati, 2013) this study explores the intricate

dance between Australia's stock market and eighteen emerging frontier markets across five diverse regions. By examining weekly closing prices from broad market indices, we delve into both the immediate and enduring ties that bind these financial landscapes. The relationship, much like a slowly unfolding drama on a grand stage, reveals modest yet evolving connections through time. As if navigating an ancient map where new lands gradually come into focus, our analysis employs the AGDCC GARCH model to trace these subtle shifts in correlation patterns. While some relationships remain as faint whispers carried by trade winds across vast oceans of economic activity, others have strengthened slightly under specific conditions such as during global financial disturbances. In this complex web woven by globalization's invisible hands—a tapestry featuring threads from continents apart—the Australian market stands not as a conqueror but rather akin to an old sage: experienced yet constantly learning from its younger counterparts scattered around globe's mosaic.

3. CONTROL VARIABLES

So as to isolate the impact of WOB on the FP of the firm, certain variables are held constant. The variables are Leverage, Company Age and Company Size.

4. GDP

In essence, the gross domestic product, or GDP, measures the total value of every commodity produced based on a nation's borders within a specific timeframe, commonly a year or quarter. It is often considered a critical indicator of an economy's size and state and is one of the most widely used indicators to gauge the success of a country's economy. This has frequently been used control variable (Ionascu et al., 2018; Kamath, 2022; Singh et al.,2021; Srivastava et al., 2018)

5. IMPACT OF STOCK MOVEMENTS AND COINTEGRATION RELATIONSHIP

(Phiri et al., 2023) uses daily data covering the period from February 2, 2020 to August 28, 2021 to investigate the co-movement between the key equity market stock returns in the G20 countries and the worldwide COVID-19 indicators (cases, recoveries, and deaths). Our empirical findings demonstrate that during the course of the time window, there has been a flip in the co-movement between COVID-19 and G20 stock returns between positive and negative correlations. Further findings from the wavelet coherence analysis show that for cases and deaths, negative (positive) co-movements are more mixed and primarily manifest as lower (higher) frequencies. The results also demonstrate that the short-frequency components are associated with times around the first declaration of the pandemic and the subsequent COVID-19 virus variations.

The biggest unregulated bitcoin derivatives market, BitMEX lists contracts that can be used for hedging and leverage

trading. We analyse its price discovery and hedging efficacy using minute-by-minute data. The efficiency of its hedging and price discovery are examined by (Alexander et al., 2019). We find that prices on the main bitcoin spot exchanges are influenced by BitMEX derivatives. Important factors that influence price discovery include relative trading volumes, bid-ask spreads, and inter-exchange spreads. Subsequent investigation reveals that BitMEX futures are an efficient hedge against spot price volatility, have positive net spillover effects, and are more informationally efficient than bitcoin spot pricing. Based on our research, regulators should give the validity of BitMEX and its contracts first priority.

Examines the dynamic mechanism of volatility spillovers between the G20 stock markets and important global financial indicators. (Korkusuz et al., 2023) integrates complex network theory with a bivariate GARCH-BEKK model to investigate volatility spillover relations. In particular, we use the spatial connectivity of spillovers (i.e., nodes and edges) to build a volatility network of global financial markets. The results demonstrate that over the five sub-periods that were investigated, the spillover linkages between global variables and G20 markets differ significantly. Interestingly, networks during crisis times are far denser than during non-crisis times. The Global Financial Crisis (2008) and the COVID-19 Crisis (2020) are two crisis periods that can be compared. According to network statistics, the later period's volatility spillovers are more intense and transitive than the former. implies that there is a faster spread of financial instability (Pradhan et al., 2021) examines the possibility of Granger causal linkages between economic growth, inflation rate, real interest rate, bond market development, and stock market development. aims to broaden the discussion of economic growth by delving deeper than is typically done in the literature into the potential effects of developments in the bond and stock markets on growth. offers empirical evidence that the development of the stock and bond markets is correlated with the rate of inflation, real interest rates, and economic growth. The most convincing outcome of the panel Granger causality test is that the development of the bond and stock markets, the rate of inflation, and the real interest rate are all observable long-term drivers of economic growth.

Therefore, we propose the following conceptual model in Figure I:
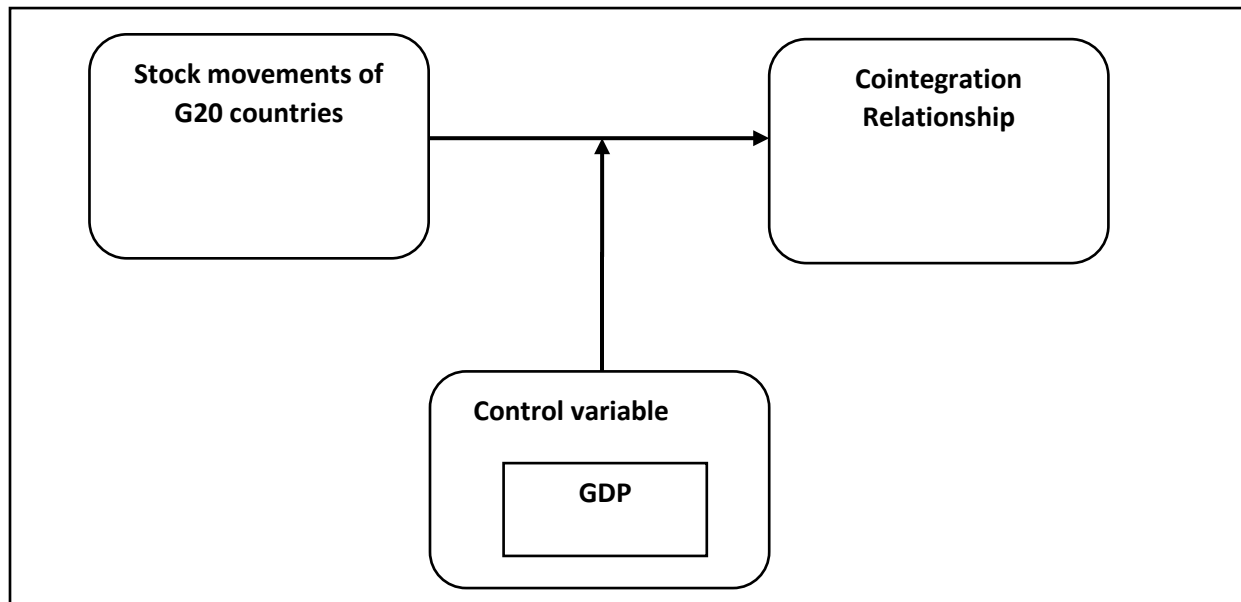
Figure I. Conceptual model.

Source: Authors.

The Covid-19 pandemic's effects on stock market returns and volatility in the G20 countries (Caporale et al., 2022). This analysis uses a far more sophisticated Covid-19 index based on a Balanced Worth (BW) methodology in place of Covid-19 deaths, and it accounts for heterogeneity by providing additional estimates for the G7 and the remaining countries (non-G7) separately. The analysis is based on a comprehensive dynamic panel model that takes into account the effects of both the epidemiological situation and restrictive measures as well as fiscal and monetary responses. Therefore, we propose the hypothesis:

(H1): There exists a long term relationship or cointegration between the stock movements of G20 countries.

(H0): There is a no long term relationship or cointegration between the stock movements of G20 countries.

This hypothesis suggests that either the stock movements of G20 countries move independently or move together in the long run. For testing this hypothesis we have applied cointegration analysis to the stock movements of the G20 countries and by analyzing the result we can determine if there is a long term relationship between the stock prices of these countries.

The general form of a cointegration equation for two variables Yt and Xt can be expressed as:

$Yt = \alpha + \beta Xt + \varepsilon t Yt = \alpha + \beta Xt + \varepsilon t$ (1)

Where:

- Yt is the dependent variable.
- Xt is the independent variable.
- α is the intercept term.
- β is the coefficient representing the long-term relationship between $YtYt$ and $XtXt$.
- εt is the error term, which captures short-term deviations from the long-term equilibrium.

The coefficient β indicates the strength and direction of the long-term relationship between the variables. If β is statistically significant and positive, it suggests a positive long-term relationship between Yt and Xt, while a statistically significant negative coefficient indicates a negative long-term relationship.

In a multivariate setting with more than two variables, the cointegration equation becomes more complex, involving multiple independent variables and possibly lagged terms to account for dynamics in the system. The specific form of the equation depends on the model specification and estimation technique used in the analysis.

6. RESEARCH GAP IDENTIFICATION

There is a significant lack of research focused on examining the cointegration relationship between stock movements and in exploring the broader macro-financial linkages between G20 countries. This involve investigating how factors such as GDP growth, inflation cointegrate with stock market integration.

7. METHODOLOGY

Research Design

The research is conducted using a quantitative empirical research design. The purpose of this research design is to systematically collect and analyse to test hypotheses, econometric techniques are used in this quantitative empirical research design to assess the cointegration linkages between the stock movements of the G20 countries.

Sampling Design

The sampling has been done through Convenience sampling. 20 countries have been considered for the present study. Collected data from different national stock exchanges of these countries.

Data collection

The study is conducted for the last 20 years data, i.e., from 1992 to 2022. All the data collected are secondary data and it has been collected from a secondary source.

Data Analysis Techniques

Data Analysis includes usage of statistical and logical methods to comprehend the scope of the data, organize its structure, condense it, and visualize it using tables, graphs, and charts. Also, to draw conclusions and develop judgements, it incorporates statistical and probability data. Data must be gathered from trustworthy, objective sources and managed with integrity in order to be subject to good data analysis practices. To achieve accurate and significant results, it also necessitates the adoption of proper data collecting and analysis procedures. The techniques of data analysis employed in this study, with the help of data analysis tool E views are discussed below in more detail.

Cointegration Analysis

A statistical method for analysing the long-term equilibrium relationship between two or more non-stationary time series variables is cointegration analysis. It is especially helpful in the fields of economics and finance, where researchers frequently work with a variety of variables that, although displaying short-term volatility, may be connected in the long run.

Once cointegration is proven, it suggests that the variables have a long-term link and that they have a tendency to move in tandem over time. Developing econometric models, predicting, and comprehending the underlying financial or economic dynamics all benefit from this information.

Cointegration analysis is useful in many areas, such as international trade, finance, macroeconomics, and more. For instance, in macroeconomics, it's used to examine the link between important economic variables like consumption, investment, and income. In finance, it's used to find pairings of assets for pairs trading techniques. Cointegration analysis is a frequently employed method in empirical research across various fields, as it is a potent instrument for comprehending the long-term interactions among non-stationary time series variables.

Johansen test

A statistical technique used to ascertain if a set of time series data is cointegrated is the Johansen test, also referred to as the Johansen cointegration test. The presence of cointegration suggests that the variables have a long-term equilibrium relationship, which means that even if they may display short-term oscillations, over time they move together. This is especially helpful for financial and economic analysis, since correlations between several time series variables are frequently sought for by researchers. It is important to comprehend cointegration before attempting the Johansen test. Time series variables can show short-term departures from a stable, long-term relationship, but cointegration is a statistical feature that shows this relationship is stable over the long term. In the banking industry, for example, it is possible that two stock values,

despite short-term swings, have a tendency to move together over the long term.

The Vector Error Correction Model is the foundation for the Johansen test. The Vector Autoregression (VAR) model is expanded upon by this model. Every variable in a VAR model is regressed on both the lagged values of the other variables in the system and its own lagged values. In order to account for variations from long-term equilibrium connections among the variables, the VECM adds error correction components to the VAR model.

The maximum eigenvalue statistic and the trace statistic are the two primary statistics used in the Johansen test. The number of cointegrating relationships in the system is ascertained using these statistics.

8. DATA ANALYSIS

TABLE 1: Cointegration Table

G20 countries	Countries with Cointegration								
Argentina	Australia	Brazil	Canada	Italy	Japan	Korea	Mexico		
	+ve	+ve	+ve	-ve	+ve	-ve	-ve		
Australia	Argentina	Brazil	Canada	Italy	Japan	Korea	Mexico	Russia	UK
	+ve	+ve	+ve	-ve	+ve	-ve	-ve	-ve	+ve
Brazil	Argentina	Australia	Canada	Italy	Japan				
	+ve	+ve	+ve	-ve	+ve				
Canada	Argentina	Australia	Brazil	Italy	Japan	Korea	Mexico		
	+ve	+ve	+ve	-ve	+ve	-ve	-ve		
China	Argentina	Australia	Brazil	Italy	Japan	Korea	Mexico		
	+ve	+ve	+ve	-ve	+ve	-ve	-ve		
France	Argentina	Australia	Brazil	Japan	Korea	UK			
	+ve	+ve	+ve	+ve	-ve	+ve			
Germany	Argentina	Australia	Brazil	Italy	Japan	UK			
	+ve	+ve	+ve	-ve	+ve	+ve			
India	Argentina	Australia	Brazil	Italy	Japan	Korea	Mexico	UK	
	+ve	+ve	+ve	-ve	+ve	-ve	-ve	+ve	
Indonesia	Argentina	Australia	Brazil	Italy	Japan	Korea	Mexico	UK	
	+ve	+ve	+ve	-ve	+ve	-ve	-ve	+ve	
Italy	Argentina	Australia	Brazil	Canada	Indonesia	Korea	Mexico	UK	
	+ve	+ve	+ve	+ve	-ve	-ve	-ve	+ve	
Japan	Argentina	Australia	Brazil	Canada	Indonesia	Italy	Korea	Mexico	UK

	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	+ve
Korea	Argentina	Australia	Brazil	Indonesia	Italy	Japan	Mexico	UK	US
	+ve	+ve	+ve	-ve	-ve	-ve	-ve	+ve	-ve
Mexico	Argentina	Australia	Brazil	Canada	Indonesia	Japan	Korea	UK	US
	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	
Russia	Argentina	Australia	Brazil	Canada	Indonesia	Japan	Korea	Mexico	
	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve
Saudi Arabia	Argentina	Australia	Brazil	Canada	Indonesia	Japan	Korea	UK	US
	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve
South Africa	Argentina	Australia	Brazil	Canada	Indonesia	Italy	Japan	Korea	Turkiye
	+ve	+ve	+ve	+ve	-ve	-ve	+ve	-ve	
Turkiye	Argentina	Australia	Indonesia	Italy	Japan	Korea	UK	US	
	+ve	+ve	-ve	-ve	-ve	-ve	-ve		
UK	Argentina	Australia	Brazil	Canada	Indonesia	Italy	US		
	+ve	+ve	+ve	-ve	-ve	+ve	-ve	+ve	
US	Argentina	Australia	Brazil	Indonesia	Italy	Japan	Korea	UK	

Interpretation: The above table give a clear picture of the G20 countries relationship between each other. The cointegration analysis was taken among the countries to interpret about the type of relationship like short term or long-term relation of one particular country to rest countries.

After the cointegration by taking the GDP of all countries it's shows that the countries like Australia, Argentina, Brazil and Canada are cointegrated to almost more than half of countries and US to least countries. Brazil is the country which cointegrated with only 5 countries.

Due to economic growth, and financial stability Japan plays a pivotal role in establish the relationship with all the g20 countries except Indonesia. Cointegration can be find out by considering the value of Trace statistics and maximum eigen value. But when there is different value of trace statistics and eigen value then, Trace statistics is considered as the best parameter to get the results of cointegration. Here from the above table, we can see that a particular country is having both positive and negative cointegration with other countries, when there is a positive cointegration that means they have a long-term relationship with that particular country and when negative cointegration is established it means it has a short-term impact on that particular country.

The Below table of all the g20 countries from Argentina to US gave the results with the countries it is established the strong, weak, short term or long-term relationship.

Johansen Test Analysis

1. Country: Argentina

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value
None *	0.989763	422.6078	228.2979
At most 1 *	0.921918	280.5741	187.4701
At most 2 *	0.881319	201.5242	150.5585
At most 3 *	0.790283	135.4535	117.7082
At most 1 *	0.958108	310.8540	187.4701
At most 2 *	0.894258	212.5017	150.5585
At most 3 *	0.800407	142.8522	117.7082
At most 4 *	0.672884	92.89647	88.80380

Figure I: Cointegration with countries: Argentina, Brazil, Canada, Italy, Japan, Korea, Mexico

Hypothesis of Johansen Test:
H0: There is no Cointegration
But when the Trace value is greater than the critical value at 0.05 it reject the hypothesis and shows the Cointegration.

From the above Fig.I :

For Argentina, the trace values are 422.6,280.5,201.5, 135.42, 310.85, 212.5, 142.85,92.89 for the countries Australia, Brazil, Canada, Italy, Japan, Korea, Mexico respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.5, 117.69 and 88.80, which shows that due to the greater value of trace value it rejects null

hypothesis as a result Argentina has the Cointegration with these countries

2. Country: Australia

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.962429	293.8087	187.4701	0.0000
At most 2 *	0.815363	192.0812	150.5585	0.0000
At most 3 *	0.747870	139.7109	117.7082	0.0010
At most 4 *	0.635024	96.99883	88.80380	0.0113
At most 5 *	0.579115	65.75318	63.87610	0.0345
At most 1 *	0.421579	27.02754	25.87211	0.0358

Figure II: Cointegration with countries: Argentina, Brazil, Canada, Italy, Japan, Korea, Mexico, Russia, UK

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig II:

For Australia, the trace values are 422.60, 280.57, 201.52, 135.45, 293.80, 192.08, 139.71, 96.99, 65.75, 27.02 for the countries Argentina, Brazil, Canada, Italy, Japan, Korea, Mexico, Russia, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.5, 117.69,88.80,63.87,25.87 which shows that due to the greater value of trace value it rejects null hypothesis as a result Australia has the Cointegration with these countries

3.Country: Brazil

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.955431	294.1725	187.4701	0.0000
At most 2 *	0.933846	197.7404	150.5585	0.0000

Figure III: Cointegration with countries: Argentina, Australia, Canada, Italy, Japan

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig III:

For Brazil, the trace values are 422.60,187.47,160.55,117.70, 187.47,150.55 for the countries Argentina, Australia, Canada, Italy, Japan respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55 which shows that due to the greater value of trace value it rejects null hypothesis as a result Brazil has the Cointegration with these countries.

4. Country: Canada

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.950317	320.2468	187.4701	0.0000
At most 2 *	0.888990	227.1820	150.5585	0.0000
At most 3 *	0.827319	159.0399	117.7082	0.0000
At most 4 *	0.753598	104.5942	88.80380	0.0023

Figure IV: Cointegration with countries: Argentina, Australia, Brazil, Italy, Japan, Korea, Mexico

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it reject the hypothesis and shows the Cointegration.

From the above Fig IV:

For Canada, the trace values are 422.60,280.57, 201.52, 135.45,320.24, 227.18, 159.03, 104.59 for the countries Argentina, Australia, Brazil, Italy, Japan, Korea, Mexico respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55, 117.70, 88.80 which shows that due to the greater value of trace value it rejects null hypothesis as a result Canada has the Cointegration with these countries.

5. Country: China

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.961894	342.6907	187.4701	0.0000
At most 2 *	0.938922	241.4015	150.5585	0.0000
At most 3 *	0.874690	154.7380	117.7082	0.0000
At most 4 *	0.658270	90.35221	88.80380	0.0385

Figure V: Cointegration with countries: Argentina, Australia, Brazil, Italy, Japan, Korea, Mexico

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig V:

For China, the trace values are 422.60,280.57, 201.52, 135.45,342.69, 241.40,154.70 for the countries Argentina, Australia, Brazil, Italy, Japan, Korea, Mexico respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55, 117.70, 88.80 which shows that due to the greater value of trace value it rejects null hypothesis as a result China has the Cointegration with these countries

6. Country: France

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.955431	294.1725	187.4701	0.0000
At most 2 *	0.933846	197.7404	150.5585	0.0000
At most 1 *	0.460596	31.10500	25.87211	0.0102

Figure VI: Cointegration with countries: Argentina, Australia, Brazil, Japan, korea, UK

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig VI:

For France, the trace values are 422.60,280.57, 201.52, 135.45, 294.17, 197.74, 31.10 for the countries Argentina, Australia, Brazil, Japan, korea, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55, 25.87 which shows that due to the greater value of trace value it rejects null hypothesis as a result France has the Cointegration with these countries

7. Country: Germany

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.964408	308.5680	187.4701	0.0000
At most 2 *	0.940880	205.1631	150.5585	0.0000
At most 1 *	0.436187	25.99699	25.87211	0.0483

Figure VII: Cointegration with countries: Argentina, Australia, Brazil, Italy, Japan, UK

Hypothesis of Johansen Test:
H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig VII:

For Germany, the trace values are 422.60, 280.57, 201.52, 135.45, 308.56, 205.16, 25.99 for the countries Argentina, Australia, Brazil, Italy, Japan, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55, 25.87 which shows that due to the greater value of trace value it rejects null hypothesis as a result Germany has the Cointegration with these countries.

8. Country: India

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.981869	339.0555	187.4701	0.0000
At most 2 *	0.916188	214.7416	150.5585	0.0000
At most 3 *	0.736367	137.8870	117.7082	0.0015
At most 4 *	0.669826	96.55791	88.80380	0.0123

Figure VIII: Cointegration with countries: Argentina, Australia, Brazil, Italy, Japan, Korea, UK

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig VIII:

For India, the trace values are 422.60, 280.57, 201.52, 135.45, 339.05, 214.74, 137.88, 96.55 for the countries Argentina, Australia, Brazil, Italy, Japan, Korea, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55, 117.70,88.80 which shows that due to the greater value of trace value it rejects null hypothesis as a result India has the Cointegration with these countries.

9. Country: Indonesia

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.989763	422.6078	228.2979	0.0000
At most 1 *	0.921918	280.5741	187.4701	0.0000
At most 2 *	0.881319	201.5242	150.5585	0.0000
At most 3 *	0.790283	135.4535	117.7082	0.0024
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498

Figure IX: Cointegration with countries: Argentina, Australia, Brazil, Italy, Japan, Korea, UK

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig IX:

For Indonesia, the trace values are 422.60, 280.57, 201.52,135.45,321.87,195.02, 129.05, 88.82 for the countries Argentina, Australia, Brazil, Italy, Japan, Korea, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 187.4, 150.55, 117.70,88.80 which shows that due to the greater value of trace value it rejects null hypothesis as a result Indonesia has the Cointegration with these countries.

10. Country: Italy

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.980565	421.7523	228.2979	0.0000
At most 1 *	0.962340	299.5919	187.4701	0.0000
At most 2 *	0.861458	197.9380	150.5585	0.0000
At most 3 *	0.716862	136.6639	117.7082	0.0019
At most 4 *	0.678634	97.54738	88.80380	0.0101
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498

Figure X: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Korea, Mexico, UK

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig X:

For Italy, the trace values are 421.75, 299.59, 197.93, 136.66, 97.54, 321.87, 195.02, 129.05, 88.82 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Korea, Mexico, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 88.80, 187.47, 150. 55, 117.70,88.80 which shows that due to the greater value of trace value it rejects null hypothesis as a result Italy has the Cointegration with these countries.

11. Country: Japan

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.981808	427.9897	228.2979	0.0000
At most 1 *	0.953959	303.7790	187.4701	0.0000
At most 2 *	0.860503	208.3540	150.5585	0.0000
At most 3 *	0.847273	147.2930	117.7082	0.0002
At most 4 *	0.734024	89.04078	88.80380	0.0481
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498
At most 1 *	0.430123	28.83021	25.87211	0.0208

Figure XI: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Italy, Korea, Mexico, UK
Hypothesis of Johansen Test:
H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XI:

For Japan, the trace values are 427.98,303.77,208.35,147.29,89.04,321.87,195.02, 129.05, 88.82,28.82 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Italy, Korea, Mexico, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70, 88.80, 187.47, 150. 55, 117.70,88.80,25.87 which shows that due to the greater value of trace value it rejects null hypothesis as a result Japan has the Cointegration with these countries.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.994904	445.3094	228.2979	0.0000
At most 1 *	0.929703	281.6532	187.4701	0.0000
At most 2 *	0.890316	199.3474	150.5585	0.0000
At most 3 *	0.778906	130.8327	117.7082	0.0057
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498
At most 1 *	0.415053	30.15272	25.87211	0.0138
At most 2 *	0.353663	13.52945	12.51798	0.0338

12. Country: Korea

Figure XII: Cointegration with countries: Argentina, Australia, Brazil, Indonesia, Italy, Japan, Mexico, UK, US

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XII:

For Korea, the trace values are 445.30, 281.65,199.34,130.83, 321.87,195.02,129.05, 88.82, 30.15, 13.52 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Italy, Korea, Mexico, UK respectively and the critical values are 228.29, 187.47, 150.55, 117.70,187.47,150.55, 117.70,88.80,25.87,12.51 which shows that due to the greater value of trace value it rejects null hypothesis as a result Korea has the Cointegration with these countries.

13. Country: Mexico

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.991929	473.3434	228.2979	0.0000
At most 1 *	0.972473	323.9392	187.4701	0.0000
At most 2 *	0.896989	212.5694	150.5585	0.0000
At most 3 *	0.797150	142.1089	117.7082	0.0006
At most 4 *	0.721131	92.65493	88.80380	0.0256
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498
At most 1 *	0.387797	26.37960	25.87211	0.0432

Figure XIII: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XIII:

For Mexico, the trace values are 473.34, 323.93,212.56, 142.10,92.65, 321.87, 195.02,129.05, 88.802,26.37 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US respectively and the critical values are 228.29, 187.47, 150.55, 117.70,,88.80,187.47, 150.55,117,88.80,25.87 which shows that due to the greater value of trace value it rejects null hypothesis as a result Mexico the Cointegration with these countries.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.992855	464.5708	228.2979	0.0000
At most 1 *	0.947950	311.3886	187.4701	0.0000
At most 2 *	0.905818	219.7668	150.5585	0.0000
At most 3 *	0.824192	146.5285	117.7082	0.0002
At most 4 *	0.712738	92.63934	88.80380	0.0257
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079

14. Country: Russia

Figure XIV: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, Mexico

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XIV:

For Russia, the trace values are 464.57, 311.388, 219.76, 146.52, 92.63, 321.87, 195.02, 129.05 for the countries Argentina, Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, Mexico respectively and the critical values are 228.29, 187.47, 150.55, 117.70,,88.80,187.47, 150.55,117.70 which shows that due to the greater value of trace value it rejects null hypothesis as a result Russia the Cointegration with these countries

15. Country: Saudi Arabia

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.994591	480.4942	228.2979	0.0000
At most 1 *	0.941205	318.6814	187.4701	0.0000
At most 2 *	0.919767	230.8368	150.5585	0.0000
At most 3 *	0.795615	152.6293	117.7082	0.0001
At most 4 *	0.764884	103.4090	88.80380	0.0030
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 1 *	0.432512	31.14120	25.87211	0.0100
At most 2 *	0.354687	13.57860	12.51798	0.0331

Figure XV: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XV:

For Saudi Arabia, the trace values are 480.49, 318.68, 230.83,152,62, 103.40, 321.87, 195.02,129.05, 31.14, 13.57 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US respectively and the critical values are 228.29, 187.47, 150.55, 117.70,,88.80,187.47, 150.55,117.70,25.87, 12.51 which shows that due to the greater value of trace value it rejects null hypothesis as a result Saudi Arabia the Cointegration with these countries.

16. Country: South Africa

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.982693	429.7512	228.2979	0.0000
At most 1 *	0.955713	303.9944	187.4701	0.0000
At most 2 *	0.891152	207.3657	150.5585	0.0000
At most 3 *	0.778885	138.6140	117.7082	0.0013
At most 4 *	0.710543	91.83274	88.80380	0.0297
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498
At most 1 *	0.469046	42.93980	42.91525	0.0497

Figure XVI: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XVI:

For South Africa, the trace values are 429.75, 303.99,207.35,138.61, 91.83, 321.87, 195.02,129.05,88.82,42.93 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Italy, Japan, Korea, Turkey respectively and the critical values are 228.29, 187.47, 150.55, 117.70,,88.80,187.47, 150.55,117.70, 88.80, 42.91 which shows that due to the greater value of trace value it rejects null hypothesis as a result South Africa the Cointegration with these countries.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.990052	414.5851	228.2979	0.0000
At most 1 *	0.925235	271.6638	187.4701	0.0000
At most 2 *	0.907948	191.2681	150.5585	0.0000
At most 1 *	0.983294	321.8731	187.4701	0.0000
At most 2 *	0.880928	195.0214	150.5585	0.0000
At most 3 *	0.726837	129.0526	117.7082	0.0079
At most 4 *	0.653449	88.82426	88.80380	0.0498
At most 1 *	0.432512	31.14120	25.87211	0.0100
At most 2 *	0.354687	13.57860	12.51798	0.0331

17. Country: Turkey

Figure XVII: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US

Hypothesis of Johansen Test:
H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XVII:

For Turkey, the trace values are 414.58, 271.66, 191.26, 321.87, 195.02, 129.05, 88.82, 31.14, 13.57 for the countries

Argentina, Australia, Indonesia, Italy, Japan, Korea, UK, US respectively and the critical values are 228.29, 187.47, 150.55,187.47,150.55, 117.70,,88.80,25.87,12.51 which shows that due to the greater value of trace value it rejects null hypothesis as a result Turkey the Cointegration with these countries.

18. Country: UK

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.992343	460.9624	228.2979	0.0000
At most 1 *	0.973117	309.9281	187.4701	0.0000
At most 2 *	0.861021	197.8237	150.5585	0.0000
At most 3 *	0.768077	136.6474	117.7082	0.0019
At most 4 *	0.684297	91.34559	88.80380	0.0324
At most 1 *	0.888572	189.6709	150.5585	0.0001
At most 2 *	0.733671	121.6453	117.7082	0.0275
At most 2 *	0.354687	13.57860	12.51798	0.0331

Figure XVIII: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XVIII:

For UK, the trace values are 460.96, 309.92, 197.82, 136.64, 91.34,189.67, 121.64, 13.57 for the countries Argentina, Australia, Brazil, Canada, Indonesia, Italy, US respectively and the critical values are 228.29, 187.47, 150.55, 117.70,,88.80,150.55,117.70,12.51 which shows that due to the greater value of trace value it rejects null hypothesis as a result UK the Cointegration with these countries.

19. Country: US

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.992720	439.4501	228.2979	0.0000
At most 1 *	0.911252	286.8467	187.4701	0.0000
At most 2 *	0.897778	211.7660	150.5585	0.0000
At most 1 *	0.975666	362.3346	187.4701	0.0000
At most 2 *	0.920803	247.1425	150.5585	0.0000
At most 3 *	0.872209	168.5321	117.7082	0.0000
At most 4 *	0.771474	104.7538	88.80380	0.0022
At most 1 *	0.432512	31.14120	25.87211	0.0100

Figure XIX: Cointegration with countries: Argentina, Australia, Brazil, Canada, Indonesia, Japan, Korea, UK, US

Hypothesis of Johansen Test:

H0: There is no Cointegration

But when the Trace value is greater than the critical value at 0.05 it rejects the hypothesis and shows the Cointegration.

From the above Fig XIX:

For US, the trace values are 439.45,286.84,211.76,362.33,247.14,168.53,104.75,31.14 for the countries Argentina, Australia, Brazil, Indonesia, Italy, Japan, Korea, UK respectively and the critical values are 228.29, 187.47, 150.55, 187.47,150.55,117.70,88.80, 25.87 which shows that due to the greater value of trace value it rejects null hypothesis as a result US the Cointegration with these countries.

9. FINDINGS AND DISCUSSIONS

The cointegration analysis of the GDP of the G20 reveals that the US is less interconnected than other countries, with Canada, Australia, Argentina, and Brazil showing strong long-term economic links with over half of the G20 countries. With only five other nations, Brazil's low cointegration raises the possibility of a more isolated economic position. With the exception of Indonesia, Japan emerges as a major force in promoting economic links among the G20. In cointegration analysis, taking trace statistics is the importance parameter.

The country with positive impact shows a long-term relationship and negative impact shows a short or weak relationship with the particular country. These results provide important new insights into the inter-country economic dynamics within the G20 and for future studies and policy discussions.

Australia, Argentina, Brazil, Canada, and more than half of the G20 countries show a high degree of cointegration. This implies that a significant chunk of the global economy is intimately connected to their economic performance. When compared to other G20 countries, the United States has the lowest degree of cointegration, indicating a comparatively lower level of economic interconnectivity. However, Brazil's cointegration with just five other nations points to a more constrained degree of economic integration.

With the exception of Indonesia, Japan emerges as a major actor in forging economic ties with the majority of the G20 nations. This demonstrates Japan's significant economic connections throughout the G20 and its contribution to global economic growth and financial-stability.

The results indicate that Trace statistics is the better parameter to use in determining cointegration when there are differences between the values of Trace statistics and highest eigenvalue. This suggests that trace statistics offer a more accurate way to pinpoint the long-term economic ties between the G20 nations.

10. CONCLUSION

Several significant insights into the interdependence of the G20 countries' economies are shown by the cointegration study performed on their stock movements. First, the results show that the stock markets of the G20 countries have different levels of cointegration, or how much their stock markets move together over time. While some nations show weaker levels of integration, indicating more independent market activity, others show stronger cointegration, indicating a high degree of synchronization in their stock movements. Secondly, the analysis emphasizes how crucial particular nations are to the dynamics of the world stock market. For example, because of their sizeable economies and strong financial sectors, nations like the United States, China, and Japan may have a big impact. Knowing the cointegration patterns can help shed light on how these nations influence trends in the world economy.

Additionally, the possibility of contagion risk and cross-border spillover effects is highlighted by the presence of cointegration. Modifications in the stock market of one nation may spread to others, increasing volatility and affecting the stability of the world economy. In order to reduce systemic risks and improve market resilience, regulators and investors must acknowledge these interdependencies. To sum up, the cointegration study of G20 stock movements offers important new perspectives on the dynamics of international financial markets and the degree of economic interdependence. Through comprehending the cointegration patterns, stakeholders can enhance their decision-making abilities to effectively manage market volatility and foster sustainable economic expansion.

11. SUGGESTIONS

Cointegration analysis is a useful tool that financial institutions and policymakers can use to find vulnerabilities and systemic risks in the global financial system.G20 countries can explore opportunities for promoting investment and fostering economic cooperation based on the insights gained from cointegration analysis.

12. FUTURE SCOPE

Subsequent research endeavours may delve into the intricacies of cointegration associations at elevated frequencies, like intraday or daily data. Cointegration analysis and machine learning algorithms together can improve a model's accuracy and predictive capacity.

13. DECLARATION

We, Ritam Nath, Snehasmita Sengupta & Binoti Patro, hereby confirm that the manuscript titled "Cointegration between Stock Movements Of G20 Countries" authored by Ritam Nath, Snehasmita Sengupta and Binoti Patro, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

We affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspective Conference (IMPeC) 2025.

We declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Costantini, V., and Martini, C. (2010). The causality between energy consumption and economic growth: a multi-sectoral analysis using non-stationary cointegrated panel data, Energy Economics, 32, 591–603.

[2.] Shwai, S., and Shigu., V. (2021). Multi-modal Attention Network for Stock Movements Prediction, University of Electronic Science and Technology of China, 40(3), 793–805.

[3.] Li, Q., Wang, T., Li, P., Liu, L., Gong, Q., and Chen, Y. (2014). The effect of news and public mood on stock movements, Information Sciences, 27, 826 – 840.

[4.] LeBaron, B., Arthur, W. B., and Palmer, R. (2020). Time series properties of an artificial stock market, Journal of Economic Dynamics & Control, 23, 1487–1516.

[5.] Fama., F. (2020). The behavior of stock-market prices, Journal of business 38, 34–105.

[6.] Frank, M. Z., and Antweiler, W. (2021). Is all that talk just noise? the information content of internet stock message boards, Journal of Finance, 59(3), 1259–1294.

[7.] Patel, J., Shah, S., Thakkar, P., Kotecha, K. (2017). Predicting stock and stock price index movement using trend deterministic data preparation and machine learning techniques, Expert Systems with Applications, 42(1),259–268

[8.] Ruiz, E.J., Hristidis, V., Castillo, C., Gionis, A., Jaimes, A. (2018). Correlating financial time series with micro-blogging activity, Proceedings of the fifth ACM international conference on Web search and data mining, 513–522

[9.] Godfrey, M.D., Granger, C.W., Morgenstern, O.(2010). The random-walk hypothesis of stock market behaviora, Kyklos, 17(1), 1–30

[10.] Masih, A. M. M., and Masih, R. (1996). Electricity consumption, real income and temporal causality: results from a multicountry study based on cointegration and error correction modeling techniques, Energy Economics, 18, 165-183.

[11.] Oh, W., and Lee, K. (2019). Energy consumption and economic growth in Korea testing the causality relation, Journal of Policy Modeling, 26, 973–981.

[12.] Pedroni, P. (2020). Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors, Oxford Bulletin of Economics and Statistics, 61, 653-670.

[13.] Westerlund J., and Edgerton, D.L., (2021). A panel bootstrap cointegration test, Economics Letters, 97, 185-190.

[14.] Zachariadis, T. (2016). Exploring the relationship between energy consumption and economic growth with bivariate models: new evidence from G-7 countries, Energy Economics, 29, 1233-1253.

[15.] Soytas, U., and Sari, R., (2015). Energy consumption and income in G-7 countries, Journal of Policy Modeling, 28(7), 739-750.

[16.] Yildirim, E., Sarac, S., and Aslan, A. (2012) Energy consumption and economic growth in the USA: Evidence from renewable energy, Renewable and Sustainable Energy Reviews, 16, 6770-6774.

[17.] Yoo, S. H. (2020). Electricity Consumption and Economic Growth: Evidence from Korea, Energy Policy, 33, 1627-1632.

[18.] Zachariadis, T. (2021). Exploring the relationship between energy consumption and economic growth with bivariate models: new evidence from G-7 countries, Energy Economics, 29, 1233-1253.

[19.] Masih, A. M. M., and Masih, R. (2017). Electricity consumption, real income and temporal causality: results from a multicountry study based on cointegration and error correction modeling techniques, Energy Economics, 18, 165-183.

[20.] Mohammadi, H. D. and Amin, M. D. (2015). Long-run relation and short-run dynamics in energy consumption-output relationship: International evidence from country panels with different growth rates, Energy Economics, 52(A), 118-126.

[21.] Narayan P. K., Narayan, S.m and Popp, S. (2010). Energy consumption at the state level: the unit root null hypothesis from Australia, Applied Energy, 87, 1953-62.

[22.] Magazzino, C. (2016). Is per capita energy use stationary? Panel data evidence for the EMU countries, Energy, Exploration and Exploitation, 34, 3, 440-448.

[23.] Aharony, J., Barniv, R., & Falk, H. (2010). "The impact of mandatory IFRS adoption on equity valuation of accounting numbers for security investors in the EU", European Accounting Review, 19(3), 535- 578.

[24.] Zhang, Z., Zhao, Y.,Su, B., Zhang, Y., Wang, S., Liu, Y., Li, H.(2018). Embodied carbon in China's foreign trade: An online SCI-E and SSCI based literature review. Renew. Sustain. Energy Rev, 68, 492–510.

[25.] Fereidouni, H. G., Lee, J. Y., & Sab, C. N. B. C. (2013). Examining the bi-directional long run relationship between renewable energy consumption and GDP growth. Renewable and Sustainable Energy Reviews, 22, 209–222.

[26.] Afia, N. Ben. (2019). The relationship between energy consumption, economic growth and happiness, Journal of Economic Development, 44(3), 41–57.

[27.] Alam, M. S., Bala, B. K., Huq, A. M. Z., & Matin, M. A. (1991), A model for the quality of life as a function of electrical energy consumption, Energy, 16(4), 739-745.

[28.] Dong, K., Jiang, H., Sun, R., Dong, X. (2019). Driving forces and mitigation potential of global CO2 emissions 414 from 1980 through 2030: evidence from countries with different income levels, Science of the Total 415 Environment, 649, 335–343.

[29.] Carbonell, A., & Gowdy, J. M. (2017). Environmental degradation and happiness. Ecological 422 Economics, 60(3), 509–516.

[30.] Giovanis, E., & Ozdamar, O. (2018). Health status, mental health and air quality: evidence from pensioners in Europe, Environmental Science and Pollution Research, 25(14), 14206-14225.

[31.] Filis, G. (2010). Macro economy, stock market and oil prices: do meaningful relationships exist among their cyclical fluctuations?, Energy Economics, 32(4), 877-886.

[32.] Nandha, M., Brooks, R. (2019). Oil prices and transport sector returns: an international analysis. Review of Quantitative Finance and Accounting, 33(4), 393.

[33.] Bley, J., Chen, K.H. (2020). Gulf Cooperation Council (GCC) stock markets: The dawn of a new era, Global Finance Journal, 17(1), 75-91.

[34.] Khazali, O., Darrat, A.F., Saad, M. (2016). Intraregional integration of the GCC stock markets: The role of market liberalization. Applied Financial Economics, 16(17): 1265-1272.

[35.] Louis, R.J., Balli, F. (2014). Oil price and stock market synchronization in gulf cooperation council countries,

Emerging Markets Finance and Trade, 50(1), 22-51.

[36.] Sadorsky, P. (1999). Oil price shocks and stock market activity, Energy Economics, 21(5), 449-469.

[37.] Elwood, S.K. (2001). Oil-price shocks: Beyond standard aggregate demand/aggregate supply analysis. The Journal of Economic Education, 32(4), 381-386.

[38.] Ftiti, Z., Guesmi, K., Teulon, F., Chouachi, S. (2016). Relationship between crude oil prices and economic growth in selected OPEC countries. Journal of Applied Business Research (JABR), 32(1), 11-22.

[39.] Eyden, R., Difeto, M., Gupta, R., Wohar, M.E. (2019). Oil price volatility and economic growth: Evidence from advanced economies using more than a century's data. Applied Energy, 233, 612-621

APPENDIX: List of G20 Countries

1	Argentina	11	Japan
2	Australia	12	Korea
3	Brazil	13	Mexico
4	Canada	14	Russia
5	China	15	Saudi Arabia
6	France.	16	South Africa
7	Germany	17	Turkey
8	India	18	United Kingdom
9	Indonesia	19	United States
10	Italy	20	European Union

Sustainable Destination Image in the Digital Age: Exploring the Moderating Role of Age on Social Media Influence

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ABSTRACT

Social networking is a popular tool these days, especially in the travel sector. Technology is changing so quickly that there has been a noticeable increase in the use of social media websites such as Facebook, YouTube, and Instagram. Users are welcome to create blogs on these platforms, share photos from their travels, and interact with other users by sharing details about their interests and activities. From the perspective of the travel industry, people involved in the industry namely hoteliers, travel agents, and government are choosing social media with the purpose of connecting with their guests. When someone wants to travel, buy something, or use a service, they would rather rely on the advice of others. Huge dependency on social media for every prominent decision relating to travel has made social media and social networking sites an integral part of life.

PURPOSE

The current study aims to analyze the impact of social media on the travel decisions made by Generation Z and investigate the effect of social media in shaping prospective travelers' perceptions of the destinations they aim to travel to. The Technology Acceptance Model has been used in the current study to develop a conceptual framework that will help understand the impact of social media on the travel decisions of the younger generation.

The current study aims to also test the role of age as a moderating factor. The study aims to observe the moderating impact of age on the formation of destination images among Generation Z.

DESIGN/METHODOLOGY/APPROACH

A sample size of 420 people was used to meet the goal of examining the impact of social media on the creation of sustainable destination pictures in tourists' imaginations. To examine the relationship between the intention to use social media, and destination image a conceptual model has been framed with the help of the Technology Acceptance Model. The results of this study will be extremely important to online travel marketers because they will give them a better understanding of how the younger generation uses social networking sites and the way social networking sites aid prospective travelers in the formation of impressions of their destinations. This will enable marketers to adjust their online marketing strategies accordingly.

FINDINGS

The findings refute the work's presumptions while confirming the theoretical model's robustness and strength. The main findings are that travelers' information sources, including social media, have an impact on their reasons for visiting a place; travelers' motives have an impact on their cognitive image; and travelers' motivations have an impact on their affective image. Managers must take note of these findings.

ORIGINALITY/ VALUE

This research is a first of its kind where various variables namely Perceived Costs, Perceived Enjoyment, and Perceived Ease of Use examine their impact on the intention to use social media that to for travel purposes. This study considers social networking sites as a source of information and takes into account the direct and moderating linkages between numerous variables namely motivations, information sources, and image dimensions.

Keywords: Sustainable Destination Image, Cognitive Destination Image, Affective Destination Image, Age, Social Media

1. INTRODUCTION

Communication between communities, organizations, and individuals has undergone major and pervasive changes due to the Internet, particularly social media (Kietzmann et al., 2011). As a result, social media has become a powerful tool for people by serving as a channel for communication and expression. Through it, people can now publish and share information by elaborating on their thoughts, experiences, and other ideas, in addition to searching for and obtaining information from a variety of traditional and regular sources (Dickey and Lewis, 2011).

The usage of communication technology is particularly important in the tourism business because luring people to travel to a destination is the most difficult task, especially in the tourism industry. To do this, the destination's online and social media presence needs to be increased (Tham, A.,

Croy, G., & Mair, J.; 2013). Additionally, it's critical to acquire knowledge beyond the basics of promoting relevant areas on social media. It has been noted that social media can have an impact on people's decisions on sustainable travel destinations. The fundamental factor that can shape tourists' opinions is the content that is made available to potential passengers. Furthermore, travel companies can examine and leverage the destination image more effectively with the help of social networking sites like Instagram, YouTube, Facebook, and Twitter which provide new opportunities to share information (Li, R.; Suh, A., 2015). Several studies have demonstrated the beneficial effects of social media information sources on the creation of destination pictures on the internet, as well as their ability to boost customer satisfaction, loyalty, and intention toward a specific location.

Additionally, social media has an impact on the destination decision while planning a trip. In the past, people utilized a variety of conservative techniques, such as friends, family, peers, advertising agents, and travel agencies, to organize their own travels and obtain information. However, social media is increasingly regarded as an excellent and well-researched method of information collecting. Additionally, the data on social media is updated frequently.

Travel agencies, tour operators, and destination marketing companies use social media and websites to reach a large number of individuals with useful information. The details could include the place, the products available, and the variety of services related to tourism (Shuang, Y, 2013). DMOs have profited from the opportunities provided by utilizing the various digital platforms to enhance engagement with passengers and personalize tourism information. DMOs may enhance client relations and influence how tourists view their location by utilizing social media and websites with multimedia features (Huertas, A., 2018). Social media interaction can provide value and enhance visitors' impressions of a place. Nevertheless, DMOs should use social media regularly to build a positive reputation in the eyes of passengers. DMOs may also be in charge of developing or organizing the destination image. Using social media and sharing their material on these social networking sites, a variety of travel agencies and tour operators want to spark interest and draw in the general public. When customers interact with and participate in social media material, marketers get direct feedback. Tour operators will be better able to understand the needs and preferences of their customers as a result, and customers will be able to accept, comment on, change, distribute, or reject this content. The main reason for this is that travel agencies may use social media to get in touch with customers directly and sway their choices. Travelers can share their vacation experiences on social media platforms, allowing for the creation and sharing of incredibly interactive and interesting material. Travelers can produce interactive content on social media in the form of blogs, music, movies, and images thanks to these social media connections. Travelers are

sharing massive volumes of data and information on social networking sites. Social networking sites have become the most popular means of communication for individuals to communicate with one another and trust the information offered by others due to their vast informational database. Similar to this, social media offers a wealth of learning opportunities due to technological advancements. In order to facilitate learning and spread knowledge, a variety of virtual learning platforms have been developed. Furthermore, travelers have the option to share their travelogues on TripAdvisor, Facebook, Instagram, Twitter, and YouTube (Llodra-Riera, I.; M.P.; Jiménez-Zarco, Martínez-Ruiz; A.I., 2015). A destination's image is often created by information and content generated by its merchants, advertisers, and visitors. The destination image serves two primary behavioral functions. It influences decision-making regarding destination selection in the first place. Once a trip is over, decisions about post-travel enjoyment, sharing of experiences, and repeat travel are all influenced by the destination's image.

Previous studies have found that the perception of the destination has a major role in determining where tourists choose to travel. In a similar vein, tourists' intentions to return as well as the length of their stay and their travel schedules are influenced by the perception of the place. A person will only travel to a place where they have a favorable and enjoyable mental impression. Studies have looked into how content from social media affects people's impressions of places. The material available on social media platforms helps create impressions of destinations, and a variety of stakeholders, including travel firms, tour operators, tourist managers, and local government organizations, have a significant say in the database on these sites. To draw potential tourists to a specific location, these players start the process of creating images of the place. As a result, the way a visitor evaluates a location's different features and attributes shapes their overall impression of it. A traveler's decision to visit a specific location is impacted by several things, including blogs, social media networks, friends, family, and any travel documentaries produced by different specialists. According to a study on tourism, social media can enhance the effectiveness of marketing strategies and travel-related decision-making. (Gretzel, U., 2006) A range of content that is available on many platforms including blogs, online forums, and social networks like Instagram, YouTube, and Flickr has grown a lot in popularity when it comes to sustainable travel possibilities.

On most of these social media networks, individuals can share a variety of material, including posts, comments, opinions, and travelogues, all of which can be used as a resource for other users. Numerous academic studies have documented the ever-increasing importance of search engines in generating online traffic for travel-related content. Travelers' perceptions can be greatly influenced by search engines, which are now known as a "gateway" and the most

potent and trustworthy source of information. Because of its practical importance for destination administration and marketing, Stepchenkova and Mills have identified destination image as the most important element in the tourist business.

The purpose of the current study is to identify the effects of variables like Perceived Ease of Use, Perceived Enjoyment, and Perceived Cost on the intention to utilize social media for travel purposes. The present study also looks into how social media shapes potential passengers' perceptions of destinations in a sustainable way. The current study also attempts to evaluate age's impact as a moderating factor. The goal of the research is to determine how age affects how a destination's overall image is formed. Perceived Cost, Perceived Enjoyment, and Perceived Ease of Use are the factors that are now used to achieve the necessary goal.

This document is organized as follows. The first section of the paper lists all of the previously published material as well as the research that has been done thus far. The literature covers topics such as the core concepts of social media content, destination pictures (cognitive, affective, and overall images), age as a moderating variable, and the ultimate choice to visit sustainable places. The paper then goes on to construct a theoretical connection and the main factors' structure. In addition, the research methodology's specifications are given. The results of the study are then discussed, together with any implications for theory and practice. Finally, the study's conclusion includes several limits and recommendations that can be put into practice right once.

2. THEORETICAL BACKGROUND

Tourism

Traveling from one place to another is referred to as tourism, which is a type of service activity. In addition, tourism is a social, cultural, and economic phenomenon that refers to the travel of individuals for leisure, business, or professional reasons to other nations or locations. In terms of business and marketing, tourism is vital to the social, cultural, and economic advancement of most nations. The tourism business has experienced a significant impact from the revolution in internet-based information and communication technology. In the context of "interactive tourism," travelers are increasingly using their smartphones to help with navigation and location discovery.

Social Media

Since social media platforms like Facebook and Instagram fulfill people's basic need for social connection, they have become an increasingly important networking and marketing tool for e-commerce enterprises. It provides a space where like-minded people may communicate, share ideas, and cultivate common values (Mariani, M.M.; Mura, M.; Di, M., 2018). Social involvement is an essential element of

behavioral motivation. As Stephen et al. (2010) have shown, social interaction theory states that the seller benefits most from having access to a large number of users inside the social commerce network rather than from being centrally located within the network. It has been observed that these shifts in customer behavior might also be influenced by the characteristics of the retail platform itself. Consumer behavior changes as a result of the clustering phenomenon, which affects members of a community based on the closeness of their friends as well as the traits and behavior of those friends (Zhang & Benyoucef, 2016). Psychologists have determined that risk and trust are the most important characteristics since they might affect consumers' intentions to buy in e-commerce settings. In the area of social interaction, where consumer perceptions and how they affect purchase intentions are still not fully understood, this has not been as thoroughly studied. In social commerce settings, where people generate a large amount of material, word-of-mouth advertising has proven to be an extremely effective marketing tactic.

Destination Image

People's thoughts, ideas, and opinions about a specific place or destination make up their destination image (Baloglu, S.; McCleary, K.W, 1999). It is a subjective concept since it is a complex amalgam of elements and goods that work together to create an overall impression. Numerous studies that have looked at the steps involved in constructing a target picture have supported the long-held idea that the concept of the destination image is subjective and impacted by people's sentiments and beliefs. Travelers' attitudes and decision-making are known to be impacted by how they perceive their destination (Hsu, C.H.C.; Wolfe, K.; Kang, S.K., 2004). Pike's research findings indicate that destination image has a significant impact on a number of elements. These include the length of stay, frequency of visits, desire to return, and level of awareness. Thus, it has been determined that the popularity of a place among tourists is largely determined by its image, which makes it crucial to the success of destination information marketing. It has long been noted that traditional tourism-related information sources have been enhanced by social media and websites based on the Internet.

In addition to helping users find pertinent information, social networking sites enable users to share their thoughts and experiences with a large number of other users who are also looking for relevant information. Preliminary findings indicate that a more cognitive destination image and objective is favored. This component was assessed using the perceived attributes that matched the location with the emotional construct.

The emotive image reflects feelings that a visitor has about a specific place, reflecting their feelings. Recent research indicates that images need to show visitors' recommendations for a location in addition to their actual visits or plans to return. Consequently, perceptions of destinations might be

cognitive, emotive, or conative, depending on the information source, which is why the authorities now find it to be so crucial.

Two subjects that are currently receiving more attention in the tourism literature are social media and destination image. Recent studies have looked into the connection between these two subjects. Kim et al.'s research, for instance, showed that the kind of information and material available on social media influences the "cognitive-affective-conative" method of destination image creation. emotional and cognitive qualities, which are closely linked to emotional and cognitive images and are utilized in the construction of destination pictures, are the two categories of qualities found in social media material and information.

Cognitive Destination Image

According to research by Berry, L.L., Parasuraman, A., and Zeithaml (1988), a traveler's cognitive destination picture can be defined as elements such as different scenic views, the weather, cleanliness, hygiene, and other experiences that they can consistently recall. The thoughts and knowledge about the place are discussed in the cognitive destination image. The cognitive picture can be used to evaluate an individual's knowledge and opinions about the object, which impact their affective ratings. For example, social media video footage increases users' awareness of the area, which influences their future attitudes toward their activities (Zeithaml, V.A.; Berry, L.L., 1985). Finally, users' emotive and cognitive impressions of their location may influence their actual behavior once they are there.

Affective Destination Image

An evocative image conveys the visitor's ideas and emotions about various facets of their destination (Wang, H.-Y, 2012). Several studies have demonstrated that in order to assess the destination picture, one needs consider both affective factors, which depict the feelings connected to the destination, and cognitive factors, which impart the information and concepts related to the particular destination. The affective component activates the conative and comparable components (Young, K.; Kim, S.; Il, S.; Yang, S., 2017). According to Baloglu and McCleary, affect and cognition are one and that cognition has a major role in influencing affect as a whole.

Sustainable Destination Image

The ability to meet the requirements of the present generation without compromising the demands of future generations is the definition of sustainability. Sustainability emphasizes the necessity to use finite resources wisely to preserve them for use in meeting the requirements of future generations. This issue has drawn a lot of attention because of how significant it is to the travel and tourist sector. The World Health Organization has made it clear that sustainable development and sustainable tourism go hand in hand. Three essential components—financial, ecological, and

sociocultural—must be taken into account while developing sustainable tourism. In addition to satisfying the demands of stakeholders and passengers, this concept safeguards and advances prospects.

The idea of sustainable tourism has benefited from the findings of several studies. Numerous research works have added to the body of knowledge about how decisions are made in sustainable tourism. Studies reveal that social networking sites (SNS) have a big influence on how travelers act. However, there is still much to learn about topics like social media's effect on sustainable tourism. Therefore, the goal of this research is to investigate how travelers' use of social media may affect their selections, especially when it comes to selecting eco-friendly travel locations. This study closes this knowledge gap by using social media as a data source to understand how travelers form their opinions about destinations and assist them in selecting sustainable ones.

3. DEVELOPMENT OF HYPOTHESIS AND RESEARCH QUESTION

Regarding the adoption of technology, TAM is highly recognized. According to a study by Venkatesh and Davis (2000), the research model with the biggest impact is the TAM. The TAM Model is thought to be a suitable model to illustrate how people use and adopt new technologies, such as the use of big data tools, smartphones, artificial intelligence in medical education, and data sharing in the virtual market (Ooi, K. B., & Tan, G. W. H. 2016). This is based on a variety of findings.

Boufaris (2002), McKechnie, Winklhofer, & Ennew (2006), and Vijayasarathy (2004) state that the Technology Acceptance Model has been widely used to predict and analyze customers' intentions and behavior when using online services.

The two key components that form the foundation of the Technology Acceptance Model were introduced by Davis (1989). The first is the technology's perceived usefulness, and the second is its perceived ease of use. These elements are thought to have a significant impact on whether or not a person intends to use and adopt new technology.

Perceived Ease of Use (PEU)

Perceived Ease of Use is the likelihood that utilizing a technology will be simple and painless.

PEU stands for perceived ease of use, and it refers to how easy it is for a user to utilize social media for travel. It determines whether utilizing social media necessitates more work from the user. Based on their PEU, social media users may be divided into two groups: those who are comfortable with technology and can quickly adapt to new features make up the first group. They do not have to actively learn virtual reality skills. Utilizing social media is labor-intensive for the

second type. They feel intimidated by social media's abundance of alternatives.

H1: Usage of social media is positively influenced by Perceived Ease of Use.

Perceived Enjoyment (PE)

According to (Pankaj Vishwakarma, Srabanti Mukherjee, and Biplab Datta, 2019), perceived enjoyment refers to how happy people feel using new technology. The flow theory, proposed by Csikszentmihalyi in 1977, aims to differentiate between people's emotional and cognitive aspects of behavior. The definition of perceived enjoyment given by Davis et al. (1992, p. 1113) sheds light on the degree of satisfaction that new technology users experience.

H2: Perceived Enjoyment can influence the usage of social media for travel purposes positively.

Perceived Cost (PC)

According to Machogu and Okiko (2012), perceived cost is the cost of implementing new technology and is thought to be a barrier to innovation adoption. Perceived cost has a major impact on information system adoption (Mathieson, Peacock, & Chin, 2001). According to studies by Kim, Joo, and Park (2017) and Moriguchi & Andrade (2016), perceptions of cost have a significant impact on the adoption of new technologies. In this study, perceived cost refers to the monetary expense that social media users have to bear. Travelers who use social media to research tourist destinations are responsible for covering the subscription fees required to access mobile Internet services. Studies have indicated that the perceived value of any technology is negatively associated with its perceived usage costs.

H3: Perceived Costs inversely impact the intention to adopt social media for travel purposes.

Social media and its Contribution to the Formation of Sustainable Destination Image

This study's primary goal is to quantify the influence of social media on the development of positive perceptions of sustainable travel destinations among social media users and potential travelers. The idea of sustainability is a relatively new one these days, and travelers favor serene locations. The purpose of the study is to determine whether social media content is factual and useful in promoting a sustainable endpoint.

H4: Content available on social media has a positive impact on the formation of a sustainable destination image.

Age Acting as Moderator

Currently, no study has used age as a moderator when finding the impact of social media on the sustainable destination image. So, the present study envisages filling this gap by analyzing the impact of social media on sustainable destination image and finding the effect of age on sustainable destination image when using social media.

Moderators observe conversations. The degree to which the link between the independent and dependent variables varies in response to a third variable, or the moderator, is known as the moderation analysis.

H5: An increase in age leads to a negative impact on the usage of social media and the formation of sustainable destination Images.

Moderator variables can influence the direction or strength of the link between the independent and dependent variables, which is why they are also referred to as interactions or products. They either strengthen or weaken the link, or they shift its influence from strong to moderate too non-existent. Moderators may be qualitative or quantitative in nature. Test scores, weight, age, IQ, and other numerical characteristics are a few examples of quantitative modifiers. Qualitative moderators include things like ethnicity, gender, and education that have no numerical value. Since the moderator affects the relationship's degree, direction, and strength, it can also be adjusted to measure how much the relationship between the variables has changed. To ascertain if categorical or quantitative variables affect the link between independent and dependent variables, or whether the selected moderator and the projected changes have any validity, moderators are used in research.
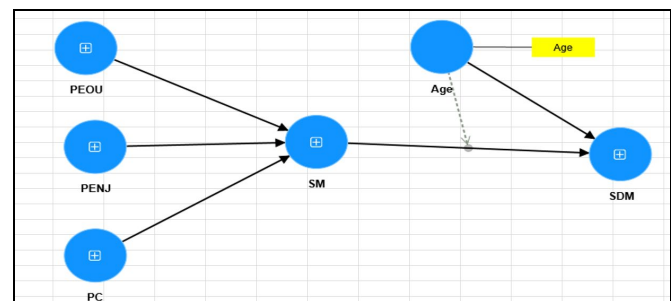
Figure 1 Conceptual Model

4. EMPIRICAL STUDY

Questionnaire and Measurements

The proposed conceptual model is shown in Figure 1 and requires verification and testing. To collect relevant data, a questionnaire based on the literature research was developed. To assure participants of the confidentiality of their answers and to give a brief overview of the study's purpose, the questionnaire included an introduction. Respondents also got an email address in case they had any questions or concerns, along with an estimate of how long the questionnaire would take to complete. The responders were chosen from the Delhi NCR area. Screening questions were used to ensure that only

individuals who had travelled for pleasure at least once in the preceding year were chosen.

For this study, those who regularly use social media and were aware of it were contacted. For the current study, data gathered from 420 respondents was analysed and results were drawn. The data was evaluated using model fit indices, and the study makes use of the Structural Equation Model proposed by (Anderson, J. C., & Gerbing, D. W. 1988) to analyse the relationships between the variables. The intended model has five constructs: the intention to utilize social media for sustainable destination (SM), perceived ease of use (PEOU), perceived enjoyment (PENJ), perceived cost (PC), and sustainable destination image (SDM). The measurement tool was a 7-point Likert scale, with 1 denoting strongly disagree and 7 strongly agree.

To improve the content validity and suit the research setting, measurement questions, and variables were drawn from earlier studies. Considering the context of the study, the following items were employed: Venkatesh and Davis (1996) provided three responses on perceived ease of use; Ghani, Supnick, & Rooney (1991) provided four responses on perceived enjoyment; Luarn & Lin (2005) provided two responses on perceived cost; Lai, Kim, and Joo provided four responses on intention to use social media; and Joo and Mohaidin provided an adaptation of four responses on sustainable destination image.

5. DATA ANALYSIS AND RESULTS

Confirmatory Factor Analysis (CFA) is a statistical method that was applied as a measuring model to determine correlations between different variables. For each item, the factor loadings were found to be greater than 0.50. Therefore, every piece of information used in the study has significance (Hair, J. F., LDS Gabriel, M., Silva, D. D., & Braga, S. 2019). The metrics Composite Reliability (CR) and Average Variance Extracted (AVE) are used to quantify the correlation between the variables. The results are displayed in Figure 2. It displays each dependent and independent variable's route coefficient.
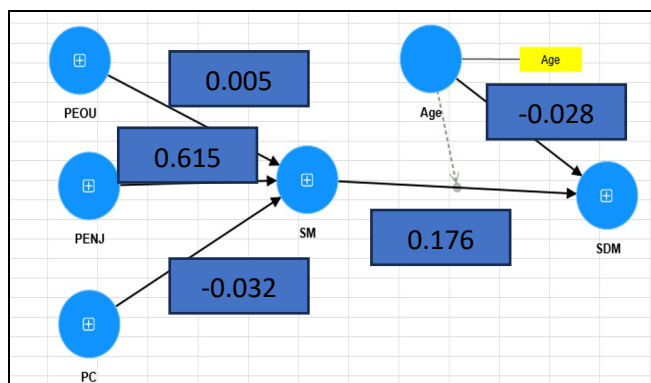
Figure 2: Results

TABLE 1: Construct Reliability and Validity - Results

Constructs	Items	AVE	Composite reliability (rho_a)	Composite reliability (rho_c)
Perceived Ease of Use (PEOU)	PEOU1: Getting to learn social media will be extremely convenient for a layman. PEOU2: In my opinion, social media is a very easy technology. PEOU3: In my opinion, any person with basic or no knowledge of technology can use social media.	0.722	1.109	0.885
Perceived Enjoyment (PENJ)	PENJ1: Social media for experiencing a destination will be very enjoyable. PENJ2: Social media for experiencing a destination will be extremely fun. PENJ3: It will be extremely pleasant to experience a destination via social media. PENJ4: It will be very interesting and exciting to experience a destination by using social media.	0.724	0.911	0.913
Perceived Cost (PC)	PC1: Social media is an expensive technology. PC2: The application and usage of social media comes with financial constructs.	0.875	0.859	0.933
Intention to use social media for sustainable destination (SM)	SM1: Is the content present on the social networking sites relevant? SM2: Is the content available on social networking sites continuously updated from time to time? SM3: Social media is	0.686	0.850	0.897

	effective towards a sustainable destination. SM4: Social media content is accurate.			
Sustainable Destination Image (SDM)	When does a destination can be termed as sustainable? SDM1: What does a sustainable destination mean when it's environmentally friendly? SDM2: The destination is considered sustainable when it is positive towards travelers. SDM3: If a destination is satisfactory to the community, then will it be considered sustainable? SDM4: Will you choose a site that is a sustainable destination?	0.512	0.725	0.805

Two-step data analysis was used to evaluate the measurement model, and the structural model was then fitted to test the hypotheses. Confirmatory Factor Analysis (CFA) has been used to develop the validity and reliability of the component. The whole measuring model's fitness has also been evaluated using CFA. The application of Structural Equation Modeling has been utilized to determine the causal relationship between different variables or constructs.

TABLE 2: Cronbach's Alpha – Results

Constructs	Items	Cronbach's Alpha (α)
Perceived Ease of Use (PEOU)	PEOU1: Getting to learn social media will be extremely convenient for a layman. PEOU2: In my opinion, social media is a very easy technology. PEOU3: In my opinion, any person with basic or no knowledge of technology can use social media.	0.852
Perceived Enjoyme	PENJ1: Social media for experiencing a destination will be	0.876

Constructs	Items	Cronbach's Alpha (α)
nt (PENJ)	very enjoyable. PENJ2: Social media for experiencing a destination will be extremely fun. PENJ3: It will be extremely pleasant to experience a destination via social media. PENJ4: It will be very interesting and exciting to experience a destination by using social media.	
Perceived Cost (PC)	PC1: Social media is an expensive technology. PC2: The application and usage of social media comes with financial constructs.	0.857
Intention to use social media for sustainable destination (SM)	SM1: Is the content present on the social networking sites relevant? SM2: Is the content available on social networking sites continuously updated from time to time? SM3: Social media is effective towards a sustainable destination. SM4: Social media content is accurate.	0.846
Sustainable Destination Image (SDM)	When does a destination can be termed as sustainable? SDM1: What does a sustainable destination mean when it's environmentally friendly? SDM2: The destination is considered sustainable when it is positive towards travelers. SDM3: If a destination is satisfactory to the community, then will it be considered sustainable? SDM4: Will you choose a site that is a sustainable destination?	0.801

Confirmatory Factor Analysis (CFA) was employed to conduct an empirical investigation of the measurement model. The internal consistency of each construct is indicated by Cronbach's alpha (α) coefficient values, which range from 0.801 to 0.876 in Tables 1 and 2. These tables have helped to determine that all the variables have a high degree of dependability because their values are higher than the recommended cut-off value of 0.7. The purpose of measuring composite construct dependability was to assess the multi-item scales. The results for the same have been seen to range from 0.725 to 1.109, satisfying the 0.60 minimum criteria. Furthermore, every average variance extracted (AVE) value, which ranged from 0.512 to 0.875, was greater than the suggested cut-off points of 0.50.

TABLE 3: Summary Results of Hypothesized Model Testing

Hypothesis	Path	P-Values	Result
H1	PEOU -> SM	0.043	Supported
H2	PENJ -> SM	0.000	Supported
H3	PC -> SM	0.022	Supported
H4	SM -> SDM	0.003	Supported
H5	Age x SM -> SDM	0.021	Supported
H5	Age -> SDM	0.042	Supported

The p-value is displayed in Table 3. It is assumed that a hypothesis will be accepted only when the p-value for the same is less than 0.05. The study concludes that there is a positive correlation between the perceived ease of use and the intention to use social media for sustainable destinations. The p-value for this correlation is less than 0.05, which means that H1 is accepted. In a similar vein, PENJ and the goal of utilizing social media for environmentally friendly travel destinations align, leading us to embrace H2. The results of this study show that there is an inverse relationship between perceived costs and intention to utilize social media. H3 has been approved consequently. The data studies show that social media positively influences the sustainable destination, which leads to the acceptance of H4. As per the results, it has been observed that the p-value of the age that has been used as a moderator is 0.042 which is lower than the value of 0.05 hence H5 is also accepted.

TABLE 4: Discriminant Validity (HTMT)

	Age	PC	PENJ	PEOU	SDM	SM	Age x SM
Age							
PC	0.105						
PENJ	0.169	0.145					
PEOU	0.045	0.127	0.121				
SDM	0.144	0.110	0.131	0.209			
SM	0.077	0.373	0.651	0.069	0.231		
Age x SM	0.077	0.082	0.062	0.040	0.091	0.167	

Table 4 shows showing Discriminant Validity of each variable. The discriminant Validity is established between two reflective constructs only when the HTMT value is below 0.90.

TABLE 5: Discriminant Validity: The Fornell – Larcker Criterion

	Age	PC	PENJ	PEOU	SDM	SM
Age	*1.000*					
PC	0.097	*0.936*				
PENJ	0.158	0.574	*0.851*			
PEOU	0.052	-0.102	-0.071	*0.850*		
SDM	0.115	0.003	0.099	0.159	*0.715*	
SM	0.069	0.320	0.596	-0.036	0.187	*0.828*

Table 5 shows the values representing Discriminant Validity: The Fornell – Larcker Criterion. The values that are bold and italic (Diagonal Values) represent the square root of AVE and on the other hand, off-diagonal values represent the correlations. The table indicates that all the reflective constructs are best loaded with themselves, as the square root of AVE is larger than correlations. Therefore, it is stated that discriminant (construct) holds.

6. CONCLUSION

Social Media has grown into an important source of information for understanding what a sustainable process is. Because social networking sites are largely used for the goal of selecting sustainable travel destinations, they are frequently effective at tackling sustainability challenges. For more than a decade, sustainable destination choice behaviour was considered the gold standard for efficiently managing travel locations.

This study presents a novel perspective on the influence of social media on the production of destination pictures and the selection of environmentally friendly vacation destinations. The results of this study indicate that when individuals are forming opinions about a destination, the information and material found on different social networking sites is thought to be the most important source of knowledge.

The suggested research methodology has promise for augmenting and expanding our comprehension and investigation of tourism. The findings will stimulate more investigation, which will assist researchers in identifying other factors that could affect travellers' decisions on sustainable tourism destinations. Furthermore, these discoveries will lead to social media marketing initiatives that are more successful. Furthermore, there are several ways to adjust the conceptual framework to better determine the intentions of visitors about their choice of location.

The present study has also provided age information. That is how age has an inverse relation with the usage of social media. The study presents that with an increase in age, the usage of social media reduces which in turn reduces the frequency in the formation of sustainable destination image.

MANAGERIAL IMPLICATIONS

The importance of social media content is growing, which has significant implications for how travel arrangements are made, including hotel, food, and transportation. At the national level, commercial organizations and tourism organizations will find great value in the current study's

practical application. When developing their advertising campaigns and updating their official websites, marketers in the travel industry should seriously consider the information they post on social media.

To differentiate their destination and draw in potential clients, destination promoters need to handle their location as a "product" with great care. They need to figure out what factors influence how potential traveller's view the locations. This study will encourage travel industry professionals to use destination information as a key tool to draw in and shape the opinions of potential customers. You can think of a tourism destination as a brand composed of both material and immaterial components. As a result, destination branding management calls for marketers to focus more on using information sources to assess and enhance the location's cognitive and emotive image.

7. LIMITATIONS AND FUTURE WORK

This study included some limitations that should be considered for follow-up research. First, we failed to consider what people thought about how images are formed on specific social media sites (Facebook, Instagram, WeChat, etc.). Furthermore, we failed to draw attention to the significant social media posts—pictures, videos, storyboards, live streaming, graphic presentations, etc.—that motivate travelers to book eco-friendly accommodations. Third, there was just one time that the respondents were surveyed. It is possible to ensure that future research can be done both before and after travel to assess travelers' satisfaction levels and determine the validity of data found on social networking sites. Finally, aside from individual surveys, focus groups can be used by researchers to identify different aspects influencing the selection of sustainable travel locations.

REFERENCES

[1.] Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011). Social media? Get serious! Understanding the functional building blocks of social media. *Business horizons*, *54*(3), 241-251.

[2.] Mir, I. A. (2012). Consumer attitudinal insights about social media advertising: A South Asian perspective. *The Romanian Economic Journal*, *15*(45), 265-288.

[3.] Tham, A., Croy, G., & Mair, J. (2013). Social media in destination choice: Distinctive electronic word-of-mouth dimensions. *Journal of Travel & Tourism Marketing*, *30*(1-2), 144-155.

[4.] Li, R., & Suh, A. (2015). Factors influencing information credibility on social media platforms: Evidence from Facebook pages. *Procedia computer science*, *72*, 314-328.

[5.] Hair, J. F. (2019). LDS Gabriel M, Silva DD, Braga S. *Development and validation of attitudes measurement scales: fundamental and practical aspects. RAUSP Manag J*, *54*, 490-507.

[6.] Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision sciences*, *27*(3), 451-481.

[7.] Ghani, J. A., Supnick, R., & Rooney, P. (1991). The experience of flow in computer-mediated and in face-to-face groups.

[8.] Luarn, P., & Lin, H. H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in human behavior*, *21*(6), 873-891.

[9.] Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin*, *103*(3), 411.

[10.] Machogu, A. M., & Okiko, L. (2012). The perception of bank employees towards cost of adoption, risk of innovation, and staff Training's influence on the adoption of information and communication technology in the Rwandan commercial banks. *Journal of Internet Banking and Commerce*, *17*(2), 1.

[11.] Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: the influence of perceived user resources. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, *32*(3), 86-112.

[12.] de Sena Abrahão, R., Moriguchi, S. N., & Andrade, D. F. (2016). Intention of adoption of mobile payment: An analysis in the light of the Unified Theory of Acceptance and Use of Technology (UTAUT). *RAI Revista de administracao e Inovacao*, *13*(3), 221-230.

[13.] Vishwakarma, P., Mukherjee, S., & Datta, B. (2020). Antecedents of adoption of virtual reality in experiencing destination: A study on the Indian consumers. *Tourism Recreation Research*, *45*(1), 42-56.

[14.] Csikszentmihalyi, M., Larson, R., & Prescott, S. (1977). The ecology of adolescent activity and experience. *Journal of youth and adolescence*, *6*(3), 281-294.

[15.] Chesney, T. (2006). An acceptance model for useful and fun information systems. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*.

[16.] Ooi, K. B., & Tan, G. W. H. (2016). Mobile technology acceptance model: An investigation using mobile users to explore smartphone credit card. *Expert Systems with Applications*, *59*, 33-46.

[17.] McKechnie, S., Winklhofer, H., & Ennew, C. (2006). Applying the technology acceptance model to the online retailing of financial services. *International Journal of Retail & Distribution Management*, *34*(4/5), 388-410.

[18.] Wang, H.-Y. Investigating the determinants of travel blogs influencing readers' intention to travel. Serv. Ind. J. 2012, 32, 231–255.

[19.] Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1988). Communication and control processes in the delivery of service quality. *Journal of marketing*, *52*(2), 35-48.

[20.] Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of marketing*, *60*(2), 31-46.

[21.] Hsu, C. H., Wolfe, K., & Kang, S. K. (2004). Image assessment for a destination with limited comparative advantages. *Tourism Management*, *25*(1), 121-126.

[22.] Baloglu, S., & McCleary, K. W. (1999). A model of destination image formation. *Annals of tourism research*, *26*(4), 868-897.

[23.] Zhang, K. Z., & Benyoucef, M. (2016). Consumer behavior in social commerce: A literature review. *Decision support systems*, *86*, 95-108.

[24.] Mariani, M. M., Mura, M., & Di Felice, M. (2018). The determinants of Facebook social engagement for national tourism organizations' Facebook pages: A quantitative approach. *Journal of destination marketing & management*, *8*,

312-325.

[25.] Gretzel, U., Fesenmaier, D. R., Formica, S., & O'Leary, J. T. (2006). Searching for the future: Challenges faced by destination marketing organizations. *Journal of Travel Research*, *45*(2), 116-126.

[26.] Shuang, Y. (2013, July). Effects of information quality and source credibility on EWOM adoption in context of virtual community. In *2013 International Conference on Management Science and Engineering 20th Annual Conference Proceedings* (pp. 194-200). IEEE.s

[27.] Sultan, M.T.; Sharmin, F.; Badulescu, A.; Gavrilut, D.; Xue, K. Social Media-Based Content towards Image Formation: A New Approach to the Selection of Sustainable Destinations.

Sustainability 2021, 13,4241. https://doi.org/10.3390/su13084241

[28.] Seddighi, H.R.; Theocharous, A.L. A model of tourism destination choice: A theoretical and empirical analysis. Tour. Manag 2002, 23, 475–487.

[29.] Alcázar, M. del C.H.; Departamento; Piñero, M.S.; Maya, S.R. de The effect of user-generated content on tourist behavior: The mediating role of destination image. Tour. Manag. Stud. 2014, 10, 158–164.

[30.] Pike, S.; Page, S.J. Destination Marketing Organizations and destination marketing: A narrative analysis of the literature. Tour Manag. 2014, 41, 202–227

A Perspective on Tax Avoidance Strategies in EPC Contracts and their Linkage to Permanent Establishments under Direct Taxes

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ABSTRACT

In the context of Engineering, Procurement, and Construction (EPC) contracts, tax evasion, tax avoidance is highly relevant and widely used by corporations. The exploratory study adopts a mixed methodology with using a sample of leading EPC corporates in India and abroad – Eleven in total, with purposive sampling being used, and use of google search. The companies selected are in the top category for EPC contracts for which they are well known, in India and globally. The data has been taken for a period of five years from 2018/2019 to 2022/2023, 54 observations, available as per www.moneycontrol.com and www.investing.in and also considers key judicial rulings, as per www.itatonline.com, tax journals, over a 15 year period. The evidence of tax avoidance is modelled using ROA as dependent variable and Long-term -debt, Total assets, Inventory, Effective Tax rate (ETR), Property, plant and Equipment, -all taken as dependent variables, using the panel regression approach. This study aims to test this hypothesis for evidence of tax avoidance in practice and discusses the significance of appropriately structuring contracts to prevent corporates from being accused of tax avoidance through the use of EPC contracts. The findings indicate that tax avoidance practices are well practised by the EPC contractors and it is a global practice, to apply suitably structures, to execute such contracts, as operationally these are critical, practically feasible, legally justified, and protects the interest of all stakeholders, including investors, contractors and beneficial to the nation development.

Keywords: Keyword 1, Tax Avoidance, Effective Tax Rate Engineering, Procurement Construction contracts, Permanent establishment, Split contracts.

1. INTRODUCTION

A "Permanent Establishment" if it constitutes a substantial, enduring, or long-term part of the business, in a nation or country. Taxation only applies to the portion of a profit that can be lawfully traced back to activities carried out in India.One important component of EPC contracts is that, to a certain extent, they also consider using tax avoidance to take advantage of tax advantages, and numerous previous studies have demonstrated this across different regions. It is well known that EPC contracts are important in India because of their beneficial effects on growth and development. An enity's business link is only subject to taxation if a PE is established during the process and the income accruing to the PE is the amount attributable to the operations conducted in India. This apportioned amount alone may be taken into account for tax reasons. According to S-90 of the IT Act, in accordance with DTA Article 7(2), the provisions of a Tax Treaty (DTA) would supersede those of the IT Act if they are more beneficial to the taxpayer. In this context, tax evasion and the role of structures are also crucial. Among other things, the many contract forms—such as split contracts, LSTK, turnkey contracts, composite contracts, etc.—use special SPV structures to facilitate tax evasion, avoidance and minimisation. Various factors also influence the way contracts are written and the interests of the project's investors. The study is divided into two sections. The first portion analyses the tax avoidance practices of EPC businesses, and the second part links the findings to previous research and focusses on important aspects and court decisions.

2. REVIEW OF LITERATURE

The potential desire to reduce the taxability arising from permanent establishments in the country where the project is being implemented may be influenced by a number of factors, including corporate governance, tax evasion, uncertainty, evolving tax legislation, and SPV structures. Tax avoidance also plays a significant role in this regard, and India loses USD 31.7 billion in taxes in 2021, primarily as a result of tax evasion by multinational firms, according to Tax Justice.net reports. The most widely used indicators of tax aggression have basic traits that are not just distinct from one another but also exhibit distinct, fluctuating behavioural patterns. It has consequences for how tax aggressiveness may impact financial and tax reporting as well as the types of tax aggressiveness that they may be able to measure, since certain metrics are more susceptible to year-to-year fluctuations than others. Researchers should be aware of the special characteristics of every measure they employ, and tax planning models should consider a greater variety of financial and economic factors. This makes it easier to identify and control non-tax factors that may unjustly affect tax aggressiveness metrics. (Dunbar, A., Higgins, D. M., Phillips, J. D. et al 2010). This paper summarises the empirically accessible metrics for tax avoidance and their close relationships. It compare the first three measures presented after comparing a number of book-tax differences, ETR (GETR, CETR) based measures, the measure created by Henry and Sansing (2014), Unrecognised Tax Benefits & Tax Shelter Scores conceptually. A straightforward descriptive study reveals that there is a significant

correlation, especially between yearly proxies, and that this correlation increases with the similarity of the calculations and inputs. Nonetheless, there are disparities among the various measures, and these discrepancies endure throughout time. (Gebhart, M. S. (2017). The literature on tax avoidance was critically reviewed, with an emphasis on theories of corporate tax avoidance and empirical substitutes for tax avoidance. Agency theory should be regarded as one of the pertinent analytical foundations in order to gain a better understanding of the dynamics between managers and shareholders with respect to corporate tax evasion strategies. However, the numerous empirical proxies for corporate tax avoidance developed using financial statement variables may not be helpful to companies who engage in conforming tax avoidance, which lowers both book and taxable revenue. An alternative to open tax evasion is the use of tax shelters and questionable tax benefits.(Lee, B. B., A. Dobiyanski, & S. Minton 2015). This paper notes that because firm management tax policies and corporate tax return information are confidential, we know very little about these corporations' tax-aggressive activity. Despite their lack of inside knowledge, tax scholars have continued to attempt to use publicly available statistics as proxies to assess corporate tax aggression.There are other dichotomous proxies, including involvement in tax disputes and belonging to a harmful tax regime. This demonstrates the usage of the different proxies and examines whether they estimate the aggressive taxation of large publicly traded company entities consistently, using sample of ASX 200 companies in Australia, and a variety of proxies. (Krever, R., Sadiq, K., & McCredie, B. (2022, March). There is proof that tax hostility and managerial skill are at odds. The results hold up well when a range of tax aggressiveness measures are used, firm fixed effects are included, and endogeneity is taken into account using a difference-in-differences technique. According to recent studies, this negative correlation is more pronounced for companies that have more investment prospects or that are more vulnerable to reputational issues. Given the substantial costs associated with aggressive tax evasion practices and the potential harm to managerial reputation in the event of discovery, the results suggest that more competent managers are less likely to engage in them. (Francis, B., Sun, X., Weng, et al,(2013). As businesses aim to grow their value, tax avoidance has been seen as more beneficial to shareholders. However, recent research has cast severe doubt on this belief. Using data from the listed firms' financial statements (Ghana Stock Exchange), SPSS statistical tools, and a standard Ordinary Least Square regression model, the study experimentally assessed whether tax evasion of a corporation genuinely increases its worth or profitability. The results confirmed that there was a negative relationship between the profitability measure (ROA) and the tax evasion measure (ETR). One concludes that tax evasion may yield value or profitability based on the combination of professionalism and competence displayed. (Mbroh, N., Monney, A.,et al (2019). Using a two-stage instrumental

variable, a regression discontinuity design (RDD), and exogenous variation in the index membership close to the DAX and MDAX threshold, the study investigates the relationship between tax evasion and corporate governance. The investigation shows that good corporate governance characteristics reduce the effective tax rate for DAX companies. This study attempts to show how institutional investors have a wide-ranging impact on business policy, in this case tax management, by establishing a causal relationship between governance and taxation. Kiesewetter, D., & Manthey, J. (2017). The study explores the connection between tax evasion and poor business management. According to the perspective of stakeholders, a number of factors influence whether or not firms avoid paying their fair share of taxes, including ownership structure, board composition, audit, enforcement, capital market monitoring, government interactions, and stakeholder pressure. The motivations of management and shareholders must coincide. The findings demonstrate that effective corporate governance procedures best prevent tax evasion for any organisation. Nevertheless, corporate tax evasion cannot be adequately explained by the conventional principal-agent paradigm. It is necessary to do a more comprehensive analysis of the elements driving corporate tax avoidance, taking into consideration corporate governance frameworks and all significant stakeholders in the company. Additionally, it shows that corporate governance systems can both encourage tax evasion, which would increase firm profitability, and restrict it to a point where the risks involved do not outweigh the benefits. (Kovermann, J., & Velte, P. (2019). Researchers looked into the relationship between certain corporate governance practices and tax evasion in companies that were listed between 2011 and 2015 on the Tehran Stock Exchange. It was investigated how certain corporate governance metrics—like board size, non-duty members, management ownership, and organisation ownership—affect tax evasion. Multiple regression analysis revealed no relationship between tax avoidance and institutional ownership or the proportion of off-duty board members. Furthermore, there is no link between tax evasion and management ownership.(Jamei, R. 2017). Tax avoidance includes everything from breaking the law to using legal means to lower corporate tax rates. It attempts to summarise the key results of tax evasion research from the accounting and finance literatures over the previous ten years. Regarding the interrelated problems of quantifying tax avoidance, as well as the potential causes and effects of corporate tax avoidance, it address theoretical advancements and the relevant empirical findings, and offer some suggestions for additional study to look into unexplored areas of tax evasion. Wang, F., Xu, S., Sun, J., & Cullinan, C. P. (2020), A. (2004),Tax planning can raise the organization's financial complexity while also delivering the anticipated tax savings. It examines whether the information environment is less open for aggressive tax planning businesses. Transparency issues can develop to the extent that this increased financial

complexity cannot be appropriately explained through interactions with outside stakeholders, such as investors and analysts. The relationships between tax evasion and information asymmetry, analyst forecasting mistakes, and profits quality, aggressive tax planning is linked to less company openness, and evidence exist that management at tax-aggressive companies try to address these issues with openness by boosting different tax-related disclosures. Overall, findings indicate that businesses must choose between tax advantages and financial openness when determining how aggressively to manage their taxes. (Balakrishnan, K., Blouin, et al (2019). The paper looks at the tax difficulties in contracts related to engineering, procurement, and construction (EPC), with a particular emphasis on Indonesian legislation. Since construction services are primarily subject to Final Income Tax, it emphasises the significance of contract segregation in order to streamline taxation. Both onshore and offshore components present difficulties, such as equipment supply and services, which might result in disagreements over the status of Permanent Establishments (PE) and the allocation of income. India and Indonesian case studies illustrate divergent tax views. Generally speaking, Indonesia taxes EPC contracts as a single entity, whereas India concentrates on profit attribution within its borders. The study emphasises how tax treaties, such as the Indonesia-Germany agreement, determine tax treatment according to each nation's activity. In light of jurisdictional activities and pertinent Tax Treaties, it emphasises the necessity of consistent tax treatment through contract segregation. (Fathoni, M. I. (2024). The study examines the relationship between tax avoidance and business group affiliation in various legal and economic contexts. Tax avoidance should be made easier by the company group structure, which permits the ultimate owner to distribute revenue and resources among group companies. However, there will probably be non-tax expenses associated with such operations. In nations with developed economies or code law systems, where non-tax costs are lower, business group firms evade taxes more than stand-alone firms. In nations with emerging economies or common law systems, where non-tax costs are higher, they avoid taxes less. It sheds light on the ownership structure of business groups as well as the linkage between tax evasion by corporates and a nation's legal genesis and economic development.(Hong, H. A., Kim, J. B., et al) (2022). The effect of insufficient tax transparency on tax evasion is covered in this article. Tax evaders may still take use of alternative tax evasion opportunities even while FATCA and CRS address some types of tax evasion. If tax evaders are able to continue avoiding taxes through other means, anti-tax evasion efforts may not be successful or economical, and the article examines potential policy solutions to the issues brought about by insufficient tax transparency.(Noked, N. (2018).This study looks at tax avoidance by corporate entities in the setting of a contract with a company's shareholders and a tax manager, with the latter engaging in possible evasion of taxes and may also

possess confidential knowledge about the legal validity of possible reduction in tax claims, in reporting of revenue. It explicitly characterises the ideal incentive using an expensive state falsification framework. and examines how the structure of a contract evolves in response to different enforcement measures enforced by the taxman. (Crocker, K. J., & Slemrod, J. (2005).

3. RESEARCH GAP

Large contracts, which are crucial for development are valued because they necessitate cooperation from a wide range of stakeholders to create the project, including in the areas of infrastructure, machinery and equipment, power generation equipment, etc. EPC contracts usually consist of two components: onsite and offshore. These help in creation of infrastructure, provide employement and increase national GDP over long term. In view of their unique characteristics and the fact that they can result from the use of various structures, including SPVs, which add another layer of tax shelter, by dividing contracts into onsite and offshore. DTA among the two countries in question also adds another factor to depict the PE is evolving. Few studies have linked the potential role of tax avoidance, structures, and factors that make an entity create a PE, as well as the motives that lead to a PE becoming taxable. Previous research has concentrated on the significance, applicability, types, and varieties of PEs that may arise. The courts later ruled that the structures had no significant commercial function and were primarily used for tax avoidance. There is now room for more research based on big contracts and engineering procuring contracts since tax avoidance motives, namely in the structure of EPC contracts. were not covered in earlier studies. This study examines tax avoidance, tax planning the emergence of PEs in EPC contracts, structures created in response, and the results of court cases.

4. OBJECTIVES OF THE STUDY

a) To study the relevance and relevance of tax avoidance in area of the EPC contracts, and whether it can be said that EPC contracting corporates are practicing tax avoidance

b) To examine the aspects and variables that affect how EPC contracts are split, as well as any potential considerations that the courts might have

c) To study the decided cases in the context of EPC contracts holding splitting of EPC contracts, into offshore and onsite part as being tax avoidance - using select cases and trends. in the past cases with rationale behind decision.

5. METHODOLOGY

The study adopts a hybrid methodology that includes a sample of eleven top EPC corporates in India and overseas, selected through purpose sampling and a Google search. The chosen organisations are well-known both in India and

internationally and fall into the top category for EPC contractors. According to www.moneycontrol.com and www.investing.in, the data, which includes 54 observations, was collected during a five-year period, from 2018/2019 to 2022/2023. Using ROA as the dependent variable and long-term debt, total assets, inventory, effective tax rate (ETR), property, plant, and equipment as dependent variables, the evidence of tax avoidance is arrived at. The strategy has been to take into account the motivations as per previous research studies for b)—the elements driving the divide into off-shore and onsite. Regarding c) a few cases decided by different Indian and Nigerian courts, the reasoning behind the court's ruling and the reason it was deemed to be tax evasion are discussed. The reasons for the court's view of whether or not a PE has arisen are clarified by the numerous court rulings and the circumstances that led up to them. The exploratory research provides guidance and recommendations on the latest advancements in business practices while taking into consideration the legal rulings of the ITAT, HC, SC, and professional consultants such as Deloitte, KPMG, E&Y, etc. Different ratios were determined using Microsoft Excel. For analysis, descriptive statistics were employed. Pannel regression and STATA 17 correlation are computed to test hypotheses.

This exploratory study uses secondary data based on Itatonline.org, the OECD, Deloitte, PWC KPMG, the Tax Justic network, Itatonline, various judicial rulings at forums as the sources of data . It also looked at important court cases, particularly how they were decided at various levels at the HC, SC, AAR, and ITAT levels, mostly between 2007–2008 and 2023., over a 15 year period.

6.   FINDINGS AND IMPLICATIONS:

a) Study the relevance and relevance of tax avoidance in area of the EPC contracts, and whether it can be said that EPC contracting corporates are practicing tax avoidance.

TABLE-1: List of Variables

Variable	Code	Description
Dependent Variable (DV)	ROA	Return on Assets = (PAT / To TAl Assets)
Independent Variables (IVs)		
1	LTD to TA	Long Term Debt / To TAl Assets
2	PPE to TA	Property, plant, and equipment (PP&E) / To TAl Assets
3	INV to TA	Inventory / To TAl Assets
4	ETR	CTA is the ETR's (either Accounting

		ETR or Cash ETR) proxy measure for corporate tax evasion.
5	LOG_TA	Log Values of To TAl Assets
6	LOG_PBT	Log Values of Profit Before Tax

Fig-1: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
ROA	54	.0116164	.0692429	-.2084561	.2237553
ETR	54	.2483662	.4001723	-1.181793	1.200474
LTDtoTA	54	.1062617	.099783	.0030863	.5118039
PPEtoTA	54	.1980517	.1816381	.041567	.6424033
INVtoTA	54	.0946782	.1237203	.0055443	.5332866
Log_PBT	54	3.795691	.8448518	0	5.933357
Log_TA	54	4.546564	1.009308	3.511869	7.32039

Source: Authors Computations

The Fig-1 provides basic information about the distribution of ROA, LTD to TA, PPE to TA, INV to TA, ETR, LOG_TA and LOG_PBT variables, namely the mean, Standard Deviation (SD), range of values . These variables detailed interpretation as follows:

- **ROA**: The mean ROA for sample data is **0.0116164**, with a SD of **0.0692429**. The lowest and highest values are **-0.2084561** and **0.2237553**, respectively.

- **ETR**: Effective tax rate is the percentage of income that a company pays in taxes. The mean ETR for sample data is **0.2483662**, with a SD of **0.4001723**. The lowest and highest values are **-1.181793** and **1.200474**, respectively.

- **LTD to TA**: Long-term debt to to TAl assets is a solvency ratio that measures the proportion of a company's assets that are financed by long-term debt. The mean LTD to TA for sample data is **0.1062617**, with a SD of **0.099783**. The lowest and highest values are **0.0030863** and **0.5118039**, respectively.

- **PPE to TA**: Property, plant, and equipment to to TAl assets is an efficiency ratio that measures how much of a company's assets are invested in property, plant, and equipment (PPE). The mean PPE to TA for sample data is **0.1980517**, with a SD of **0.1816381**. The lowest and highest values are **0.041567** and **0.6424033**, respectively.

- **INV to TA**: Inventory to to TAl assets is an efficiency ratio that measures how much of a company's assets are invested in inventory. The mean INV to TA for sample data is **0.0946782**, with a SD of **0.1237203**. The lowest and highest values are **0.0055443** and **0.5332866**, respectively.

- **Log_PBT**: Logarithm of profit before taxes (PBT) is the natural logarithm of the difference between to TAl revenue and to TAl expenses before taxes have been deducted from earnings. The mean Log_PBT for sample data is **3.795691**, with a SD of **0.8448518**. The lowest and highest values are **0** and **5.933357**, respectively.

- **Log_TA**: Logarithm of to TAl assets (TA) is the natural logarithm of the sum of all assets owned by the company at the end of the fiscal year or quarter being analysed. The mean Log_TA for sample data is **4.546564**, with a SD of **1.009308**. The lowest and highest values are **3.511869** and **7.32039**, respectively.

Fig-2: Correlations

	ROA	ETR	LTDtoTA	PPEtoTA	INVtoTA	Log_PBT	Log_TA
ROA	1.0000						
	54						
ETR	0.2145	1.0000					
	0.1194						
	54	54					
LTDtoTA	-0.4028*	0.0308	1.0000				
	0.0025	0.8249					
	54	54	54				
PPEtoTA	0.4015*	-0.1228	-0.0286	1.0000			
	0.0026	0.3765	0.8373				
	54	54	54	54			
INVtoTA	-0.1894	-0.1286	-0.0069	0.0252	1.0000		
	0.1701	0.3542	0.9606	0.8567			
	54	54	54	54	54		
Log_PBT	0.3052*	0.0866	-0.0496	0.0618	-0.1585	1.0000	
	0.0248	0.5334	0.7216	0.6568	0.2523		
	54	54	54	54	54	54	
Log_TA	0.0907	0.0082	0.0506	-0.1654	-0.1201	0.7130*	1.0000
	0.5141	0.9530	0.7166	0.2321	0.3872	0.0000	
	54	54	54	54	54	54	54

Source: Authors Computations

The hypothesis for testing the correlation between two variables is:

H_{01}: linear relationship between the two variables is absent.

H_{a2}: linear relationship between the two variables exists

The **Fig-2** shows the Pearson correlation coefficients between ROA, LTD to TA, PPE to TA, INV to TA, ETR, LOG_TA and LOG_PBT variables. From the above it can be observed as under :-

- There is a low positive correlation among ROA and ETR, however it is not statistically significant ($r = 0.2145$, $p = 0.1194$).

- There is a moderate negative correlation between ROA and LTD to TA, and it is statistically significant ($r = -0.4028$, $p = 0.0025$). This means that as ROA increases, LTD to TA tends to decrease, and vice versa.

- There is a moderate positive correlation between ROA and PPE to TA, and it is statistically significant ($r = 0.4015$, $p = 0.0026$). This means that as ROA increases, PPE to TA tends to increase, and vice versa.

- There are weak negative correlations between ROA and INV to TA, ETR and PPE to TA, ETR and INV to TA, LTD to TA and PPE to TA, LTD to TA and INV to TA, PPE to TA and INV to TA, Log_PBT and INV to TA, Log_TA and PPE to TA, Log_TA and INV to TA, however are not significant.

- There are lower favourable correlations among ETR and LTD to TA, LTD to TA and Log_PBT, LTD to TA and Log_TA, PPE to TA and Log_PBT, INV to TA and Log_PBT, but are not significant.

- There is a moderate favourable correlation between ROA and Log_PBT, and it is statistically significant ($r = 0.3052$, $p = 0.0248$). This means that as ROA increases, Log_PBT tends to increase, and vice versa.

- There is a lower correlation observed among ETR and Log_PBT, however not significant ($r = 0.0866$, $p = 0.5334$).

- There are weak negative correlations between PPE to TA and Log_TA, but it is not statistically significant ($r = -0.1654$, $p = 0.2321$).

- There appears to exist a high level of positive correlation among Log_PBT and Log_TA, and it is statistically significant ($r = 0.7130$, $p < 0.0001$). This means that as Log_PBT increases, Log_TA tends to increase very strongly, and vice versa.

7. PANEL DATA REGRESSION ANALYSIS:

We used panel data regression, ROA, LTD to TA, PPE to TA, INV to TA, ETR, LOG_TA, and LOG_PBT variables to obtain a more reliable result.

For Fixed Effect Panel Regression:

$$ROA = \beta_0 + \beta_1 LTD\,to\,TA + \beta_2\,PPE\,to\,TA + \beta_3 INV\,to\,TA + \beta_4 ETR + \beta_5\,LOG\_TA + \beta_6 LOG\_PBT + \varepsilon \;\ldots\ldots\;(Eq.1)$$

Where, ε = error term

For Random Effect Panel Regression:

$$ROA = \beta_0 + \beta_1 LTD\,to\,TA + \beta_2\,PPE\,to\,TA + \beta_3 INV\,to\,TA + \beta_4 ETR + \beta_5\,LOG\_TA + \beta_6 LOG\_PBT + \varepsilon + \mu \;\ldots\ldots\;(Eq.2)$$

Where, ε = within entity error term, μ = between entity error term

H_{02}: The preferred model is random effects on ROA during the study period.

H_{a2}: The preferred model is fixed effects on ROA during the study period.

Fig-3: Random Effect Model

```
Random-effects GLS regression          Number of obs     =        54
Group variable: CompanyNo              Number of groups  =        11

R-squared:                             Obs per group:
    Within  = 0.1880                               min =         4
    Between = 0.5628                               avg =       4.9
    Overall = 0.4462                               max =         5

                                       Wald chi2(6)      =     17.76
corr(u_i, X) = 0 (assumed)             Prob > chi2       =    0.0069
```

ROA	Coefficient	Std. err.	z	P>|z|	[95% conf. interval]	
ETR	.02123	.0173928	1.22	0.222	-.0128592	.0553192
LTDtoTA	-.2146295	.1069022	-2.01	0.045	-.4241539	-.0051051
PPEtoTA	.1347809	.0700166	1.92	0.054	-.0024491	.2720108
INVtoTA	-.0856145	.0692745	-1.24	0.217	-.22139	.0501609
Log_PBT	.0241933	.0118238	2.05	0.041	.001019	.0473676
Log_TA	-.0019354	.0158833	-0.12	0.903	-.0330661	.0291953
_cons	-.0728261	.0711717	-1.02	0.306	-.21232	.0666678
sigma_u	.04252416					
sigma_e	.03838846					
rho	.55097997	(fraction of variance due to u_i)				

Source: Authors Computations

Fig-3: Random Effect Model shows a positive relationship between LTD to TA, PPE to TA, INV to TA, ETR, LOG_TA and LOG_PBT as expected. R-square is 0.188 Lower positive to this model. 'rho' is known as the intraclass correlation 55.09% of the variance is due to differences across panels. The z-statistics of LTD to TA and LOG_PBT variables are significant at 5% ($p < 0.05$) and chi-square also significant at 1% ($p < 0.01$).

Fig-4: Fixed Effect Model

```
Fixed-effects (within) regression       Number of obs     =        54
Group variable: CompanyNo              Number of groups  =        11

R-squared:                             Obs per group:
    Within  = 0.3133                               min =         4
    Between = 0.0429                               avg =       4.9
    Overall = 0.0375                               max =         5

                                       F(6,37)           =      2.81
corr(u_i, Xb) = -0.9839                Prob > F          =    0.0234
```

ROA	Coefficient	Std. err.	t	P>|t|	[95% conf. interval]	
ETR	.01828	.0179849	1.02	0.316	-.0181609	.0547209
LTDtoTA	-.1241821	.1386977	-0.90	0.376	-.4052103	.156846
PPEtoTA	.2729545	.1344117	2.03	0.050	.0006105	.5452985
INVtoTA	-.1873704	.0857216	-2.19	0.035	-.3610588	-.013682
Log_PBT	.021534	.0119651	1.80	0.080	-.0027096	.0457775
Log_TA	.3272417	.1298776	2.52	0.016	.0640846	.5903988
_cons	-1.585609	.5965771	-2.66	0.012	-2.794389	-.3768288
sigma_u	.36702523					
sigma_e	.03838846					
rho	.98917858	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(10, 37) = 5.52          Prob > F = 0.0001
```

Source: Authors Computations

Fig-4: Fixed Effect Model shows a positive relationship between LTD to TA, PPE to TA, INV to TA, ETR, LOG_TA

and LOG_PBT as expected. R-square is 0.3133 low positive to this model. 'rho' is known as the intraclass correlation 98.91% of the variance is due to differences across panels. The t-statistics of PPE to TA, INV to TA and LOG_TA variables are significant at 5% ($p \leq 0.05$) and F-statistic is also significant at 1% ($p < 0.01$).

Fig-5: Hausman Test

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
	Coefficients			
ETR	.01828	.02123	-.0029501	.004577
LTDtoTA	-.1241821	-.2146295	.0904473	.0883684
PPEtoTA	.2729545	.1347809	.1381736	.1147353
INVtoTA	-.1873704	-.0856145	-.1017558	.05049
Log_PBT	.021534	.0241933	-.0026593	.0018331
Log_TA	.3272417	-.0019354	.3291771	.1289028

```
                 b = Consistent under H0 and Ha; obtained from xtreg.
                 B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            =     6.31
Prob > chi2 = 0.3899
(V_b-V_B is not positive definite)
```

Source: Authors Computations

Fig-5: Since the probability value is greater than 0.05, we are unable to reject the Hausman Test null hypothesis that the Random Effect Model is appropriate. Hence, it can be suggested that the Random Effect Model is suitable for examining the connection between these factors. Consequently, we can state with certainty that the level of LTD to TA, PPE to TA, INV to TA, ETR, LOG_TA, and LOG_PBT has a favourable impact on the ROA of the various sample organisations (included here).

8. CASES ANALYSIS:

Based on the samples of EPC corporates collected, it appears to indicate that there is possibly some amount of Corporate tax avoidance(ETR) being practiced by the EPC corporates, and coupled with the past studies that depict a relationship between tax avoidance and ROA, in a move to increase shareholder value the corporates may be looking at different ways of structuring the EPC contracts, and at times, it comes under judicial review of the courts.

b) Examine the aspects and variables that affect how EPC contracts are split, as well as any potential considerations that the courts might have.

The split contracts help mitigate tax risks and add commercial value, by shifting of major portion of work to the offshore entity can lower tax risk. The structure of participating entities plays an important role in mitigating tax risk, and subsidiary as a structure for local execution of contracts is an accepted commercial practice. Split up of such contracts is also very much an international practice globally as can be seen in evidence across other countries too. Other

key motives include fixing of responsibility to individual contractors for packages, effective operational coordination, ensuring meeting the deliverables as per timelines, jurisidictional challenges, requirement for different skill sets for execution of such contracts, investor mandates for minimum return, tax man curiousity for taxing the entire contract, judicial overreach, etc . In practice globally the EPC contractors, take the advisory of leading legal counsel, tax consulting firms (big -4 or others) as these entities are listed answerable to stakeholders, and have a detailed due diligence process to be gone through prior to inking the final contracts. Such approaches are also necessary to work out a feasible and cost effective project delivery approach, that can be treated as sustainable. Judicial and sovereign over reach also encourage such tendencies.

The other factors that could influence the EPC contract structures could be i) General industry practices ii) judicial rulings in the past favouring certain structures iii) existing corporate processes to manage tax risks iv) Corporate governance mechanism in place in entities v) Effectiveness of enforcement of tax laws by taxman vi) Advisory of external legal and tax counsel vii) incremental tax reduction accruing due to split contracts and its trade off with challenge by taxman viii) Tax strategies adopted – aggressive V defensive -nature by senior management in the entity ix)

General perception, culture in the entity towards tax payments.

These factors can significantly influence the outcome of raising a PE or otherwise in tax cases and is therefore becoming a crucial aspect of planning for EPC contracts in such a way that liability due to PE arising is kept to a minimum level.

c)Study the decided cases in the context of EPC contracts holding splitting of EPC contracts, into offshore and onsite parts as being tax avoidance - using select cases and trends. in the past cases with rationale behind the decision.

In the development of EPC contracts, the vital role of tax planning, avoidance, and contract splits are closely tied. Tax planning is acceptable, but the judiciary has taken a dim view of tax evasion. However, corporations frequently struggle with how to increase shareholder value through tax avoidance practises as opposed to pure tax planning, which results in lower levels of wealth creation and project profitability, by getting under the taxman's glare. Looking at historical judgements at various levels reveals the main elements of tax avoidance in relation to EPC contracts. In the following cases the tax avoidance aspect has been upheld by courts.

TABLE-2: Case Laws on PEs

SL.No	Case law	Citation-Authority	Decision favour of	Decision and Rationale
1.	Ansaldo Energia SPA-V- ITO	(2009) 310 ITR 237(Mad)	D-TA	The contract was a composite of four contracts that were tightly intertwined. The contract breakup was a artificial split, without genuine reason, therefore taxable income—PE—arose.
2.	Durr Systems AG, Chennai-V-DCIT(Intl tax)	[TS-5398-ITAT-2023(CHENNAI)-O	D-TA	The German company's revenue is directly tied to and a part of the same turnkey project, it was determined that it is taxable in India, as its components—were artificially divided rather than naturally split into two parts. Consequently, it was decided that the shipments of equipments were taxable in India and that the contract was composite.
3	*JGC Corporation v. Federal Inland Revenue Service* (2014) 15 TLRN	Nigerian case	D-TA	The High Court of Nigeria ruled that offshore contract execution is exempt from taxes.
4	*Saipem* Contracting Nigeria v. FIRS TLRN (Vol. 15), July 2014.	Nigerian Federal court case	D- TA	Saipem Portugal and Saipem S. A. made appeal at the Federal High Court stating that it was a multiple contract case, and also no profits were derived from Nigeria but the High court held since it was single contract and was performed in Nigeria it will be taxable in Nigeria as per their Corporate Income Tax Act regulations.
5	CIT VS Hyundai Heavy Industries	291 ITR 482 -SC	A-TA	The court held that the installation PE arose post the conclusion of the contract with the project owner transaction

SL.No	Case law	Citation-Authority	Decision favour of	Decision and Rationale
	Co Ltd			materialized, fabricated platform delivered offshore to the agents of the project owner. Therefore, profits earned for the supply of the fabricated platform not attributable to the installation PE in India
6	CIT V Mitsui Engg & Shipbuilding	(2002) 174-CTR-66(Del)		Contract was intended to be regarded as a single, comprehensive transaction. It was decided under the aforementioned fact circumstance that it was not possible to allocate the total consideration into two parts The full contract price, included all phases of the machinery supply process, was what was paid to the assessee.
7	Technip France SAS	(AARNo 1413/2012	A-TA	While offshore services are taxable in India since they are closely linked to the establishment of a plant there, offshore equipment supplied under composite contracts is not.
8	Progressive Rail Locomotive Inc V DCIT(ITD)	WPC-Del - 12405/2019 to 12411/2019	A-TP	DelhiHC examined the fixed place PE, Service PE and DAPE and held that there is no PE arising as TPO has resolved the transfer pricing aspect as being at arms length, mere visit by representatives of parent on subsidiary board would not make it a PE,no evidence for subsidiary to conclude contracts habitually, visit by petitioners' employees insufficient for service PE.
9	Huawei technologies Co ltd V ADIT	(ITA/1500/Del/2014	A-TA	A PE in India is an Indian subsidiary of a foreign business. In India, revenue derived from the supply, installation, and commissioning of telecom equipment is subject to taxation.
10	Nippon Steel Engg Co Ltd V CIT	(AAR 1203/2012)	A-TA	Under the IT Act and the Indo-Japan Treaty, payments for equipment imported from abroad are not subject to taxes in India.
11	Hyundai Rotem Company V Asst DIT	53 SOT 142 (Del Trib)	A-TP	A consortium along with Japanese company was formed for Delhi Metro, rising PE in India, Cost plus 9% was the arms' length PE attributable As per Art 7(2) of DTAA -India -Korea, department has to consider it was necessary to evaluate at arms length and hence TP study to be considered
12	DCIT V Kalpataru Power Transmission	ITA 35/Ahd/2021-Tax sutra	A-TP	Design and drawing-related services to be taxed as fees for technical services;However they are taxable as business income FTS clause is not present in DTA. Again PE arose and hence this is not taxable .

A= Assessee D = Department TA =Tax Avoidance TP- Tax planning

9. LIMITATIONS

Only a few EPC firms are included in this exploratory study, which is not empirical in nature and ignores behavioural attitudes, litigation nature, taxpayer and department attitudes in such cases, and tax morale in economies such as India.

10. CONCLUSION

The taxation of EPC contracts, which have a variety of structures with separate offshore and onsite parts performed and delivered in India for the final customer, is, according to the authors, one of the most frustrating and complicated aspects of large contracts. The authors conclude that the project sponsor or investor should be informed of the tax outcomes in order to avoid significant uncertainty and loss of

trust. Past studies as well as our paper here observes, some amount of tax avoidance practices are likely to be found in practice, so long as it does cross a specified safe harbour limits, the taxman should not be contesting the same and the Govt would do well to announce some safe harbour rules on Turnover, profit margin, asset levels etc.

This will bring more certainty to taxation of these project and have an impact on FDI flows and trust of investors, which are essential for economic development. A sine qua non for the efficient growth of the economy at reasonable costs is the certainty of legal outcomes in the field of taxation in EPC contracts. The use of SPVs, trusts, subsidiary structures to get tax savings in the process are likely to continue and care needs to be seen that they do not cross the line into tax avoidance. The taxpayer will use various structures to reduce his tax liabilities, which can be legitimately held to be valid.

11. FUTURE RESEARCH AGENDA

The domain of EPC contracts its relevance and importance is critical for development and gdp growth of a nation. Typically taxman tries to bring the entire contract into the tax net, while the taxpayer tries to keep as much of the contract outside the ambit or jurisdiction of taxes. These opposing objectives, lead to considerable pressure on the judiciary to decide on a cases which increases litigation, and its negative implication for the country as a safe destination for FII, investors. The other variables like structure type, promoter holdings, corporate governance practices, independent director on board, etc may also be influencing the extent of tax avoidance in such contracts. Researchers can look at possible relationships between transfer pricing for services, in the context of EPC contracts, tax cooperation agreements between nations, along lines of DTAAs, imbedding certain special provisions in DTAAs to deal exclusively deal with EPC contracts or provide special provisions in Income Tax Act for the taxation of same. Even special rates for taxation of EPC contracts can be proposed, either on split basis, or composite basis, and reduce litigation.

Future research can concentrate on identification of arising of permanent establishments using AI algorithms, predictive analytics, to find the outcome of cases, developing proto-type models which can specify the chances that the project is liable to be litigated, and the management can take suitable steps to remediate the same. Research can also focus on use of game theoretic approaches, Fuzzy logic approaches, etc to arrive at possible combinations of strategies that can help both the assessee and revenue, in a way that does not act as detriment to investor trust, FDI flows, and revenue interests. The Govt and Taxman can also come out with appropriate guidelines, Rules, and a more structured approach to simplification of taxability of EPC contracts, to avoid litigation.

12. DECLARATION

I, *R. Ravichandran*, hereby confirms that the manuscript titled "A Perspective on Tax Avoidance strategies in EPC contracts and their linkage to permanent establishments under direct taxes" authored by *R. Ravichandran* and *Dr. Laxmana Rao G,* has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to **[Name of the Journal/Conference].**

R. Ravichandran and *Dr. Laxmana Rao G* declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Cobham, A., & Janský, P. (2020). Estimating illicit financial flows: A critical guide to the data, methodologies, and findings (p. 224). Oxford University Press.

[2.] Dunbar, A., Higgins, D. M., Phillips, J. D., & Plesko, G. A. (2010). What do measures of tax aggressiveness measure?. In Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association (Vol. 103, pp. 18-26). National Tax Association.

[3.] Gebhart, M. S. (2017). Measuring corporate tax avoidance–An analysis of different measures. Junior Management Science, 2(2), 43-60.

[4.] Lee, B. B., Dobiyanski, A., & Minton, S. (2015). Theories and Empirical Proxies for Corporate Tax Avoidance. Journal of Applied Business & Economics, 17(3).

[5.] Krever, R., Sadiq, K., & McCredie, B. (2022, March). Identifying tax aggressive behaviour: testing the proxies. In Australian Tax Forum (Vol. 37, No. 1, pp. 27-63).

[6.] Ping, Y. H., Wu, H., & Zhang, X. Y. (2022). The geography of corporate tax avoidance. eJTR, 20, 102.

[7.] Francis, B., Sun, X., Weng, C. H., & Wu, Q. (2013). Managerial ability and tax aggressiveness. China Accounting and Finance Review, 24(1).

[8.] Mbroh, N., Monney, A., & Bonsu, M. O. A. (2019). Corporate tax avoidance and firm profitability.

[9.] Kiesewetter, D., & Manthey, J. (2017). The relationship between corporate governance and tax avoidance-evidence from Germany using a regression discontinuity design (No. 218). Arqus Discussion Paper.

[10.] Kovermann, J., & Velte, P. (2019). The impact of corporate governance on corporate tax avoidance—A literature review. Journal of International Accounting, Auditing and Taxation, 36, 100270.

[11.] Jamei, R. (2017). Tax avoidance and corporate governance mechanisms: Evidence from Tehran stock exchange. International Journal of Economics and Financial Issues, 7(4), 638-644.
https://taxjustice. net/country-profiles/india

[12.] www. moneycontrol. com Balance sheet, Income statement, Select ratios- HCCLtd, L&T, Siemens Ltd, BHEL, BGR,ONGC,Linde Engg,Punj Lloyd

[13.] www. investing. com Balance sheet, Income statement, Select

ratios -Samsung Engg,Saipem SPA, Hyundai Engineering

[14.] https://www. mondaq. com/nigeria/tax-authorities/591226/bifurcation-of-contracts--a-legal-kevlar-against-the-single-contracts-doctrine-of-taxation-of-non-residents-in-nigeria

[15.] Rego, S. O. (2003). Tax-avoidance activities of US multinational corporations. Contemporary Accounting Research, 20(4), 805-833.

[16.] Wang, F., Xu, S., Sun, J., & Cullinan, C. P. (2020). Corporate tax avoidance: A literature review and research agenda. Journal of Economic Surveys, 34(4), 793-811.

[17.] Balakrishnan, K., Blouin, J. L., & Guay, W. R. (2019). Tax aggressiveness and corporate transparency. The Accounting Review, 94(1), 45-69.

[18.] Fathoni, M. I. (2024). The Tax Landscape of Split Contracts in Engineering, Procurement, and Construction (EPC) Investments: An In-Depth Study. Jurnal Syntax Admiration, 5(8), 2860-2872.

[19.] Hong, H. A., Kim, J. B., Matsunaga, S. R., & Yi, C. H. (2022). Organizational structure and tax avoidance: multinational evidence from business group affiliation. Asia-Pacific Journal of Accounting & Economics, 1-25

[20.] Noked, N. (2018). Tax evasion and incomplete tax transparency. Laws, 7(3), 31.

[21.] Crocker, K. J., & Slemrod, J. (2005). Corporate tax evasion with agency costs. Journal of Public Economics, 89(9-10), 1593-161

The Impact of Financial Literacy on Consumer behaviour in Green Finance Products

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ABSTRACT

This study examines the impact of financial literacy on consumer behavior in adopting green finance products, like eco-friendly investments and sustainable banking. As climate awareness grows, understanding how financial knowledge influences sustainable choices becomes crucial. Financially literate individuals are often more confident evaluating long-Investments, Environmental Awareness term benefits, which may make them more open to green finance options. The research first reviews existing studies on financial literacy and green finance, identifying that consumers with stronger financial understanding are generally more receptive to sustainable products. To further explore this, a survey was conducted, gathering data on respondents' financial knowledge, familiarity with green finance, and willingness to invest in environmentally friendly financial options. Initial analysis using statistical techniques such as regression and ANOVA suggests a positive link between financial literacy and interest in green finance. Consumers with higher financial literacy levels show a stronger inclination toward sustainable financial decisions, likely because they can better assess the risks and rewards associated with these options. The study underscores the potential of financial literacy to encourage eco-friendly financial behavior. By promoting financial education that includes green finance, policymakers and institutions can foster informed choices that benefit both the individual and the environment.

Keywords: Financial Literacy, Green Finance, Consumer behaviour, Sustainable Investments, Environmental Awareness

1. INTRODUCTION

The role of financial literacy in promoting sustainable finance is an increasingly relevant topic in the global shift toward environmental sustainability. Financial literacy is defined as the ability to understand and effectively apply financial knowledge, encompassing skills in budgeting, investing, and managing financial risks. This knowledge plays a crucial role in empowering individuals to engage with green financial products, such as eco-friendly investments and sustainable banking solutions, by equipping them to make informed decisions and manage risks associated with these options (Huhmann & McQuitty, 2009; OECD, 2014)

Research indicates that individuals with a strong grasp of financial concepts are more likely to participate in sustainable finance. They possess the capability to assess the long- term benefits and potential risks of investments such as green bonds, socially responsible mutual funds, or other Environmental, Social, and Governance (ESG)-linked financial products. For example, Chen (2018) highlights that financial literacy fosters a proactive approach toward risk management, enabling consumers to incorporate strategies that address climate risks and other ESG concerns into their financial planning

Moreover, financial literacy plays a pivotal role in bridging the accessibility gap in sustainable finance. It enables individuals from diverse socio-economic backgrounds to understand complex financial instruments, thereby democratizing access to these green opportunities (Gounopoulos et al., 2020). Studies have also revealed that awareness of sustainability issues enhances advocacy and engagement among financially literate investors. These individuals are more likely to champion corporate sustainability through shareholder activism, influencing companies to adopt greener practices (Bauer et al., 2005)

In addition to influencing individual behaviors, financial literacy extends to community education and regulatory advocacy. Programs designed to improve financial literacy often incorporate ESG factors, familiarizing individuals with sustainable financial practices and fostering a cultural shift toward environmentally responsible decision-making. This is evident in the European Commission's action plan on financing sustainable growth, which emphasizes financial education as a tool for promoting sustainability

This interplay between financial literacy and sustainable finance underscores the need for targeted education initiatives. By bridging knowledge gaps, these programs can empower a broader segment of the population to make environmentally conscious financial decisions, aligning individual financial goals with broader sustainability objectives.

2. LITERATURE REVIEW

TABLE 1: Keyword Table

Financial Literacy	Consumer Behaviour	Green Finance Products
Personal Finance	Purchasing Decision*	Green Bonds
Financial	Behavioural Finance	Green Loans

Education		
Risk Awareness	Investment Preferences	Carbon Finance
Investment Literacy	Consumer Awareness	Sustainable Investments
Financial Inclusion	Sustainability Preferences	Fintech
Wealth Management	Consumer Trust	Green Mutual Funds
Credit Literacy	Ethical Consumption	Sustainable Bonds

Financial literacy plays a crucial role in shaping consumer behavior, particularly in investment decisions and adoption of financial products, including green finance. A growing body of research emphasizes how financial literacy impacts decision-making, attitudes toward risk, and the willingness to engage with financial technologies, such as neobanks and sustainable investment products.

Financial literacy is closely linked to consumer confidence, especially in the context of new financial technologies. Raut (2023) argues that perceived risk, computer confidence, and financial literacy significantly affect online stock trading decisions. This aligns with the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB), which suggest that financial literacy serves as a mediator in shaping attitudes and behaviors, particularly regarding risk. These models illustrate that a higher level of financial literacy leads to better decision-making, as individuals can better evaluate the risks involved in financial investments, including those in digital platforms (Raut, 2023). Moreover, financial literacy is a key driver in the adoption of digital financial services, particularly in the emerging sector of neobanks and Banking-as-a-Service (BaaS). Taneja (2024) explores how financial literacy moderates the impact of perceived effort expectancy, hedonic motivation, and perceived risk on consumers' intentions to adopt neo banking services. His study emphasizes the growing importance of financial literacy in shaping attitudes toward sustainable banking, suggesting that better financial knowledge leads to more favourable attitudes toward environmentally conscious banking products. This highlights how financial literacy is not just an enabler for general financial decision-making but also influences consumer behaviours in the emerging green finance sector.

In the specific context of green finance, the role of financial literacy is particularly evident in the adoption of green bonds. Azad (2024) investigates why retail investors, despite increasing interest in sustainability, are less inclined to adopt green bonds compared to institutional investors. His research identifies that financial literacy significantly influences individuals' understanding of the financial and environmental benefits of green bonds. By enhancing financial knowledge, consumers are better equipped to evaluate and engage with green financial products, leading to higher adoption rates.

This supports the notion that financial literacy is crucial for broadening the appeal and uptake of green investment products.

Similarly, the literature suggests that financial literacy can also influence broader economic participation and inclusion. Rastogi (2021) highlights the role of financial technologies like the Unified Payment Interface (UPI) in improving financial literacy, particularly among marginalized communities in India. His study demonstrates that when individuals are equipped with the necessary financial knowledge, they are more likely to engage with digital financial services, contributing to greater financial inclusion and overall economic development. The intersection of financial literacy and digital financial inclusion has implications for green finance, as financially literate individuals are more likely to explore and invest in sustainable financial products.

Furthermore, the COVID-19 pandemic significantly impacted financial behaviors, with Billore (2020) examining the barriers to adopting FinTech services among low-income customers. The study identifies trust and awareness as major barriers, which are influenced by financial literacy. Consumers with higher financial knowledge are more likely to trust digital platforms and adopt new financial products, including those focused on sustainability. Billore's work highlights the importance of financial education in overcoming barriers to financial adoption, particularly in times of crisis, such as the pandemic.

Trust and privacy concerns also remain significant obstacles to the adoption of green finance, and financial literacy can play a pivotal role in mitigating these concerns. Tyagi (2024) suggests that financial literacy enhances consumers' understanding of privacy protections and security measures in digital banking. This increased understanding helps build trust in green finance products, as consumers become more confident in the safety and benefits of these environmentally friendly investments. Financial literacy, therefore, serves as a foundation for the successful adoption of digital green finance products, where transparency and trust are key components.

The relationship between financial digitization and innovation in the green finance sector is also explored by Hossain (2024), who finds that financial digitization fosters green innovation, especially in countries with lower initial innovation levels. This study underscores how financial literacy can amplify the impact of financial digitization by enabling consumers and businesses to engage with innovative green finance products. The role of financial literacy in supporting the transition to a sustainable economy is crucial, as it equips individuals with the knowledge needed to navigate the increasingly complex landscape of green finance.

Similarly, the work of Anand (2023) demonstrates how financial literacy intersects with social norms to shape

consumer behaviors toward sustainable products. Social norms have a significant impact on the purchasing decisions of consumers, and financial literacy helps individuals understand the broader financial and environmental implications of their consumption choices. This, in turn, drives more sustainable purchasing behaviors, including the adoption of green finance products.

In rural India, financial literacy is also a key enabler of financial inclusion, as highlighted by Dash (2024). His research shows that financial literacy, when combined with financial advisory services, improves financial behavior and decision-making in rural households. This improvement extends to the adoption of green financial products, as individuals who are financially literate are more likely to engage with sustainable investment opportunities. Financial literacy, therefore, plays a critical role in fostering economic development and promoting the adoption of environmentally sustainable financial products.

Finally, Kumar (2024) emphasizes the role of financial literacy in promoting sustainability through green finance practices. His study highlights how financial literacy enhances both consumers' and institutions' understanding of the benefits of green banking, thereby improving sustainability outcomes. This research supports the idea that financial literacy is not only essential for effective financial decision-making but also for fostering sustainable practices within the financial sector.

In conclusion, the literature strongly supports the notion that financial literacy is a critical factor influencing consumer behavior toward green finance products. From enhancing decision-making abilities to building trust in digital financial services, financial literacy acts as a key enabler in the adoption of sustainable financial products. The integration of financial literacy into consumer education, particularly in the context of green finance, can lead to more informed, responsible, and sustainable financial behaviors.

3. RESEARCH METHODOLOGY

In this paper, we will analyse the effect of consumer behaviour, if it is getting effected or not on the basis of literacy about the green finance products. We have collected primary as well as secondary data. Primary data is collected via Survey from 65 respondents. Secondary data is collected using SCOPUS. The review of literature is analysed as a part of secondary data. To analyse this data we have got few questions that we will be answering and few hypotheses that will be tested in this paper.

1. **H₀**: Financial literacy does not influence the adoption of green finance products.

    H₁: Financial literacy influences the adoption of green finance products.

3. **H₀**: There is no significant difference in investment preferences for green finance products between financially literate and financially illiterate consumers.

    H₁: There is a significant difference in investment preferences for green finance products between financially literate and financially illiterate consumers.

4. **H₀**: Financial literacy does not influence consumer trust in green finance products.

    H₁: Financial literacy positively influences consumer trust in green finance products.

5. **H₀**: Financial literacy does not affect long-term commitment to sustainable investments.

    H₁: Financial literacy positively influences long-term commitment to sustainable investments.

6. **H₀**: There is no significant relationship between financial literacy and willingness to pay a premium for green finance products.

    H₁: There is a significant relationship between financial literacy and willingness to pay a premium for green finance products.

4. DATA ANALYSIS

Hypothesis Testing

1. **H₀:** Financial literacy does not influence the adoption of green finance products.

2. **H₁:** Financial literacy influences the adoption of green finance products.

TABLE 2: Regression and ANOVA for Hypothesis 1

Regression Statistics	
Multiple R	0.146756924
R Square	0.021537595
Adjusted R Square	0.006006445
Standard Error	0.267735368
Observations	65

ANOVA

	df	SS	MS	F	*Significance F*
Regression	1	0.099404283	0.099404283	1.386735415	0.243386692
Residual	63	4.515980332	0.071682227		
Total	64	4.615384615			

	Coeffici	*Standar*	*t Stat*	*P-value*	*Lower*	*Upper*	*Lower*	*Upper*

	e nts	d Error			95%	95%	95.0%	95.0%
Interc	2.090350	0.145876	14.32958	1.71E-21	1.798839	2.381861	1.798839	2.381861
ept	338	567	272		279	397	279	397
Q5	-	0.037840	-	0.243386	-	0.031057	-	0.031057
	0.044560	22	1.177597	692	0.120178	104	0.120178	104
	541		306		186		186	

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	20.00769231	1	20.00769231	17.78461538	4.64E-05	3.915138332
Within Groups	144	128	1.125			
Total	164.0076923	129				

Interpretation:

a. R-Square – 2.14% - The R-Square value indicates that only 2.14% of the variation in familiarity with green finance products can be explained by confidence in understanding basic financial concepts. This suggests that financial literacy confidence has a very weak explanatory power in this relationship.

b. Significance - (P-Value – 0.2432) - The p-value is 0.2434, which is greater than the commonly used significance threshold of 0.05. This means there is no statistically significant relationship between Financial Literacy and Adoption of green finance products, **hence we fail to reject H0**. In other words, confidence in financial literacy does not significantly impact familiarity with green finance products.

c. Co-efficient (-0.0446) - The regression coefficient is negative (-0.0446), suggesting a small decrease in familiarity with green finance products for every one-unit increase in financial literacy confidence. However, since the relationship is not statistically significant, this result is likely due to random variation and should not be overinterpreted.

d. Conclusion - Financial literacy confidence does not significantly influence familiarity with green finance products. Familiarity with green finance products may instead depend on external factors such as marketing efforts, accessibility to information, or personal interest in environmental initiatives.

2. **H₀: There is no significant difference in investment preferences for green finance products between financially literate and financially illiterate consumers.**

   H₁: There is a significant difference in investment preferences for green finance products between financially literate and financially illiterate consumers.

TABLE 3: Regression and ANOVA statistics for Hypothesis 2

Anova: Single Factor

Groups	Count	Sum	Average	Variance
Q5	65	244	3.753846154	0.782211538
Q9	65	193	2.969230769	1.467788462

Regression Statistics	
Multiple R	0.269884817
R Square	0.072837814
Adjusted R Square	0.058120954
Standard Error	1.175788755
Observations	65

	df	SS	MS	F	Significance F
Regression	1	6.842272233	6.842272233	4.949276818	0.02969155
Residual	63	87.09618931	1.382479195		
Total	64	93.93846154			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.58143823	0.640632683	2.4685569	0.016291299	0.301235967	2.861640493	0.301235967	2.861640493
Q5	0.369698832	0.166179408	2.224697017	0.02969155	0.037615785	0.70178188	0.037615785	0.70178188

a. R-Square- 7.28%- The R-Square value of 7.28% indicates that 7.28% of the variation in the likelihood of adopting green finance products in the future is explained by confidence in financial literacy. This suggests a weak but meaningful relationship between the two variables.

b. Significance – P-value- 0.0297 - The p-value of 0.0297 is less than 0.05, meaning the relationship between Financial literacy and green finance usage in future is statistically significant, **hence we reject H0**. This

indicates that financial literacy confidence has a meaningful impact on the likelihood of adopting green finance products in the future.

c. Co-efficient – 0.3697 - The coefficient of 0.3697 indicates that for every one-unit increase in confidence in financial literacy, there is a predicted 0.3697 increase in the likelihood of adopting green finance products in the future.

d. This positive relationship suggests that as individuals become more confident in their financial literacy, they are more likely to adopt green finance products.

e. Confidence Interval - The 95% confidence interval for the coefficient ranges from 0.0376 to 0.7018, which does not cross zero. This reinforces the statistical significance of the relationship and suggests the result is reliable.

f. Conclusion - Confidence in financial literacy has a statistically significant positive impact on the likelihood of adopting green finance products in the future. This finding indicates that individuals who are more confident in their financial literacy are more likely to consider green finance products as part of their future financial plans.

4. **H₀:** Financial literacy does not influence consumer trust in green finance products.

   H₁: Financial literacy positively influences consumer trust in green finance products.

TABLE 4: Regression and ANOVA statistics for Hypothesis 3

Regression Statistics	
Multiple R	0.290899324
R Square	0.084622417
Adjusted R Square	0.070092614
Standard Error	1.153271783
Observations	65

	df	SS	MS	F	Significance F		
Regression	1	7.746205853	7.746205853	5.824058139	0.018728744		
Residual	63	83.79225569	1.330035805				
Total	64	91.53846154					

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.75414874	0.628364231	2.791611385	0.006934062	0.498463022	3.009834458	0.498463022	3.009834458

| Q5 | 0.393362016 | 0.162996985 | 2.413308546 | 0.018728744 | 0.067638533 | 0.719085499 | 0.067638533 | 0.719085499 |

a. R-square – 8.46% - The R-Square value of 8.46% indicates that 8.46% of the variation in the extent to which financial literacy influences long-term commitment to sustainable investments is explained by financial literacy

b. confidence. This suggests a weak relationship between the two variables, but the relationship is stronger than in the previous results.

c. Significance – P-value – 0.0187 - The p-value of 0.0187 is less than 0.05, meaning the relationship between Financial literacy and long term investment in green finance is statistically significant, **hence we reject H0**. This indicates that confidence in financial literacy does meaningfully impact the extent to which it influences long-term commitment to sustainable investments.

d. Co-efficient – 0.3934 - The coefficient of 0.3934 indicates that for every one-unit increase in confidence in financial literacy, there is a predicted 0.3934 increase in the extent to which financial literacy influences long-term commitment to sustainable investments. This positive relationship suggests that higher confidence in financial literacy leads to a greater perceived influence of financial literacy on long-term commitment. Confidence Interval - The 95% confidence interval for the coefficient ranges from **0.0676 to 0.7191**, which does not cross zero. This reinforces the statistical significance of the relationship and suggests the result is reliable.

e. Conclusion - Confidence in financial literacy has a statistically significant positive impact on the extent to which financial literacy influences long-term commitment to sustainable investments. This finding highlights that individuals who feel more confident in their financial literacy are likely to perceive it as having a greater role in shaping their long-term commitment to sustainable investments.

5. **H₀:** Financial literacy does not affect long-term commitment to sustainable investments.

   H₁: Financial literacy positively influences long-term commitment to sustainable investments.

TABLE 5: Regression and ANOVA statistics for Hypothesis 4

Regression Statistics	
Multiple R	0.197716406
R Square	0.039091777
Adjusted R Square	0.023839266

	Standard Error	1.193854486
	Observations	65

	df	SS	MS	F	Significance F
Regression	1	3.652976219	3.652976219	2.562973133	0.114395741
Residual	63	89.79317763	1.425288534		
Total	64	93.44615385			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.893669333	0.650475861	2.911206155	0.004972714	0.593797045	3.193541615	0.593797045	3.193541615
Q5	0.270129072	0.168732717	1.600928834	0.114395741	-0.067056357	0.607314501	-0.067056357	0.607314501

a. R-square – 3.91% - The R-Square value indicates that only 3.91% of the variation in long-term commitment to green finance products can be explained by confidence in financial literacy. This shows a very weak explanatory power, meaning financial literacy has limited influence on long term commitment to green finance.

b. Significance – P-value- 0.1144 - The p-value of 0.1144 is greater than 0.05, indicating the relationship between financial literacy and long term commitment to green finance is not statistically significant, **hence we fail to reject H0**.

c. Confidence in financial literacy does not have a strong enough impact on long- term commitment to green finance products to be considered meaningful.

d. Co-efficient- 0.2701- The regression coefficient of 0.2701 suggests that for every one-unit increase in financial literacy confidence, there is a predicted 0.27 increase in long-term commitment to green finance products. However, this relationship is not statistically significant, so this positive trend may not be reliable or generalizable.

e. Confidence Interval - The 95% confidence interval for the coefficient ranges from-0.0671 to 0.6073, crossing zero, further confirming the absence of statistical significance.

f. Conclusion - Financial literacy confidence does not significantly influence long- term commitment to green finance products.

g. While there is a slight positive trend, it is not strong enough to establish a meaningful relationship. Other factors, such as environmental values, income levels, or product benefits, might play a larger role in driving long-term commitment to green finance products.

H_0: There is no significant relationship between financial literacy and willingness to pay a premium for green finance products.

H_1: There is a significant relationship between financial literacy and willingness to pay a premium for green finance products.

TABLE 6: Regression and ANOVA statistics for Hypothesis 5

Regression Statistics	
Multiple R	0.121664681
R Square	0.014802295
Adjusted R Square	-0.000835764
Standard Error	0.493916711
Observations	65

	df	SS	MS	F	Significance F
Regression	1	0.230915796	0.230915796	0.946555758	0.334318367
Residual	63	15.3690842	0.243953718		
Total	64	15.6			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.145052243	0.269112276	4.254923858	7.07E-05	0.607274272	1.682830215	0.607274272	1.682830215
Q5	0.067916411	0.069807426	0.972910971	0.334318367	-0.071582599	0.20741542	-0.071582599	0.20741542

R-square – 1.48% - This indicates that only 1.48% of the variation in willingness to pay a premium for green finance products is explained by financial literacy. This is a very low value, meaning that financial literacy is not a strong predictor in this model.

Significance – P-value – 0.3343 - The p-value for the overall model (Significance F) is 0.3343, which is greater than 0.05, **hence we fail to reject H0**. This means the relationship between financial literacy and willingness to pay a premium is not statistically significant.

Co-efficient – 0.0679 - The coefficient of 0.0679 suggests that for a one-unit increase in financial literacy, the willingness to pay a premium increase by 0.0679 units. However, this effect is very small and not statistically significant because the p-value for financial literacy is 0.3343 (greater than 0.05).

Confidence Interval - The 95% confidence interval for the financial literacy coefficient ranges from -0.0716 to 0.2074. Since this range includes zero, it further indicates that the relationship is not statistically significant.

Conclusion - There is no significant relationship between financial literacy and the willingness to pay a premium for green finance products based on this

analysis. Financial literacy does not appear to be a strong or meaningful factor in predicting willingness to pay a premium for these products in this dataset.

5. FINDINGS

This study highlights the pivotal role of financial literacy in shaping consumer behavior toward green finance products. Both the literature and the analytical findings affirm that financial literacy significantly enhances consumer confidence and trust in adopting green financial options. However, its influence on long-term commitment and willingness to pay a premium is limited, suggesting the need for complementary factors such as tailored marketing strategies, government incentives, and simplified product designs.

From the literature, research by Raut (2023) and Taneja (2024) emphasizes that financial literacy mitigates perceived risks and fosters trust, thereby encouraging the adoption of innovative financial products. Similarly, the analysis in this study confirms that individuals with higher financial literacy levels are more inclined to explore and adopt green finance products. However, both the literature and the analysis indicate that awareness and familiarity with green finance remain low, even among financially literate consumers. This underscores the need for targeted educational efforts to bridge this gap. Intrinsic motivators, such as altruistic values and positive attitudes (Azad, 2024; Anand, 2023), were identified in the literature as significant drivers of green finance adoption. These findings align with the survey results, where respondents expressed a strong inclination toward the environmental benefits of green financial products. At the same time, extrinsic factors, including government policies, tax benefits, and ESG disclosures (Prajapati, 2021; Kumar, 2024), were found to be critical in fostering adoption. The analysis also highlighted that privacy concerns, trust issues, and perceived complexity act as

significant barriers, reflecting similar observations in the literature by Tyagi (2024) and Billore (2020).

A notable divergence between the analytical and literature findings emerges in the context of willingness to pay a premium. While studies such as Azad (2024) and Hossain (2024) suggest that financially literate individuals are more willing to invest in green products due to their perceived long-term benefits, the analysis reveals no significant relationship between financial literacy and premium willingness. This suggests that economic constraints, such as lower disposable income levels, may override the perceived value of green products, particularly among younger, low-income demographics.

Demographic insights further illustrate the influence of financial literacy. The respondents in this study, predominantly young students with limited income, exhibited positive attitudes toward green finance but lacked the financial capacity or detailed knowledge required for substantial engagement. These findings are consistent with observations by Rastogi (2021) and Dash (2024), who emphasize the importance of financial literacy in driving inclusion among underserved populations.

Overall, while financial literacy is confirmed as a crucial enabler of green finance adoption, the findings highlight its limitations when not supplemented by external motivators such as policy support, transparent product designs, and accessible educational initiatives. Bridging the gap between awareness and action will require integrating these elements into comprehensive strategies that resonate with the diverse needs of consumers.

6. CONCLUSION

This study underscores the complex and multifaceted role of financial literacy in shaping consumer behavior toward green finance products. While financial literacy is a significant predictor of the likelihood of adopting green finance products and fostering trust, its impact on long-term commitment and willingness to pay a premium remains limited. These findings suggest that financial literacy, while critical, is not a standalone solution. Other factors, such as demographic characteristics, accessibility of information, marketing efforts, and government incentives, play a substantial role in driving green finance adoption.

The implications of these findings are noteworthy for multiple stakeholders. For financial institutions, improving consumer trust through transparent product offerings and targeted educational campaigns can enhance adoption rates. Simplified, consumer-friendly designs of green finance products can reduce perceived complexity and increase accessibility, particularly for financially underserved segments. For policymakers, the study highlights the importance of integrating financial education programs with broader sustainability initiatives. This can include

offering tax incentives, mandating ESG disclosures, and creating awareness about the environmental and economic benefits of green finance products.

Demographic insights from the study further emphasize the need for segment-specific approaches. Younger, lower-income consumers, who often lack the financial capacity or knowledge to adopt green finance products, require tailored educational interventions and affordable product designs. By addressing these barriers, stakeholders can align financial literacy efforts with broader sustainability and inclusion goals, creating a more equitable and environmentally conscious financial ecosystem.

In conclusion, this research highlights the need for a holistic approach that combines financial literacy initiatives with targeted marketing, technological innovation, and policy-level support. Such an integrated strategy will not only encourage the adoption of green finance products but also contribute to a more sustainable and inclusive economy. Future research and interventions should aim to address the nuanced barriers identified in this study to maximize the potential of green finance for environmental and societal well-being.

7. FUTURE SCOPE

1. *Enhanced Financial Education Initiatives:*

Governments, financial institutions, and FinTech companies should prioritize comprehensive financial literacy programs. These initiatives must go beyond basic knowledge, emphasizing how green finance contributes to environmental sustainability and long-term economic benefits.

2. *Product Customization and Accessibility:*

Green finance products should be tailored to address diverse consumer segments, considering factors such as income, educational background, and regional disparities. Simplifying the user interface and integrating consumer feedback into product design can significantly enhance adoption.

3. *Policy Innovations:*

Policymakers must introduce targeted incentives like tax benefits and ESG disclosures to make green finance products more attractive. Additionally, regulations should promote transparency and accountability, addressing concerns around trust and privacy.

4. *Leveraging Technology for Inclusion:*

Digital tools like mobile apps and AI-driven advisory platforms can bridge knowledge gaps and simplify decision-making for consumers. Future research should explore how these technologies can be integrated effectively, especially for rural and low-income populations.

5. *Longitudinal Studies:*

To capture evolving consumer behavior, future studies should focus on longitudinal data analysis. This approach can provide deeper insights into how financial literacy initiatives and market dynamics influence green finance adoption over time.

8. DECLARATION

We, Pratishtha Upadhyaya & Dheeraj Zope, hereby confirm that the manuscript titled " **The Impact of Financial Literacy on Consumer Behaviour in Green Finance Products.**" authored by Pratishtha Upadhyaya and Dheeraj Zope, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

We affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspective Conference 2025 (IIM Sambalpur).

We declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Chen, L. (2018). Understanding the implications of ESG factors in investment decisions. *Journal of Sustainable Finance*.

[2.] Bauer, R., et al. (2005). Shareholder activism and corporate sustainability. *Journal of Corporate Governance*.

[3.] Gounopoulos, D., et al. (2020). Risk management in sustainable investments. *Journal of Financial Economics*.

[4.] Huhmann, B. A., & McQuitty, S. (2009). Financial literacy and financial satisfaction. *Journal of Consumer Affairs*.

[5.] OECD. (2014). *Financial education for sustainable development*. Paris: OECD Publishing.

[6.] Sahu, P., Goswami, D., & Choudhary, D. (2023). Understanding the impact of financial literacy on sustainable financial behavior in India. *Digital Policy, Regulation and Governance*. https://doi.org/10.1108/DPRG-07-2023-0101

[7.] Kumar, R., & Gupta, A. (2024). The role of green finance in fostering sustainable energy policies. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2024.3395130

[8.] Wong, S., & Lee, H. (2024). Financial literacy as a driver for sustainable consumer behavior. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.3743

[9.] Singh, M., & Gupta, V. (2021). Evaluating financial literacy's effect on green finance adoption. *Universal Journal of Accounting and Finance*, 9(3), 435-446. https://doi.org/10.13189/ujaf.2021.090326

[10.] Tan, K., & Li, Y. (2021). Role of green investments in emerging economies: A review. *Theoretical and Methodological Journal*, 8(2), 121-130. https://doi.org/10.33182/tmj.v8i2.1064

[11.] Patel, R., & Shah, S. (2023). Environmental literacy and

financial behavior in emerging markets. *Journal of Sustainable Finance & Investment*. https://doi.org/10.1057/s41264-023-00236-6

[12.]O'Connor, M., & Perez, L. (2024). Economic incentives in green finance: A policy review. *Energy Economics*, 114, 107736. https://doi.org/10.1016/j.eneco.2024.107736

[13.]Park, J., & Kim, S. (2023). Financial literacy and green investments among millennials. *Investment Management and Financial Innovations*, 19(4), 300-312. https://doi.org/10.21511/im.19(4).2023.23

[14.]Huang, F., & Liu, X. (2024). Financial literacy and green consumer behavior: Evidence from Asia. *Journal of Cleaner Production*, 422, 141731. https://doi.org/10.1016/j.jclepro.2024.141731

[15.]Roy, T., & Basu, S. (2024). The intersection of financial literacy and sustainability initiatives. *Social Responsibility Journal*. https://doi.org/10.1108/SRJ-02- 2024-0096

[16.]Chen, Z., & Chang, Y. (2024). Green finance: Challenges and opportunities for emerging markets. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2024.3357350

[17.]Fisher, L., & Becker, M. (2021). The impact of financial literacy on sustainable finance. *Qualitative Research in Financial Markets*, 13(3), 209-224. https://doi.org/10.1108/QRFM-10-2021-0174

[18.]Menon, R., & Nair, A. (2023). Financial literacy in promoting green investments in India. *Indian Journal of Finance and Management*, 17(2), 150-161. https://doi.org/10.1177/09726527231160861

[19.]Gupta, R., & Sharma, P. (2021). A framework for financial literacy and green finance. *International Journal of Social Economics*, 48(4), 573-586. https://doi.org/10.1108/IJSE-03-2021-0183

[20.]Ali, M., & Wang, T. (2023). Green finance policies and resource allocation. *Resources Policy*, 80, 103447. https://doi.org/10.1016/j.resourpol.2023.103447

[21.]Tanaka, H., & Nakajima, K. (2021). Financial literacy and green banking in Japan.

[22.]*Investment Management and Financial Innovations*, 18(1), 178-190. https://doi.org/10.21511/imfi.18(1).2021.15

Preference of LIPOR Approach to Analyse the Current Forex Retail Trading as Comparative before COVID-19

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ABSTRACT

Purpose

To evaluate the efficacy of the LIPOR technique in spotting lucrative trading opportunities in a volatile market environment by analysing changes in retail FOREX trading trends and dynamics, especially as they were influenced by the COVID-19 outbreak, this study has been done.

Design/methodology/approach

In order to examine the development of retail FOREX trading before to, during, and beyond COVID-19, as well as the applicability of the LIPOR approach in the current FOREX market, this study uses a mixed-method approach that combines quantitative data analysis with qualitative insights.

Findings: The major findings of this research paper are 1) to increased retail participation, 2) market volatility and currency fluctuation, 3) preference of the LIPOR approach, and 4) sustained trends post-pandemic.

Originality: The LIPOR approach is using to FOREX retail trading analysis.

Research limitations/implications

The LIPOR approach is a linear model but as changing the technical environment more developed models and upgrade model of LIPOR approach can be used to depth research in retail equity investment worldwide at present. Practical implications

The LIPOR (Liquidity, Integrity, Perception, Observation, and Risk- Awareness) approach can be implemented as a structured trading framework, guiding retail traders in their analysis of market conditions.

Social implications

The LIPOR approach contributes positively to this landscape by offering a structured, data-driven framework for safer decision-making in volatile markets.

Keywords: Forex Retail Trading, Financial Uncertain-ities, Market Volatility, LIPOR Approach Market Dynamics

1. INTRODUCTION

Before the pandemic, retail trading was rather stable, but participation was low because of high entry hurdles such brokerage fees, a lack of easily available platforms, and low financial awareness among individual investors. Draw attention to the institutional investors' hegemony and the small part that individual traders play in shaping market trends. The efficiency of foreign exchange intervention has been the subject of conflicting research, as examined by Fratzscher et al. (2019). Talk about the dependence on conventional trading platforms and the fact that there are less active retail traders than institutional ones. This demonstrates that because of the market's extreme volatility, anyone wishing to connect in the stock equity market must be informed of and knowledgeable about the market.

The LIPOR Approach: An Integrated Approach for decision making in the stock market investment
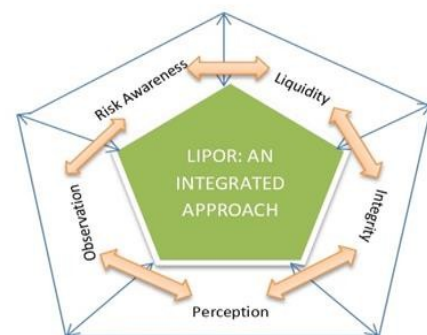
Source: The LIPOR Approach: An Integrated Approach for Stock Market Investment. ROC No. L-143261/2024; Dated: 09/02/2024

The LIPOR technique proposed by Gupta and Loya (2024) is a better way to deal with these issues. Liquidity, Integrity, Perception, Observation, and Risk Awareness make up the LIPOR method. According to the pertinent scenario, these five factors are essential for identifying market possibilities. These five components create the five factors—Investment, Knowledge, Personnel, Industrial, and Economics—by establishing relationships between one aspect and another in a linear model of stock investment decision-making. According to Barunik and Kocenda (2019), forex volatility highlights how market conditions, policy divergence, and external shocks affect currency swings. According to research, monetary policy differences—such as disparities in the rates of interest among nations—have a big influence on volatility spillovers in foreign exchange markets.

Following the personnel factor as association of "Perception" and "Observation," the pandemic acted as a catalyst for retail trading, with lockdowns, economic uncertainty brought on by fluctuations in liquidity and risk awareness as per the LIPOR approach, and increased disposable time driving more people into the market. Retail traders were able to access the market at previously unheard-of levels because to the democratization of trading platforms like Robinhood and other zero-commission apps. Social media and community-driven platforms, such as Reddit and WallStreetBets, are necessary to educate retail equity investors about the "Knowledge" factor, which is linked to "Integrity" and "Perception." These platforms have made it possible for coordinated retail trading activities, which challenges conventional market dynamics. The stock market liquidity's impact on corporate investment and production decisions is discussed by Amihud and Levi (2023), who demonstrate how technological advancements and mobile applications have made it easier for retail investors to participate in international markets. In order to establish a connection between the five elements of the LIPOR strategy, features like gamification, real-time statistics, and inexpensive access enhanced engagement, especially among younger populations. Retail investors engaged in long-term investments rather than speculative or day trading prior to the pandemic and most of their trading was passive. Following the epidemic, speculative trading increased in popularity and was frequently impacted by news, social trends, and herd behavior. In the post-COVID era, retail trading had a much larger role in price discovery and market volatility. Challenges like increased vulnerability to behavioral biases, disinformation, and speculative bubbles have been brought about by increased retail engagement. Regulatory agencies are tackling these concerns by concentrating on safeguarding individual investors while preserving market integrity, which could show how the LIPOR method is being applied.

OBJECTIVES

1. To assess the LIPOR approach for Forex Retail Trading Market Analysis.

2. To analysis the applicability of the LIPOR technique for International Retail Equity Investors.

3. To know the justification of LIPOR approach as comparative analysis for two times frame of Forex Retail Trading.

2. REVIEWS OF LITERATURE

2.1 Effect of the foreign exchange volatility

According to earlier research, interventions may have a short-term impact on currency rates, particularly in nations with pegged exchange rates or smaller, less liquid markets. Others contend that persistent interventions are less profitable, particularly in systems with movable currency rates or markets that have considerable liquidity. Recent study highlights the need of market conditions of use, interaction with monetary policy, and accountability for initiatives to be successful. Studies on emerging markets usually show better success rates than those on wealthy nations, where interventions could be having a less important impact on stabilizing currency values (Fratzscher et al., 2019).

Uncertainty movement has an impact on the digital revolution that supports the present day by increasing market competition and creating long-term instability during times of crises. Watorek et al. (2021) assert that, in comparison to more traditional markets like the stock market or foreign exchange, the cryptocurrency market, that continues to be in its formative stages, offers a unique viewpoint on market complexity.

The work uses sophisticated statistical physics techniques, like as multifractal cross- correlation analysis, to evaluate nonlinear correlations between bitcoin trading platforms in order to address these kinds of vulnerabilities. Whereas digital currencies appear to overlap complexity tendencies with traditional markets, a study using powerful statistical physics tools found that less coherence results in more frequent arbitrage opportunities.

These particular features may encourage new investing strategies, as highlighted by the paper's above remarks. As an instance, Bitcoins could be used as a novel asset class's base currency, which serves as vital to individual equity investors wishing to make investment in international stock markets.

Heimer and Simsek (2018) examine the consequences of 2010's leverage regulations on the U.S. retail foreign exchange market in order to determine if lowering leverage enhances market quality or only lessens speculative trading.

By applying a difference-in-differences method to three distinct datasets, the results show that, while bid-ask spreads stay the same, leverage limitations limit the losses of high-leverage traders by 40%, cut trading volumes by 23%, and lower brokerage capital by 25%.

But according to the research study on this paper, regulating leverage offers a regulatory balance between market safety and brokerage operating efficiency, improving social welfare by lowering speculative losses without compromising market liquidity.

In accordance with what is known of previous studies, investors that trade on a regular basis are more impacted by fluctuations in liquidity when it comes to regarding the way the foreign exchange market swings.

2.2 Liquidity effects on Forex Retail Trading

To address the liquidity challenges, Atanasova and Weisskopf (2020) investigate the manner in which liquidity impacts the disparity among the market pricing and net worth of assets (the net asset values) in global equity exchange-traded fund (ETFs). Previous investigation has shown that ETFs are intended to promote arbitrage processes, which intended to continue keeping their prices on the market corresponding to NAVs. However, considerations including costs of holding, liquidity, and market volatility are typically linked to the presence of a premium or discount.

As liquidity tends to reduce price differences between ETFs and their constituent portfolios, this study has emphasized the importance of liquidity in promoting price convergence. This analysis supports this notion by examining 584 foreign exchange- traded funds (ETFs) that were introduced in the US between 2012 and 2017. Research indicates that increased liquidity leads to better correlation between ETF prices and their underlying assets as well as smaller ETF premium/discount magnitudes. Furthermore, liquidity is essential for lowering pricing frictions in ETFs, as demonstrated by the fact that its effect on price convergence is most noticeable in ETFs with high holding costs.

Amihud and Levi (2023) look into how price conversion impacts business investment and output decisions, as well as how liquidity in the stock market influences these decisions. Previous research investigations have discovered that enhanced liquidity generally reduces an organization's cost of capital, encouraging additional investment by lowering the necessary rate of return. The elevated cost of capital of illiquid businesses, and on the other hand, may prevent them from generating investments in fixed assets, R&D, and merchandise. The correlation is valid even for organizations that are unrestrained by financial limitations, demonstrating that illiquidity has pervasive, systemic effects on investment behaviour.

In order to lower risk, this study additionally demonstrates how business entities that have difficulty with lack of liquidity might turn to less investment-intensive manufacturing methods; these organizations tend to prioritize labor earlier than investment and maintain low operating leverage to avoid the long-term expenses associated with capital-intensive operations. The study reinforces its findings

and defends the claim that corporate resource allocation is significantly impacted by liquidity by investigating the effects of the 2001 decimalization, a legal move that enhanced liquidity, and employing instrumental factors to adjust for heterogeneity.

To address these issues, Chaieb et al. (2021) offer an innovative global asset pricing model for investigating how market differentiation, insolvency, and invest propensity restricts influence investment returns in 42 markets. Yields and insolvency are known to be correlated; stocks that have decreased liquidity tend to have greater expected returns as a make up for their higher trading expenditures.

Since these changes demonstrates that retail investors are liable to confront greater costs of capital when they are in the habit of customize portfolios or comply with their financing needs at the completion of each month, According to Etula et al. (2020), the monthly payment cycle has an effect on the volatility features of the worldwide financial markets. The authors present an indirect as well as direct proof that financial firms are engaged in these patterns, which may result from systematic trading strategies or liquidity requests from institutional investors. It represents a consistent, transient increase in financing and equity spending on capital that corresponds with the monthly financial requirements.

The study also quantifies the related expenses, indicating that pricing impacts induced by liquidity are substantial enough to have an impact on overall market efficiency. Importantly, the paper analyzes the limits to arbitrage, which prohibits market forces from fixing these inefficiencies altogether. The results highlight the difficulties mutual funds and other market player encounter when they are constrained by liquidity, which eventually affects their performance and the stability of the market.

In order to investigate the factors that influence stock liquidity, Xie et al. (2022) analyze shares from January 2003 to September 2021. They create nine idiosyncratic and five systematic variables to evaluate the predictive and contemporaneous influences on stock liquidity. It's noteworthy to note that they found that stock liquidity exhibits an unusual tumble when contrasted to both 1-year deferred structural returns and contemporary individual returns. For either present as well as future liquidity, specific variables are more important than structural ones.

Moreover, the analysis demonstrates that individualistic return variance influences both short-term in nature and simultaneous liquidity, and that the ability to predict diminishes with extended prediction periods. Moreover, economic policy uncertainty (EPU) determines the degree of sensitivity stock liquidity is to each of these factors. Verified using to be accurate over sub-periods while employing four different liquidity metrics, those findings provide perspectives on the dynamics of the liquidity in a developing marketplace environment by highlighting unique stock

liquidity anomalies linked to specific market mechanisms and investor psychology in China.

Lim & Choi (2022) investigate liquidity spillovers among S&P 500 sectors in order to show the mutual dependence of the U.S. stock market. Using a sector-based Amihud liquidity measure, it examines how liquidity dynamics across sectors strengthen during the COVID-19 pandemic and the 2008 Global Financial Crisis (GFC). Important results point out that liquidity links get considerably stronger during crises. The materials industry constituted the main transmitter of liquidity spillovers during the Great Financial Crisis, but the consumer discretionary sector played a similar role during the COVID-19 period, with the real estate sector acting as the most significant spillover beneficiary.

In addition, net liquidity spillovers diverged by sector in both crises; the COVID-19 pandemic identified the biggest spillovers in the consumer staples, healthcare, and industrial sectors. These findings have substantial repercussions regarding both portfolio managers seeking to understand cross-sector risk dynamics and regulators concerned with maintaining market stability during difficult economic periods.

By analyzing FTSE 100 equities and their attributes, including fluctuation, flexibility, returns, and volume of trading, Symons-Hicks (2023) investigates the UK marketplaces as sources of retail investor interest. The study suggests that greater fluctuations, returns, and quantity of trading are positively correlated with increasing retail attention, using the results of the Google Search Volume Index as a proxy for retail interest.

The outcomes offer an understanding of the factors that appeal to retail investors and emphasize the significance of trading behaviours and performance, particularly among higher-cap equities. Understanding individual investor decisions and developing techniques to help those in the market and systems a helping hand retail trading behaviours are two useful conclusions drawn from this research.

In order to strengthen their comprehension of the effects of availability, asset structure, and sales growth on the capital structure employed by manufacturing firms, Yusuf et al. (2023) looked into the manufacturing companies listed on the IDX, the Indonesian Stock Exchange, between 2009 and 2018. They concentrated on how the limiting influence of interest rates affected the value of shares as reference of bank of Indonesia.

2.3 Requirement of Market Observation

In order to tackle the challenges regarding to the requirement of market observation, the mobility of capital and exchange rate volatility are the main topics of Fanelli & Straub's (2021) description of the changing patterns of operations by central banks in an open economy with small populations. The authors look into two important factors: the somewhat

imperfect segmentation of the foreign and domestic bond markets and exogenous financial factors that increase the variability of exchange rates in reaction to capital shifts.

These approaches have a price, in particular in the form of foreigners' carry-trade profits, even as they minimize excessive exchange rate oscillations.

The most effective intervention method, according to the study, strengthens the rate of exchange by "leaning against the wind," uses forward guidance to navigate market expectations, and maintains yield spreads smoother. Translating this model to a multi- country setting because the research project argues that broad involvement could lead to social losses, excessive reserve accumulation, and a drop in global interest rates, emphasising the need for coordinated regulatory frameworks.

The review of previous research indicates that particular financial components are required to be present to keep up the investment. To further strengthen this point of view, Boburmirzo & Boburjon (2022) analyse all factors determining foreign direct investment (FDI) flows in Commonwealth of Independent States ("CIS") countries from 1995 to 2018, with an emphasis on the impacts on trading vulnerability, GDP, GDP per capita, inflation, and currency exchange rates.

A few research investigations have been performed specifically on CIS countries, notwithstanding the fact that FDI factors have been extensively studied globally. It also implies that additional elements, such as trade and economic growth strategies, may be more important. These findings emphasize the necessity of keeping an eye on more general economic indicators, like the dynamics of the equities market, as these could provide insight into investor sentiment and market circumstances that could tangentially influence FDI decisions.

To justify the significance of foreign exchange systems in foreign direct inflows, Khatabi et al. (2018) describes that factors determining of FDI in the regions of the Middle East and North Africa region between 2002 and 2016. According to the study, they emphasized on relevant factors along with successful market drivers.

The results indicate that while incoming foreign direct investment (FDI) are constrained by the rate of inflation, they are benefited by effective governance, GDP, market susceptibility, and ease of conducting business. The essential role of stable exchange rates in luring foreign investment is demonstrated by the fact that nations with fixed exchange rate regimes draw more FDI than those with two-tiered systems.

According to Patel et al. (2019), the true effective exchange rate is an important component of open-economy macroeconomics and is used to gauge how successful a nation is in the global market. Since "Global Value Chains"

have altered international trade by involving businesses in production collaboration at various stages, a more sophisticated approach of assessing competitiveness is needed.

Globally unbalanced exchange theory highlights essential inequities in the global financial system, wherein poorer countries preferentially provide biophysical resources to wealthy nations, as demonstrated by Dorminger et al. (2021), increasing the significance of exchange rates.

Despite its theoretical their significance, there is less empirical evidence that the phenomenon is a regular phenomenon in international trade. Ecologically unequal exchange between 1990 and 2015 is convincingly established by recent studies using environmentally-extended multi-regional the input-output models.

In addition to establishing significant differences in compensation for resources such as resources, electricity, land, and labor, this analysis shows that countries with high incomes have substantially higher value added for each ounce of resource that comprises exports. Countries with lower incomes are often net resource exporters, with few exceptions (e.g., land use in China and India), which enables high-income countries to make use of resources while generating economic surpluses.

These results draw emphasis to the structural disparities that drive international trade which have significant consequences for resource control, global sustainability, and the upward trajectory of lower-income nations.

2.4   *The role of market perception for investment in the international market*

According to Westerhoff (2003), behavioral explanations of currency rates contradict established efficient market assumptions by taking into consideration psychological and heuristic-driven components. This research presents a novel adaptive exchange rate model that assumes investor opinions regarding basic values have been fixed to the nearest round integer that The model differentiates among traders who believe that currency rates approximate to perceived fundamentals and those who wager on trend continuations.

Exchange rates fluctuate around perceived values as a result of these behavioral dynamics, generating complicated, cyclical patterns that result in enduring market imbalances.

According to Vijayalakshmi et al. (2022), on behalf of India small entrepreneurs play major role for economic growth of a country. However, despite attempts for changing economic policies by government to support their export growth, small and medium entrepreneurs still perform badly in global markets.

Singhal et al. (2019) state that continual interaction behavior for prices of commodities, exchange rates, and indexes of stocks are being closely examined, particularly for resource-rich economies, in order to reduce risk.

These findings show how the volatility of commodity prices affects fiscal and monetary policy, which has consequences for resource-dependent economies' ability to manage exchange rate pressures and maintain investment stability.

The marketing mix is a crucial component of a marketing strategy that is required to provide customer satisfaction and value, claim Darmawan et al. (2021). It helps organizations with controlling the competitive landscape and is traditionally comprised of four elements: product, cost, transportation, and promotion.

The weaker correlation between changes in exchange rates and macroeconomic factors is a persistent problem in international finance, claim Stavrakeva & Tang (2024).

Previous studies have shown that exchange rates frequently change in an unforeseen manner and are challenging for macroeconomic models to faithfully represent (Meese and Rogoff, 1983). Subsequent studies, however, contradict this idea by underscoring the role important macroeconomic news plays in exchange rate swings. In one instance, Engel and West (2005) consider how pricing approaches for assets that integrate persistent shocks might account for division.

Building on these foundations, our investigation shows that economic data can explain considerable fluctuations in exchange rates, particularly in recessions. Exchange rates respond to prior news, which contradicts the "Uncovered Interest rate Parity under Full Information Rational Expectations (UIP-FIRE)". Recent advances in theory that provide a framework to explicate these processes and aid in getting back to the connection between exchange rate behavior and macroeconomics include models containing institutional frictions, exchange rate risk premia, or violations from rational expectations.

Shepeleva (2022) investigates the evolving legal framework for addressing these issues, focusing special attention to the Bank of Russia's actions. The central bank's initiatives to monitor, detect, and prevent fraudulent activity as well as its training initiatives underscore the significance of financial understanding in risk mitigation. Additionally, it has been recognized that implementing new worldwide monetary regulatory norms is an essential first step in enhancing market openness. However, loopholes in legislation as well as enforcement persist problematic and require additional examination and rectification.

Hypotheses

As per previous research studies, we are following these hypotheses:

H_{01}: Retail equity investors do not follow LIPOR approach to analyse effectiveness of liquidity in foreign exchange market.

H_{A1}: Retail equity investors follow LIPOR approach to analyse effectiveness of liquidity in foreign exchange market.

H_{02}: LIPOR approach is not effective to gain foreign exchange market perception for retail equity investors.

H_{A2}: LIPOR approach is effective to gain foreign exchange market perception for retail equity investors.

H_{03}: The impact of foreign exchange is not to be correlated with preference of LIPOR approach for retail equity investors.

H_{A3}: The impact of foreign exchange is to be correlated with preference of LIPOR approach for retail equity investors.

3. RESEARCH DESIGN

Research Model to identify significance relationship between LIPOR approach and Forex Retail Trading having four factors
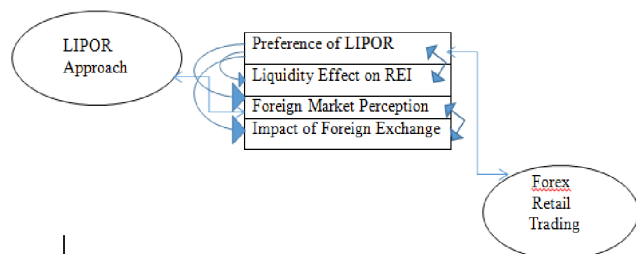
Source: Authors own model

The above model shows how the preference of LIPOR approach and foreign retail trading correlated to each other. However, due to existence of four variables, it is showing in this models that available tools are (like LIPOR) is smoothly driven a connectivity with the foreign retail trading where retail can take benefit of it to improve their decision making.

Data Collection

Previous empirical research papers have been used from 2019 onwards to support the credibility of data concerning foreign exchange. Retail equity investors are prompted to invest in equities as a dynamic strategy. To boost awareness for the use of LIPOR approach for foreign market perception and investment analysis is mentioned for the purpose to deal with and conquer this difficulty, and it involves preference LIPOR approach for retail equity investors for assessing foreign exchange market.

Sampling:

- Population: Stock trading participants who are retail foreign exchange trading investors.

- Sample Size: A statistically meaningful sample size that is established via power analysis in order to guarantee accurate and broadly applicable findings.

Tools and Software:

Google Form: for data collection, Google form created by structured questionnaire and floated to the respondents.

MS. Excel: to collect the data from Google form and for further analysis and state the objectives of the study.

SPSS 25: For statistical analysis.

Research Methodology

Utilizing a mixed-methods approach, the research methodology for examining preferences for the Liquidity, Integrity, Perception, Observation, and Risk Awareness (LIPOR) in forex trading combines quantitative and qualitative techniques to provide thorough insights. By looking at both statistical patterns and the opinions of individual traders, this hybrid method enables a more comprehensive understanding of the factors influencing LIPOR choice among forex traders.

Quantitative Phase

A survey will be given to a sample of forex traders who regularly employ the reference interest in LIPOR method as part of the quantitative phase. A positive relationship between trader preferences for LIPOR and certain market circumstances or trading profiles has been found by statistical analysis through regression analysis and correlation.

Qualitative Phase

As part of the qualitative phase, a targeted sample of forex traders who are engaged as retail investors have been preferred in research survey about LIPOR.

Ethical Consideration

To protect the respondents and preserve the integrity of the study, ethical requirements have been followed. Important ethical factors include:

Informed Consent:

Every participant has informed all receive complete information about the goals, methods, and possible dangers of the study. They are willingly agree to take part and are free to leave at any moment without incurring any fees.

Confidentiality:

The private information of participants will be kept private. To avoid identifying specific participants, all data will be anonymized and results will be presented in aggregate form.

Data Integrity:

The study will be carried out in an open and sincere manner. There will be no falsification or manipulation of the results; all data will be precisely documented and analysed.

Avoiding Harm:

No participant will experience emotional, psychological, or physical harm as a result of the study. Participants are free to skip any topics that make them uncomfortable, and sensitive issues will be avoided.

Conflict of Interest:

Any possible conflicts of interest that can compromise the study's objectivity will be declared by the researchers.

Data Analysis

Gujarat		
S.No.	City Name	Responded
1	Ahmedabad	66
2	Gandhinagar	45
3	Rajkot	8
4	Surat	12
5	Vadodara	77

As per research survey for further study, above mentioned 208 samples are collected from 5 cities (Ahmedabad, Gandhinagar, Rajkot, Surat, and Vadodara) by following Gujarat state. These samples are collected through convenient methodology. As to identify hypotheses, 30 literature reviews, and 1 copyright are being used in this research paper for qualitative research.

Frequencies

Age		Frequency	%	Valid %	Cumulative Percent
Valid	=>18 to <=28	77	37.0	37.0	37.0
	>28 to <=38	104	50.0	50.0	87.0
	>38 to <=48	27	13.0	13.0	100.0
	Total	208	100.0	100.0	

As per the research survey, there are three participants' age groups where we can see that maximum numbers of participants from >28 to <=38 as foreign exchange retail investors.

Highest Education		Frequency	%	Valid %	Cumulative %

	Graduation	60	28.8	28.8	28.8
Valid	PhD or Post PhD Degree	5	2.4	2.4	31.3
	Post-Graduation	143	68.8	68.8	100.0
	Total	208	100.0	100.0	

As per the research survey education standard, retail investors for foreign exchange market having post-graduation.

Reliability Test

Case Processing Summary			
		N	%
Cases	Valid	208	100.0
	Excluded[a]	0	.0
	Total	208	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.987	20

Descriptive Statistics Summary	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Preference of LIPOR approach	208	20	1	5	1.32	0.216	2.645
Liquidity effect on REI	208	20	1	5	1.67	0.058	2.695
Foreign Market Perception	208	20	1	5	1.69	0.293	1.596
Impact of Foreign Exchange	208	20	1	5	1.75	0.307	3.775
Valid N (listwise)	208						

The scale's items are highly correlated with one another, indicating that they consistently measure the same underlying construct, according to its reliability score of 0.987. The validity and dependability of the research findings are strongly supported by a reliability value of 0.987, which generally indicates a very consistent and trustworthy measurement method.

Validity Test

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.982

Bartlett's Test of Sphericity	Approx. Chi-Square	5594.341
	Df	190
	Sig.	.000

Factors of findings are also associated to develop hypotheses by adhering to the useful reliability test. The outstanding parameters of the research factors are demonstrated by the 0.982 result obtained from the Kaiser-Meyer-Olkin measure of sampling (KMO test). With a value of 0.00, which is less than 0.05, these are significant by Bartlett's test of sphericity.

Correlation Test

Correlations		Preference of LIPOR Approach	Liquidity effect on REI	Foreign Market Perception	Impact of Foreign Exchange
Preference of LIPOR Approach	Pearson Correlation	1	.928	.922	.927
	Sig. (2-tailed)		.000	.000	.000
	N	208	208	208	208
Liquidity effect on REI	Pearson Correlation	.928	1	.940	.935
	Sig. (2-tailed)	.000		.000	.000
	N	208	208	208	208
Foreign Market Perception	Pearson Correlation	.922	.940	1	.957
	Sig. (2-tailed)	.000	.000		.000
	N	208	208	208	208
Impact of Foreign Exchange	Pearson Correlation	.927	.935	.957	1
	Sig. (2-tailed)	.000	.000	.000	
	N	208	208	208	208

The Pearson correlation test is used to examine the relationship between the variables in the research model. All factors are significant, according to the results of the Pearson correlation test, as the p value is less than 0.05, or 0.00. This demonstrates that every variable has strong support for the proposed research model.

4. REGRESSION TEST

Preference of LIPOR approach and Liquidity effect on REI

H_{01}: Retail equity investors do not follow LIPOR approach to analyse effectiveness of liquidity in foreign exchange market.

H_{A1}: Retail equity investors follow LIPOR approach to analyse effectiveness of liquidity in foreign exchange market.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Preference of LIPOR approach	.	Enter

a. Dependent Variable: Liquidity effect on REI

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.928[a]	.861	.860	2.264

a. Predictors: Preference of LIPOR approach

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6539.838	1	6539.838	1275.847	.000[b]
	Residual	1055.931	206	5.126		
	Total	7595.769	207			

a. Dependent Variable: Liquidity effect on REI

Considering all other variables equal, each coefficient shows how the dependent variable changes when the independent variable changes by one unit.

The total model is statistically significant, as indicated by the F-statistic p-value of 0.000. Given that the total model is significant and the p-value for the coefficient is less than 0.05, we reject the null hypothesis and come to the conclusion that the liquidity effect on retail equity investment (REI) and preference for LIPOR are significantly correlated.

LIPOR and Foreign Market Perception

H_{02}: LIPOR approach is not effective to gain foreign exchange market perception for retail equity investors.

H_{A2}: LIPOR approach is effective to gain foreign exchange market perception for retail equity investors.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Preference of LIPOR approach	.	Enter

a. Dependent Variable: Foreign Market Perception

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.922[a]	.850	.849	2.446

a. Predictors: Preference of LIPOR approach

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6963.701	1	6963.701	1163.812	.000[b]
	Residual	1232.607	206	5.984		
	Total	8196.308	207			

a. Dependent Variable: Foreign Market Perception

b. Predictors: Preference of LIPOR approach

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.530	.503		3.041	.003
	V1	.933	.027	.922	34.115	.000

a. Dependent Variable: Foreign Market Perception

Each coefficient shows how the dependent variable changes when the independent variable changes by one unit while keeping all other variables constant.

The total statistical significance of the model is indicated by the F-statistic p-value of 0.000. We reject the null hypothesis since the p-value for the coefficient is less than 0.05 and the model as a whole is significant. This leads us to the conclusion that the perception of international markets and the preference for the LIPOR approach are significantly correlated.

LIPOR and Impact of Foreign Exchange

H_{03}: The impact of foreign exchange is not to be correlated with preference of LIPOR approach for retail equity investors.

H_{A3}: The impact of foreign exchange is to be correlated with preference of LIPOR approach for retail equity investors.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Preference of LIPOR approach	.	Enter

a. Dependent Variable: Impact of Foreign Exchange

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.927[a]	.860	.859	2.368

a. Predictors: Preference of LIPOR approach

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	7078.854	1	7078.854	1262.941	.000[b]
	Residual	1154.642	206	5.605		
	Total	8233.495	207			

a. Dependent Variable: Impact of Foreign Exchange

b. Predictors: Preference of LIPOR approach

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.450	.487		2.978	.003
	Preference of LIPOR approach	.941	.026	.927	35.538	.000
a. Dependent Variable: Impact of Foreign Exchange						

Keeping all other variables equal, each coefficient shows how the dependent variable changes when the independent variable changes by one unit.

The total model is statistically significant, as indicated by the F-statistic p-value of 0.000.

Given that the total model is significant and the coefficient's p-value is less than 0.05, we reject the null hypothesis and come to the conclusion that the impact of foreign exchange and the preference for the LIPOR approach are significantly correlated.

5. RESULT AND DISCUSSION

The findings of this study, which looked at how retail investors' preferences for the LIPOR approach and foreign market dynamics interact, show a complicated interaction influenced by how the foreign exchange market is seen and how foreign exchange affects the market.

The research survey's data analysis revealed a substantial positive correlation. This means that ordinary investors are frequently advised by the profound LIPOR strategy (Gupta & Loya, 2024) to look for cost efficiencies through foreign market engagements for stock equity and derivatives.

This dynamic is highlighted by the LIPOR method research as a crucial factor in influencing equity trade balances and investment choices. Interestingly, investors who depend on resource-intensive methods exhibit increased sensitivity, which is indicative of their reliance on stock market investment tactics.

According to the results, promoting stable investment strategies that adhere to the LIPOR method, which considers investors' financial behavior, may help to reduce the uncertainty associated with the presence of volatility in the foreign currency market.

Nonetheless, data analysis of the aforementioned assumptions reveals that retail investors' perceptions of foreign markets and investment decisions are significantly influenced by their choice for the independent variable of the LIPOR approach.

6. CONCLUSIONS

In their 2020 study, Zahoor et al. proposed a method for retail investors to perceive foreign markets: SME internationalization research highlights how fragmented and changing dynamics impact retail investors' perceptions of foreign markets.

It is essential to have a greater comprehension of moderators, mediators, and antecedents. Following the research studies on current financial events and news, future studies should examine complex, stage-specific processes and contextual global economic developments to inform retail investors' tactics and enhance their market engagement outcomes.

In order to solve it, it has been determined that in emerging countries such as Mexico, the perceived value of online reviews and trust play a crucial role in determining the intention

to make an online purchase. Whereas perceived risk has no direct impact, trust directly increases purchase intention and lowers perceived risk. To increase the engagement of retail investors, businesses can place a high priority on building trust by promoting good internet evaluations (Ventre & Kolbe, 2020).

7. SUGGESTIONS

- The research indicates that the diverse financial policies of various companies may dilute the investment of individual investors, resulting in a loss. However, one strategy to get around the foreign currency market would be to conduct in- depth study on the investment behaviours of retail investors.

- Additionally, artificial intelligence is helping to apply many kinds of technologies to find the best way. Therefore, given the availability of high-tech tools, it might be a topic for research on how to make financial investment decisions without bother by utilizing AI tools and the LIPOR strategy, which will be beneficial for investor behaviour.

DECLARATION

I, Abhimanyu Gupta, hereby confirm that the manuscript titled "Preference of LIPOR approach to analyse the current FOREX retail trading as comparative before COVID- 19" authored by Abhimanyu Gupta, Dr. Arpit Loya, Dr. Bijal Zaveri, and Dr. KM Singh, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to Springer (Scopus-indexed) publication/ International Management Perspective Conference (IMPeC) - 2025.

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCE

[1.] Atanasova, C., & Weisskopf, J. P. (2020). The price of international equity ETFs: The role of relative liquidity. *Journal of international financial markets, institutions and money*, *65*, 101190.

[2.] Amihud, Y., & Levi, S. (2023). The effect of stock liquidity on the firm's investment and production. *The Review of Financial Studies*, *36*(3), 1094-1147.

[3.] Chaieb, I., Errunza, V., & Langlois, H. (2021). How is liquidity priced in global markets?. *The Review of Financial Studies*, *34*(9), 4216-4268.

[4.] Etula, E., Rinne, K., Suominen, M., & Vaittinen, L. (2020). Dash for cash: Monthly market impact of institutional liquidity needs. *The Review of Financial Studies*, *33*(1), 75-111.

[5.] Xie, L., Jin, Y., & Mo, C. (2022). Predictive and Contemporaneous Power of the Determinants of Stock Liquidity. *Frontiers in Psychology*, *13*, 912159.

[6.] Lim, S. Y., & Choi, S. Y. (2022). Impact of liquidity spillovers among industrial sectors on stock markets during crisis periods: Evidence from the S&P 500 index. *PLoS One*, *17*(11), e0277261.

[7.] Symons-Hicks, J. (2023). The Influence of Market Dynamics on Retail Investor Attention. *UCL Journal of Economics*, *2*(1).

[8.] Yusuf, D., Suteja, J., & Hermawan, A. (2023). The Effect of Liquidity, Asset Structure and Sales Growth on the Capital Structure and Its Implications for Share Prices Moderated by Bi Interest Rates. *Jurnal Ekonomi*, *12*(01), 1364-1379.

[9.] Fanelli, S., & Straub, L. (2021). A theory of foreign exchange interventions. *The Review of Economic Studies*, *88*(6), 2857-2885.

[10.] Boburmirzo, K., & Boburjon, T. (2022). Exchange rate influence on foreign direct investment: empirical evidence from cis countries. *International Journal Of Management And Economics Fundamental*, *2*(04), 19-28.

[11.] Khatabi, S., Komijani, A., Mohammadi, T., & Memarnejad, A. (2020). Factors associated with FDI inflows to MENA region: An Empirical Examination. *Iranian Economic Review*, *24*(2), 313-331.

[12.] Patel, N., Wang, Z., & Wei, S. J. (2019). Global value chains and effective exchange rates at the country-sector level. *Journal of Money, Credit and Banking*, *51*, 7-42.

[13.] Dorninger, C., Hornborg, A., Abson, D. J., Von Wehrden, H., Schaffartzik, A., Giljum, S., ... & Wieland, H. (2021). Global patterns of ecologically unequal exchange: Implications for sustainability in the 21st century. *Ecological economics*, *179*, 106824.

[14.] Westerhoff, F. (2003). Anchoring and psychological barriers in foreign exchange markets. *The Journal of Behavioral Finance*, *4*(2), 65-70.

[15.] Vijayalakshmi, B., & Umayal, C. (2022). A Study on the Perception of SMEs on Foreign Exchange Risk Management. *Universal Journal of Accounting and Finance*, *10*(1), 95-101.

[16.] Singhal, S., Choudhary, S., & Biswal, P. C. (2019). Return and volatility linkages among International crude oil price, gold price, exchange rate and stock markets: Evidence from Mexico. *Resources policy*, *60*, 255-261.

[17.] Darmawan, D., & Grenier, E. (2021). Competitive advantage and service marketing mix. *Journal of Social Science Studies (JOS3)*, *1*(2), 75-80.

[18.] Stavrakeva, V., & Tang, J. (2024). A fundamental connection: Exchange rates and macroeconomic expectations. *Review of Economics and Statistics*, 1-49.

[19.] Shepeleva, D. V. (2022). Activities of illegal financial market participants: financial and legal aspects and problems. *Gaps in Russian Legislation*, *15*(1), 41-46.

[20.] Weixiang, S., Qamruzzaman, M., Rui, W., & Kler, R. (2022). An empirical assessment of financial literacy and behavioral biases on investment decision: Fresh evidence from small investor perception. *Frontiers in psychology*, *13*.

[21.] Heimer, R. Z., Iliewa, Z., Imas, A., & Weber, M. (2023). *Dynamic inconsistency in risky choice: Evidence from the lab and field* (No. w30910).National Bureau of Economic Research.

[22.] Zahoor, N., Al-Tabbaa, O., Khan, Z., & Wood, G. (2020). Collaboration and internationalization of SMEs: Insights and recommendations from a systematic review. International Journal of Management Reviews, 22(4), 427-456.

[23.] Ventre, I., & Kolbe, D. (2020). The impact of perceived usefulness of online reviews, trust and perceived risk on online purchase intention in emerging markets: A Mexican perspective. Journal of International Consumer Marketing, 32(4), 287-299.

[24.] Matiza, T. (2020). Post-COVID-19 crisis travel behaviour: towards mitigating the effects of perceived risk. *Journal of Tourism Futures*, *8*(1), 99-108.

[25.] Paul, J., Ueno, A., & Dennis, C. (2023). ChatGPT and consumers: Benefits, pitfalls and future research agenda. *International Journal of Consumer Studies*, *47*(4), 1213- 1225.

[26.] Katsikeas, C., Leonidou, L., & Zeriti, A. (2020). Revisiting international marketing strategy in a digital era: Opportunities, challenges, and research directions. *International Marketing Review*, *37*(3), 405-424.

[27.] Paul, J. (2020). Marketing in emerging markets: A review, theoretical synthesis and extension. *International Journal of Emerging Markets*, *15*(3), 446-468.

[28.] Elavarasan, R. M., Shafiullah, G. M., Raju, K., Mudgal, V., Arif, M. T., Jamal, T., ... & Subramaniam, U. (2020). COVID-19: Impact analysis and recommendations for power sector operation. *Applied energy*, *279*, 115739.

[29.] Arghashi, V., & Yuksel, C. A. (2022). Interactivity, Inspiration, and Perceived Usefulness! How retailers' AR-apps improve consumer engagement through flow. *Journal of Retailing and Consumer Services*, *64*, 102756.

[30.] Şenol, Z., & Zeren, F. (2020). Coronavirus (COVID-19) and stock markets: The effects of the pandemic on the global economy. *Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi*, *7*(4), 1-16.

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Development of Reporting Model for Green Accounting & Practices for Corporate Sustainability

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ABSTRACT

One of the critical challenges of accounting is managing disclosure practices of environmental, social, governance, and cash flow of environmental activities of the companies. This research focuses on environmental disclosure practices. Environment disclosure practices are improving the environmental performance for the corporate sustainability of the company. Green Accounting is gearing up for growth, transparency, and material information to the stakeholders, investors, lenders, etc. The main aim of the study is to determine the cash flow of environmental performance and develop the GAR Model to provide transparent disclosure of material information. The GAR Model is required to make long-term business resilience in the Indian security market more efficient and liquid. In the current research work to develop the GAR model, the responses were gathered from respondents from companies and non-working professionals, with 179 respondents. The multiple regression models were made for contents to be added to the GAR model and requirements for the model with the benefits of the model. By using the multiple regression method with SPSS software, a model for transforming the accounting practices is developed with the major components required for disclosure, major benefits, and suggestions for improving GAR practices that can guide the future disclosure of the green accounting behavior of companies for taking the benefits and minimizing the limitations. The green accounting and reporting model developed revealed that there is a requirement for environmental policy and Standards & Guidelines of the Environment, which can be incorporated with the individual companies Environment Management System as a requirement by investors for conserving the environment. Not only that, the waste must be reduced, recycled, and reused to reduce carbon monoxide and environmental noise protection. If this is to be possible, then only the motives of the green environment will be achieved. The GAR Model will provide the benefits of resolving uncertainty and reducing business risk for companies, simultaneously improving the efficiency of the accounts payable and receivable process and identifying the cash flow of environmental performance. To achieve the goal of its long-term sustainability and sustainable future, it must compare environmental costs and benefits that can be reflected in its green accounting reporting.

Keywords: Green Accounting, Managers' perception, Benefits, Limitations.

1. INTRODUCTION

Disclosure practices are always an important aspect for companies, investors, shareholders, and stakeholders to record all financial information and show a true and fair view of the picture to external parties. Recently, companies are doing events like environmental, social, governance, and sustainability activities that are not able to be recorded under financial statements due to the principles of accounting and accounting standards. "According to Emily Stebbing et al. (2021), increased emphasis on the natural capital approach in the UK has led to greater demand for methods that link economic sectors with elements of natural capital and that can provide evidence for sustainable management of the environment. According to Ben, Fang et al. (2024), companies accounting for ecological product value have a high quality of information disclosure, with less deviation from analysts' predictions and high accuracy, and the development of ecological product value accounting of listed companies reduces the divergence degree of analysts. Ecological product value accounting is an important indicator of whether a company has long-term development potential.

Companies are using cost management accounting systems that are not able to deal properly with environmental, social,

governance, and cash flow of environmental activity, and as a result, it increases general overhead accounts. A manager does not have any idea how to manage environment-related activities. To manage these activities and overheads, companies require Environment Disclosure Practices. Management accounting practices fail to incorporate environmental concerns; organizations are unaware of the impact on profit and loss accounts and the balance sheet impact of environment-related activities (Frost and Wilmhurst, 2000).

Furthermore, companies having one of the critical challenges of accounting is managing disclosure practices of environmental, social, and governance factors and the cash flow of environmental activities of the companies. This research focuses on Environmental Disclosure Practices. Environment disclosure practices are improving the environmental performance for the company's corporate sustainability. Green Accounting is gearing up for growth, transparency, and material information to the stakeholders, investors, lenders, etc.

However, there is limited work on disclosure practices on the environment, social, governance activities, and cash flow of environmental practices. Therefore, this paper is aimed to

1. To examine the green accounting disclosure practices between different continents.

2. To analyze the green accounting and reporting parameters of environmental reporting, benefits, and suggestions for implementation of green accounting in Indian companies.

3. To establish the model for the implementation of green accounting and reporting for Indian companies.

2. BACKGROUND OF THE STUDY:

Environmental Accounting (EA) was initially introduced by R. Grey et al. in 1970 (Famielec, Stępień, 2005). Since then, it has evolved alongside modifications in National Income Accounts and Economic Environment Accounting. During the 1970s and early 1980s, EA emerged as a method to address environmental issues and economic priorities through disclosure. Nine pioneering countries, including Germany, France, Philippines, Netherland, Norway, Namibia, United States, Sweden and Canada, began practical implementation of this concept. Sweden, in collaboration with Eurostat (the statistical office of the EU), played a key role in designing, testing, and implementing these accounting methods. Germany also closely collaborated with Eurostat, focusing on material flow accounts and land accounting. Canada made significant strides by integrating natural resource extensions into its national accounts. All selected countries actively engaged with the United Nations to advance EA under the System of Integrated Economic and Environmental Accounting (SEEA). Developing countries like Namibia and the

Philippines also demonstrated their commitment to EA, with Indonesia later contributing through initiatives like Wasting Assets (World Resources Institute, 1989). According to Gray, Rob (1992), there has been limited emphasis on the natural environment in accounting scholarship and practice. Instead, attention has been directed toward accounting's role in promoting sustainability, accounting (recording, summarizing, analyzing the event/transaction) and transparency in participatory democracy, exploring non-financial reporting on the biosphere, and controversially, adapting existing accounting methods to operationalize sustainability accounting. AZZONE, G., & Noci, G. (1996) Environmental awareness and regulations are compelling manufacturers to introduce new 'green' products that have minimal impact on natural resources throughout their lifecycle. However, there are uncertainties regarding how accounting information—comprising physical measures and qualitative data—can be effectively organized to inform decision-making about the impacts of each product development initiative. According to Cairns, Robert D. (2002), especially in developing countries, natural resources and the environment are not optimally managed. Nevertheless, green accounting can quantify the actual environmental contributions to the net product using current

prices. Cairns, R. D. (2006). "Environmental accounting is a tool that, used prudently, can make an important contribution to social decision-making". Jahamani et al. (2003) Developed countries have achieved a lot of progress in the field of green accounting and reporting. Countries like Jordan and the U.A.E. are still in the initial phases of development. Gonzalez et al. (2023 "Current accounting systems assume a purely financial approach without including environmental information, such as environmental costs and companies' expenses. As per the study, Columbian industrial and commercial companies had not yet implemented environmental practices within the accounting system". Therefore, the literature focuses on the critical challenges of accounting practices from managerial perspectives in the context of Indian companies.
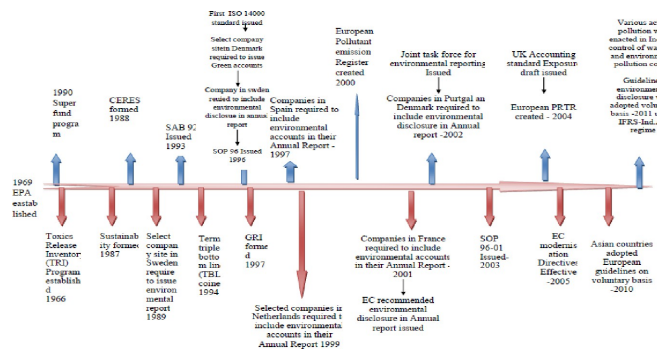
Fig. 1 Holistic overview of Green accounting in the world

Review of Literature: As this is one of the critical challenges in accounting is managing disclosure practices of environmental, social, governance, and cash flow of environmental activities of the companies. This research focuses on environmental disclosure practices.

Alfonso Aranda-Usón (2024) study focuses on interactive functionality for circular accounting and materialistic cash flow in a circular economy. The circular economy requires environmental accounting practices to offer a simplified application of material flows of cost accounting by using a dual approach of agri-food case study in Spain. The accounting implications derived from the introduction of circular models are defined in this study to analyze firms' specific circular accounting capabilities applied by small companies to less complex processes than those usual.

Odintosva Tatyana's **(2024)** sustainability opens a wide concept of linked practices: sustainability information and management practices, environment reporting, environment social governance reporting and environment rating, environment impact investment, environment stability measurement, transparency etc. The study aimed to investigate strategies for developing and implementing an environmental policy that enhances ESG value creation, meets sustainability requirements, and fosters a transparent information system. This transparent information system includes green accounting, ESG reporting, analysis, and

assurance. The transparent information system is useful for investors, stakeholders, management, and employees. The researcher recommended the development of a holistic system for sustainability governance, focusing on several aspects, i.e., the creation of management informational support, accounting transformation/ transparency, ESG reporting and associated practices, optimization, and the development of information methodologies. This recommendation is intended for practical application. They aim to structure the information field of socio-economic life, facilitating informed decision-making and fostering sustainable development practices.

Morri, Giacomo (2024) examines the association between ESG performance and financial performance within the real estate sector. The study explores the effects of triple bottom line, Environment Social Governance and their scores, serving as representative for ESG performance, on both profitability and market indicators. The study highlights the association between sustainability, especially environmental aspects, and financial performance, while governance factors negatively impact financial performance. He suggested that companies should do the enhancements in environmental practices so they can potentially increase profitability and should weigh the costs and benefits of improving their governance structures carefully.

Jill Frances Atkins, et al. (2023) the study focuses on "environmental and ecological accounts from the perspectives of human consciousness across a wide variety of media and in a broad range of forms." It recognizes that accounting practices should reflect and accommodate a wide range of perspectives and experiences, acknowledging that diversity among accountants brings different insights and approaches to the field. Moreover, the research underscores the importance of considering a broad spectrum of stakeholders to whom accounting information is delivered. In essence, the research advocates for inclusive accounting practices that recognize and embrace diversity in both the profession and the stakeholders involved, thereby enhancing transparency, accountability, and relevance in reporting and governance processes.

Rebecca Maughan (2023) provides a theoretically informed analysis of the evolution of environmental management accounting (EMA) and social and environmental reporting (SER) and the accompanying development of a sustainability program in a large family-owned, unlisted corporation. It utilizes the conceptualization of organizational identity and internal legitimacy to analyze how various key organizational actors make decisions and take actions in their involvement with Environmental Management Accounting (EMA) and Sustainability and Environmental Reporting (SER). The study shows the discrepancies between an organization's identity claims ("who we are") and its actual enacted identity ("what we do") can facilitate the adoption of constitutive, performative, and representational approaches

to Environmental Management Accounting (EMA) and Sustainability and Environmental Reporting (SER).

Hope H. Han (2023), investigates the correlation between Carbon emissions, firm valuation, and international proprietorship among Korean companies. Consequently, the study revealed that companies disclosing GHG emissions tend to have lower value compared to firms not subject to disclosure obligations. Furthermore, foreign investors hold lower ownership stakes in mandatory disclosure firms compared to those without such requirements. Within mandatory disclosure firms, there is a negative correlation between GHG intensity and firm value.

Evangelinos, N.L. (2015) aims to introduce a new approach to climate change accounting that addresses significant weaknesses in existing environmental accounting methods, such as accuracy and reliability. Currently, most accounting methods for climate change information are voluntary, supporting businesses in developing crucial environmental strategies and aiding policymakers in understanding their outcomes. However, the informal nature of these standards and the variability in financial and non-financial information can complicate their use and reliability.

Mitchell, P. & M. (2006) investigated Voluntary Environmental Reporting Practices and aimed to identify successful EPA prosecutions from 1994 to 1998. The study conducted a content analysis of environmental disclosures from 20 Australian firms and it revealed the positive findings, indicating that the disclosures made by the Australian firms were positive in nature.

Gray, Rob (1992), observes that the non-financial information of a company's environmental related activities has not been a focal point in stewardship accounting and practice. The study addresses this gap by exploring how accounting would be affected by prioritizing environmental considerations and enhancing accountability, transparency, etc. The non-financial reporting practices on the biosphere and the controversial use of current accounting methods to operational sustainability accounting. The study introduces the principles of this 'deep green' stance and examines how accounting could express these principles.

Research Approach: The study was conducted based on primary data and secondary data collection.

Scope of Data:

The data for the current research is collected from secondary and primary sources, i.e., mainly from the sustainable and then by the annual report of the company. Primary data is collected from professionals, government and private professionals, businessmen, etc. through questionnaires.

Period of study:

The period of study is limited to five years. In this study, all the reports were downloaded from the website of the selected companies.

Sample Selection:

Secondary data on green accounting and reporting practices of companies were sourced from the GRI and company websites. A sample of 400 companies was initially collected, out of which 358 were analyzed due to the availability of complete data from five years on green accounting practices. The data from companies is included in Sustainability Reports and Annual Reports. The primary data was collected based on a questionnaire and aggregate responses received from 179 respondents. The respondents are from companies' professionals, government and private practitioners, etc.

Analysis of Inter-Continent EDS Scores

The following hypothesis has been developed to investigate variations in disclosure practices among different continents.

Hypothesis 1: There is a difference in disclosure practices between different continents (based on reporting period and content).

To test the above hypothesis, one way ANOVA is used to test the variance between groups. One-way ANOVA compares unmatched groups. The P value of the hypothesis tests the data from all groups coming from populations with equal means. A large P value indicates no significant evidence to conclude that the means differ. Conversely, a small P value suggests that the observed differences are unlikely due to random sampling. ANOVA test used to compute F ratio and P Value. ANOVA offers an advantage for conducting multiple two-sample t-tests, and it would result in increasing the likelihood of making a type I error. Therefore, ANOVAs are particularly valuable when comparing three or more means.

TABLE 1: Multiple Analysis of Variance (ANOVA) Result- EDS score

EDS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Africa	57	18.7368	12.94704	1.71488	15.3015	22.1722	.00	45.00
Asia	28	33.3929	13.91333	2.62937	27.9978	38.7879	6.00	54.00
North America	56	28.4821	11.81369	1.57867	25.3184	31.6459	.00	57.00
Europe	28	32.3929	13.30090	2.51363	27.2353	37.5504	5.00	53.00
Oceania	11	21.4545	10.78298	3.25119	14.2104	28.6987	3.00	35.00
Total	180	26.3389	13.87541	1.03421	24.2981	28.3797	.00	57.00

ANOVA					
EDS					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6233.209	4	1558.302	9.660	.000
Within Groups	28229.119	175	161.309		
Total	34462.328	179			

Multiple Comparisons						
EDS Tukey HSD						
(I) Continent	(J) Continent	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Africa	Asia	-14.65602*	2.93105	.000	-22.7352	-6.5768

	North America	-9.74530[*]	2.38967	.001	-16.3322	-3.1584
	Europe	-13.65602[*]	2.93105	.000	-21.7352	-5.5768
	Oceania	-2.71770	4.18264	.966	-14.2468	8.8114
Asia	Africa	14.65602[*]	2.93105	.000	6.5768	22.7352
	North America	4.91071	2.93965	.455	-3.1922	13.0137
	Europe	1.00000	3.39442	.998	-8.3565	10.3565
	Oceania	11.93831	4.51946	.067	-.5193	24.3959
North America	Africa	9.74530[*]	2.38967	.001	3.1584	16.3322
	Asia	-4.91071	2.93965	.455	-13.0137	3.1922
	Europe	-3.91071	2.93965	.673	-12.0137	4.1922
	Oceania	7.02760	4.18868	.450	-4.5182	18.5734
Europe	Africa	13.65602[*]	2.93105	.000	5.5768	21.7352
	Asia	-1.00000	3.39442	.998	-10.3565	8.3565
	North America	3.91071	2.93965	.673	-4.1922	12.0137
	Oceania	10.93831	4.51946	.115	-1.5193	23.3959
Oceania	Africa	2.71770	4.18264	.966	-8.8114	14.2468
	Asia	-11.93831	4.51946	.067	-24.3959	.5193
	North America	-7.02760	4.18868	.450	-18.5734	4.5182
	Europe	-10.93831	4.51946	.115	-23.3959	1.5193
*. The mean difference is significant at the 0.05 level.						

There is a statistically significant difference between study groups as p< 0.05. Hence it can be concluded that EDS scores for all the continents are significantly different from each other. To measure the strength of EDS scores across continents, a Post Hoc test is applied. From the mean value analysis, it can be concluded that Asia and Europe lead the way by scoring the highest in EDS score compared to other continents. Other countries following include North

America and Oceania. Developing continents like Africa are trailing behind in disclosing the environmental values in company reports. Hence, from the above analysis, we can accept the hypothesis and conclude that there is a difference in disclosure practices between different continents.

Comparison of disclosure among size of companies

The following hypothesis is formulated to test the difference between disclosure practices across different types of companies across the continents. For this purpose, the companies are divided into three groups, SME, MNE, and large companies, and for all continents wise, the differences amongst the disclosure scores were analyzed. Further, after

taking the entire sample as one, continent-wise it was analyzed.

First, for all the companies, the disclosure score is analyzed, and differences according to the size of –

Companies, SMEs, MNEs, and large with the following hypothesis:

Hypothesis 2: There is a difference in disclosure practices between the sizes of companies on different continents.

To test the above hypothesis, one-way ANOVA is used to test the variance between groups.

TABLE 2: ANOVA Result- Disclosure score and sizes of companies

ANOVA					
Disclosure_Score					
	Sum of Squares	df	Mean Square	F	Sig.

Between Groups	191.278	2	95.639	.511	.601
Within Groups	33125.366	177	187.149		
Total	33316.644	179			

Multiple Comparisons

Disclosure_Score
Tukey HSD

(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
SME	MNE	-5.23810	5.46395	.604	-18.1527	7.6765
	Large	-5.36789	5.32839	.573	-17.9621	7.2263
MNE	SME	5.23810	5.46395	.604	-7.6765	18.1527
	Large	-.12979	2.18525	.998	-5.2949	5.0353
Large	SME	5.36789	5.32839	.573	-7.2263	17.9621
	MNE	.12979	2.18525	.998	-5.0353	5.2949

Disclosure_Score

Tukey HSD[a,b]

Type	N	Subset for alpha = 0.05
		1
SME	7	21.4286
MNE	60	26.6667
Large	113	26.7965
Sig.		.472
Means for groups in homogeneous subsets are displayed.		
Harmonic Mean Sample Size = 17.818. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.		

There is a statistically insignificant difference between study groups, i.e., SME, MNE, and large companies, as $p > 0.05$. Hence it can be concluded that disclosure scores for all types of companies (SME, MNE, and large companies) of all the continents have similar disclosure practices.

Further to identify the disclosure difference as per separate continents, first for the AFRICA continent the disclosure

scores and the type of companies are measured and the following hypothesis is developed:

Hypothesis 3: There is a difference in disclosure practices between the sizes of companies on African continents.

To test the above hypothesis, one-way ANOVA is used to test the variance between groups.

TABLE 3: ANOVA Result- Disclosure score and sizes of companies

ANOVA

Disclosure_Score

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	202.786	2	101.393	.464	.631
Within Groups	11799.354	54	218.507		
Total	12002.140	56			

There was a statistically insignificant difference between study groups, i.e., SME, MNE, and large companies, as $p > 0.05$. Hence, it can be concluded that disclosure scores for all types of companies (SME, MNE, and large companies) on the African continent have similar disclosure practices.

Further to identify the disclosure difference as per separate continents, for the Asia continent, the disclosure scores and the type of companies are measured, and the following hypothesis is developed:

Hypothesis 4: There is a difference in disclosure practices between the sizes of companies on the Asia continents.

To test the above hypothesis, a one-way ANOVA was used to test the variance between groups.

TABLE 4: ANOVA Result- Disclosure score and sizes of companies

ANOVA

Disclosure_Score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	252.232	2	126.116	.729	.492
Within Groups	4323.875	25	172.955		
Total	4576.107	27			

Multiple Comparisons

Disclosure_Score Tukey HSD						
(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
SME	MNE	3.37500	10.39696	.944	-22.5221	29.2721
	Large	-3.33333	9.80235	.938	-27.7493	21.0827
MNE	SME	-3.37500	10.39696	.944	-29.2721	22.5221
	Large	-6.70833	5.58820	.464	-20.6276	7.2109
large	SME	3.33333	9.80235	.938	-21.0827	27.7493
	MNE	6.70833	5.58820	.464	-7.2109	20.6276

Disclosure_Score		
Tukey HSD[a,b]		
Type	N	Subset for alpha = 0.05
		1
MNE	8	24.6250
SME	2	28.0000
Large	18	31.3333
Sig.		.732
Means for groups in homogeneous subsets are displayed.		
Uses Harmonic Mean Sample Size = 4.408. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.		

There was a statistically insignificant difference between study groups, i.e., SME, MNE, and large companies, as p>0.05. Hence it can be concluded that disclosure scores for all types of companies (SME, MNE, and large companies) of the Asia continent have similar disclosure practices.

Further to identify the disclosure difference as per separate continents, for the European continent, the disclosure scores and the types of companies are measured, and the following hypothesis is developed:

Hypothesis 5: There is a difference in disclosure practices between the sizes of companies on European continents.

To test the above hypothesis, one way ANOVA is used to test the variance between groups.

TABLE 5: ANOVA Result- Disclosure score and sizes of companies

ANOVA					
Disclosure_score					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4.001	1	4.001	.022	.884
Within Groups	4772.678	26	183.565		
Total	4776.679	27			

There is a statistically insignificant difference between study groups, i.e., SME, MNE, and large companies, as p > 0.05. Hence it can be concluded that disclosure scores for all types of companies (SME, MNE, and large companies) of the European continent have similar disclosure practices.

Further to identify the disclosure difference as per separate continents, for the North American continent the disclosure scores and the type of companies are measured, and the following hypothesis is developed:

Hypothesis 6: There is a difference in disclosure practices between the sizes of companies on North American continents.

To test the above hypothesis, a one-way ANOVA was used to test the variance between groups.

TABLE 6: ANOVA Result- Disclosure score and sizes of companies

ANOVA					
Disclosure_score					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	105.853	2	52.926	.371	.692
Within Groups	7570.130	53	142.833		
Total	7675.982	55			

Multiple Comparisons						
Disclosure_score Tukey HSD						
(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
SME	MNE	-6.94444	8.75822	.709	-28.0628	14.1739
	large	-7.53704	8.75822	.667	-28.6554	13.5813
MNE	SME	6.94444	8.75822	.709	-14.1739	28.0628
	large	-.59259	3.25272	.982	-8.4358	7.2506
large	SME	7.53704	8.75822	.667	-13.5813	28.6554
	MNE	.59259	3.25272	.982	-7.2506	8.4358
Disclosure_score						

Tukey HSD[a,b]			
Type	N	Subset for alpha = 0.05	
		1	
SME	2	21.5000	
MNE	27	28.4444	
Large	27	29.0370	
Sig.		.568	
Means for groups in homogeneous subsets are displayed.			
Uses Harmonic Mean Sample Size = 5.226. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.			

SME	MNE	-4.28571	9.38433	.893	-31.1009	22.5295
	large	1.50000	11.70432	.991	-31.9444	34.9444
MNE	SME	4.28571	9.38433	.893	-22.5295	31.1009
	large	5.78571	9.38433	.815	-21.0295	32.6009
large	SME	-1.50000	11.70432	.991	-34.9444	31.9444
	MNE	-5.78571	9.38433	.815	-32.6009	21.0295

There was a statistically insignificant difference between study groups, i.e., SME, MNE, and large companies, as p > 0.05. Hence it concluded that disclosure scores for all types of companies (SME, MNE, and large companies) of the North American continent have similar disclosure practices.

To identify the disclosure difference as per separate continents, for the Oceania continent, the disclosure scores and the type of companies are measured, and the following hypothesis is developed:

Hypothesis 7: There is a difference in disclosure practices between the sizes of companies on Oceania continents.

To test the above hypothesis, one-way ANOVA is used to test the variance between groups.

TABLE 7: ANOVA Result- Disclosure score and sizes of companies

ANOVA					
Disclosure_Score					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	66.799	2	33.399	.244	.789
Within Groups	1095.929	8	136.991		
Total	1162.727	10			

Multiple Comparisons						
Disclosure_Score Tukey HSD						
(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound

Disclosure_Score			
Tukey HSD[a,b]			
Type	N	Subset for alpha = 0.05	
		1	
Large	2	17.5000	
SME	2	19.0000	
MNE	7	23.2857	
Sig.		.841	
Means for groups in homogeneous subsets are displayed.			
Uses Harmonic Mean Sample Size = 2.625. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.			

There is a statistically insignificant difference between study groups, i.e., SME, MNE, and large companies, as p>0.05. Hence, it can be concluded that disclosure scores for all types of companies (SME, MNE, and large companies) on the Oceania continent have similar disclosure practices.

Thus, we can say that the differences in the disclosure scores of the companies are insignificant for the different types of companies, i.e., SMEs, MNEs, and large companies.

Hypothesis 9: The attributes configuring the level of importance of companies' practice/working significantly influence their environmental disclosure.

TABLE 9: Attributes of Environment Disclosure

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Comp_ER_1	358	1.00	5.00	3.1508	1.14883
Comp_ER_2	358	1.00	5.00	3.4190	.89183
Comp_ER_3	358	1.00	5.00	3.5531	.84881
Comp_ER_4	358	1.00	5.00	2.5866	1.34792
Comp_ER_5	358	1.00	5.00	3.2793	1.17089
Comp_ER_6	358	1.00	5.00	2.6592	1.20908

Comp_ER_7	358	1.00	5.00	3.3631	1.32266
Comp_ER_8	358	1.00	5.00	3.5978	1.22941
Comp_ER_9	358	1.00	5.00	3.0056	1.33449
Comp_ER_10	358	1.00	5.00	3.4469	.91874
Comp_ER_11	358	1.00	5.00	3.6034	.95646
Comp_ER_12	358	1.00	5.00	3.3687	1.03767
Comp_ER_13	358	1.00	5.00	3.2626	1.17717
Comp_ER_14	358	1.00	5.00	3.3296	1.10044
Comp_ER_15	358	1.00	5.00	3.3520	1.25158
Comp_ER_16	358	1.00	5.00	3.5196	.98495
Comp_ER_17	358	1.00	5.00	3.5642	.91802
Comp_ER_18	358	1.00	5.00	3.8715	.80743
Comp_ER_19	358	1.00	5.00	3.6592	.77970
Comp_ER_20	358	1.00	5.00	3.7598	1.00188
Comp_ER_21	358	1.00	5.00	3.6145	1.06634
Comp_ER_22	358	1.00	5.00	3.5922	1.08418
Comp_ER_23	358	1.00	5.00	3.7207	1.07587
Comp_ER_24	358	1.00	5.00	3.3240	.96921
Comp_ER_25	358	1.00	5.00	3.3296	1.14547
Benefit_ER_1	358	1.00	5.00	3.4246	1.12112
Benefit_ER_2	358	1.00	5.00	3.3184	1.10882
Benefit_ER_3	358	1.00	5.00	3.1285	1.08629
Benefit_ER_4	358	1.00	5.00	3.1508	1.20609
Suggestion_ER_1	358	1.00	5.00	3.4637	1.07189
Suggestion_ER_2	358	1.00	5.00	3.3128	1.11295
Suggestion_ER_3	358	1.00	5.00	3.2458	1.34746
Suggestion_ER_4	358	1.00	5.00	3.3017	1.18442
Suggestion_ER_5	358	1.00	5.00	3.5251	1.20074
Suggestion_ER_6	358	1.00	5.00	3.3408	1.18562
Suggestion_ER_7	358	1.00	5.00	3.1117	1.20338
Suggestion_ER_8	358	1.00	5.00	3.5251	.94404
Valid N (listwise)	358				

TABLE-10: Multiple regression analysis Result (N=179)

Variables	Variable name	Adj. R2	Beta	ANOVA	Sig.
Importance	Co_ER_4	0.627	0.434	32.853	0.000
	Co_ER_21		0.350		
	Co_ER_2		0.293		
	Co_ER_5		0.290		
	Co_ER_24		0.121		
	Co_ER_17		-0.196		
	Co_ER_8		-0.174		
	Co_ER_20		-0.143		
	Co_ER_9		0.158		
Benefit	Ben_ER_1	0.171	0.315	18.025	0.000
	Ben_ER_4		0.240		
Suggestion	Sugg_ER_3	0.118	0.153	11.749	0.000
	Sugg_ER_1		0.159		

The final regression model with nine independent variables- environment policy, standards and guidelines of environment, companies environment management system, investment for conserving environment, total cost of conserving environment, reduce, recycle, reuse, volatile organic compound, carbon monoxide, environmental noise protection explains almost 62.7% of the variance of importance about companies practice/working. The nine regression coefficients, along with the constraints, are statistically significant at the 0.05 level. Multi-co linearity has a significant impact across the nine variables. The ANOVA test evaluates the good fit using the F ratio. The aggregate sum of squares (303.207) represents the error that would occur if the mean of company practices/work were used to predict the dependent variable (importance). These variables environment Policy, standards and guidelines of environment, companies environment management system, investment for conserving environment, total cost of conserving environment, reduce, recycle, reuse, Volatile organic compound, carbon monoxide, environmental noise protection, reduces the errors by (192.933/303.207) 63.63%, which is statistically significant, F ratio is 32.853 and a significance level of 0.000. The analysis concluded that company green accounting practices and working conditions, as represented by theses nine variables such as environment policy, standards and guidelines of environment, companies environment management system, investment for conserving environment, total cost of conserving environment, reduce, recycle, reuse, Volatile organic compound, carbon monoxide, environmental noise protection, and these variables influencing their environmental disclosure practices.

The aggregate sum of squares (303.207) represents the squared error that would occur if the mean of company practices/work were used to predict the dependent variable.

By including these variables environment policy, standards and guidelines of environment, companies environment management system, investment for conserving environment, total cost of conserving environment, reduce, recycle, reuse, volatile organic compound, carbon monoxide, environmental noise protection, these errors are reduced by 63.63% (192.933/303.207), which is statistically significant with an F ratio of 32.853 and a significance level of 0.000. Based on this analysis, it is concluded that the variables environment Policy, standards and guidelines of environment, companies environment management system, investment for conserving environment, total cost of conserving environment, reduce, recycle, reuse, Volatile organic compound, carbon monoxide, environmental noise protection shows company green accounting and reporting practices and working conditions influence their environmental disclosure.

The regression model analyzes the benefits of environmental reporting with two independent variables and these two variables i.e. resolve uncertainty immediately and identifying the cost of environmental activity explains almost 17.1% of the variance of importance pertaining to the green accounting and reporting practices and corporate sustainability. The two regression coefficients and constraints are statistically significant at the 0.05 level.

The ANOVA analysis tests conducted which provides the overall model fit in terms of the F ratio. The model is statistically significant with an F ratio of 18.025 and significance at level of 0.000. With the above analysis, it can be concluded that two variables, i.e., benefit_1 and benefit_4 resolve uncertainty immediately and identifying the cost of environmental activity, explain the benefits of the green accounting and reporting practices and corporate sustainability which influence their environmental disclosure practices.

The final regression model for the suggestion with 2 independent variables (Sugg_ER_3 and Sugg_ER_1) explains almost 11.8% of the variance of the importance of a company's practice/working. The 2 regression coefficients, plus the constraints, are significant at 0.05 levels. The ANOVA analysis provides the statistical test for overall model fit in terms of the F ratio. The regression model shows statistical significance with an F ratio of 11.749 and a significance level of 0.000. With the above analysis, it is concluded that two variables, specifically Sugg_ER_3 and Sugg_ER_1 (required for long term sustainability and sustainable future, compare environment cost and benefits), elucidate the suggestions regarding company practices and working conditions affect their environmental disclosure.

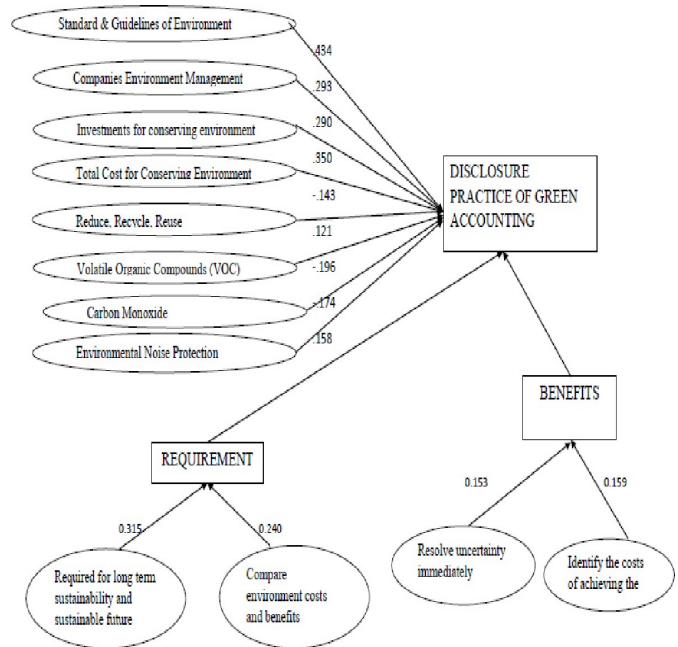The **regression model** with the help of the above variables is presented with their components as under:

Figure-2: Disclosure Practice of Green Accounting Model

It is clear from the data analyzed above that the company cannot be converted into a green company till it has standards & guidelines of the environment, companies environment management, investments for conserving the environment, total cost for conserving the environment, reduce, recycle, reuse, volatile organic compounds (voc), carbon monoxide control, and environmental noise protection equipment. Since it will provide the benefits of resolving uncertainty and the company simultaneously identifies the cost of achieving the goal for its long-term sustainability and sustainable future, it must compare environmental costs and benefits that can be reflected in its green accounting reporting.

3. CONCLUSIONS & IMPLICATIONS:

Referring to the discussion brought up by Gray Rob (1992) and Odintosva Tatyana (2024), there is the challenge of green accounting for accountability, transparency, reliability, and sustainability. Sustainability opens a wide concept for practical implementation regarding management information for decision making, environmental social governance, environmental reporting, sustainability reporting, etc. Green Accounting and Reporting Practices have much importance for the environment, social governance, cash flow of environmental activities, corporate sustainability, and management information. Based on the above analyses, it is evident that green accounting and reporting practices are not only desirable but also feasible, realistic, and practically useful for management information. Moreover, there is a noticeable lack of focused sustainability analysis and information provided to policymakers. This absence means that public debate, government planning, budget allocation, and the measurement of economic

outcomes often occur without a sustainability framework. India's high GDP growth is typically accompanied by investments in physical infrastructure, which exert increasing pressure on the country's environment and natural resources. The study underscores the necessity for a Green Accounting framework tailored to Indian companies (Gundimeda et al., 2005).

Furthermore, research has been conducted to identify the disclosure practices of green accounting and reporting and the implementation of the green accounting and reporting model. The Green Accounting & Reporting model has been created for accountability, recording, and transparency. Environmental reporting provides decision support for strategic decision-making to top-level managers. Accounting is one of the tools for communication, so the green accounting and reporting model improves the stakeholder's (investors, lenders, regulators, and the public) and shareholders' communication. Implementation of green accounting and reporting models improves corporate sustainability.

REFERENCES

[1.] Alfonso Aranda-Usón, Sabina Scarpellini, José M. Moneva, Dynamic capabilities for a "circular accounting" and material flows in a circular economy, Resources, Conservation and Recycling, Volume 209, 2024, 107756, ISSN 0921-3449,

[2.] Odintosva Tatyana,(2024) Updating the Informational and Control Practices in the Sustainability Agenda, Volume 21, Issue 1, Pages: 133-148, 1 June 2024, ISSN 22557563

[3.] Morri, G., Yang, F., & Colantoni, F. (2024). Green investments, green returns: exploring the link between ESG factors and financial performance in real estate. *Journal of Property Investment & Finance*.

[4.] Maughan, R. (2023). Adopting and adapting sustainability accounting: fit and faith in a family business. *Accounting, Auditing & Accountability Journal*, *36*(9), 1-31.

[5.] Atkins, J. F., Doni, F., McBride, K., & Napier, C. (2023). Exploring the historical roots of environmental and ecological accounting from the dawn of human consciousness. Accounting, Auditing & Accountability Journal, (ahead-of-print).

[6.] Han, H. H., Lee, J., & Wang, B. (2023). Greenhouse gas emissions, firm value, and the investor base: Evidence from Korea. *Emerging Markets Review*, *56*, 101048.

[7.] Gray, R. (1992). Accounting and environmentalism: an exploration of the challenge of gently accounting for accountability, transparency and sustainability. *Accounting, organizations and society*, *17*(5), 399-425.

[8.] AZZONE∗, G., & Noci, G. (1996). Measuring the environmental performance of new products: an integrated approach. International Journal of Production Research, 34(11), 3055-3078.

[9.] Cairns, R. D. (2006). On accounting for sustainable development and accounting for the environment. Resources Policy, 31(4), 211-216.

[10.] Jahamani, Y. F. (2003). Green accounting in developing countries: the case of UAE and Jordan. *Managerial Finance*, *29*(8), 37-45.

[11.] Gonzalez, C. C., & Peña-Vinces, J. (2023). A framework for a green accounting system-exploratory study in a developing country context, Colombia. *Environment, Development and Sustainability*, *25*(9), 9517-9541.

TRACK 4: PRODUCTION AND OPERATIONS MANAGEMENT

Environmental Sustainable Practices Among 'Thattukadas'

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ABSTRACT

Environmental sustainability is getting prominence among business and academics. In the hospitality sector, change in food habits and search for low cost food led to the mushrooming of street side food vending shops called 'thattukadas' which are generally in a temporary structure or in wheels. Dearth of information regarding the environmental sustainability practices in thattukadas led to the requirement of research to identify the environmentally sustainable practices adopted by them. This study focus on theareas like food packaging, managing food and nonfood waste, serving healthy menu, using energy efficient equipment's, usage of eco-friendly products, fuel used and water usage Research in this area will help in familiarizing the current environmental sustainable practices adopted by them and will pave light to the policy makers to design policies that will reduce the negative impact of these businesses upon the environment.

Keywords: thattukada, environmental sustainability, waste management, waterusage.

1. INTRODUCTION

Cultural interactions, fast living and increase in the number of women employees' change the food consumption habit as lack of time to cook food at home especially when both husband and wife are working evolves a new life style of dining out. This changed life style has led to the mushrooming of street food outlets which prepare and sold food at places like busy streets, near train stations, bus terminals, entertainment and festival areas where people are crowded (Sezgin,et al 2016). Street food can be defined as food prepared on the streets and ready-to-eat, or prepared at home and consumed on the streets without further preparation (Muzaffar et al., 2009). Due to their low cost and convenience for both sellers and buyers, street foods are undeniably popular (Liu, Z et al., 2014). Thus these food and drinks sold on the streets has become an integral part of a country's cuisine and are important for the local eating habits all around the world (Sezgin,et al 2016). Street foods, especially in developing countries has evolved into a large andcomplex food sector that provides both an important means of income to the vendors and an affordable source of food to millions of people around the world including the urban poor (Ohiokpehai, 2003).

The fact that our day-to-day activities have an impact on the environment and the depletion of natural resources has made the world to seriously deal with the environmental impacts of the business. The concern for environment and government regulations has made business organizations to practice sustainable operations by formulating green policies. Big organizations have the expertise, policies and strategies to address these and proclaims to the external world as one of their unique features. The environmental impact of micro enterprises is a matter to be seriously addressed as the impact created by one such unit may be negligible, but the collective impact will be a matter of serious concern. It should be noted that street food vending activities in most developing countries are mostly outside the regulation and protection of the governments (Alimi, 2016). International bodies are urging businesses to formulate environment-friendly strategies focusing on environment protection and preservation as people are becoming more and more environment-conscious day by day.

2. OBJECTIVE

This paper explores the business practices of thattukadas and assesses its environmental Impact by focusing on food packaging, managing food and nonfood waste, serving healthy menu, using energy efficient equipment's, usage of eco- friendly products, fuel used and water usage. This will pave light to the policies and practices followed by them and will in turn help the policy makers and authorities to develop, design or redesign policies and strategies that will help the thattukadas to operate in an environment friendly manner.

3. THATTUKADA

Thattukada means road side food vending in temporary structures like Sheds, handcarts or motor carts (Report on Survey on Thattukada in Kerala, 2015). There are 11,033 thattukadas across the state of Kerala, out of which 809 thattukadas (7.33%) are in the Ernakulam district (Report on Survey on Thattukada in Kerala, 2015). It should be noted that 160 thattukadas in Ernakulam distict have food safety certification, 192 have license from local bodies and 121 have both. (Report on Survey on Thattukada in Kerala, 2015).

4. SIGNIFICANCE OF THATTUKADAS

Sustainability has become an inseparable part of business and it has evolved to the level of how firms are doing the

business. Awareness and willingness alone will not make a micro level enterprise sustainable, it requires assess to facilities and assistance from authorities. Since thattukadas are normally managed by the proprietor himself who also works as a labor along with his/her family members assisting as unpaid workers, awareness, willingness and external support should collectively work together for making these firms environmentally sustainable. The level of awareness and the practices adopted depends solely on the entrepreneur himself. The proprietor can bring considerable changes in the way he or she is doing the business by incorporating environmental sustainable practices into the operational level of thattukadas which can in turn evolve as a culture.

5. BUSINESS PRACTICES IN THATTUKADA

The researcher has taken 20 thattukadas in Ernakulam district to study the business practices followed by them in the context of environmental sustainability focusing on food packaging, managing food and nonfood waste, serving healthy menu, using energy efficient equipments, usage of eco-friendly products, fuel used and water usage.

6. FOOD PACKAGING

Ernakulam has lot of restaurants associated with hotels and located independently which sells food at a premium price. While, thattukada serve food at a lower cost compared with restaurant and is usually considered as an alternative to home- cooked food *(Hajela, Soumya., 2017)*. People dine at thattukada and purchase parcel from there. The way in which the food is packaged is important as it maintains food quality and freshness during distribution and storage. Traditionally used materials for food packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free steel), paper and paperboards, and plastics *(Hajela, Soumya., 2017)*. The ideal food packaging is to contain food in a cost-effectiveway that satisfies industry requirements and consumer desires, maintains food safety, and minimizes environmental impact *(Hajela, Soumya., 2017)*.

Environmentally sustainable food packaging should be made by using biodegradable, recyclable and reusable materials. Biodegradable food packaging materials are made from plants or plant based materials for single use and will disintegrate in a few days. Recyclable packaging is also for single use. After usage it can be sold to a scrap merchant or recycling center where it is used as a raw material for making other products. Reusable packaging materials can be used again and again for packaging as it is durable which is usually made of glass, wood, aluminum, bamboo, or plastic.

For food packing inner cover

Material Used	No. of thattukadas
Plastic covers and Plastic thin sheets	11
Newspaper and plastic covers	2

Aluminum foil covers and containers	3
Thick paper cover coated with silver color, Disposable silvercontainers, Silver covers	4
Total	20

For outer cover

Material Used	No. of thattukadas
Plastic carry bags	14
Newspaper	2
Brown paper cover	4
Total	20

It was found that one thattukada encourage customers to bring their own food or drink containers by offering small discounts for people who bring their own. Generally they pack the food with an inner cover like packing sambar, dosa and chutney in separate covers and an outer cover which is used for carrying all these together.

Managing food and nonfood waste

There are over 1,000 hotels and eateries in the Kochi Corporation which produces over 8,000kg of garbage every day (https://www.newindianexpress.com).Waste from the 'thattukadas' and hotels are a night mare to the local governing bodies to the extent that while hearing a case related to flooding of the city, Kerala High Court directed the Kochi Corporation to take stringent and legally tenable action against hotels and 'thattukadas' that dumped waste into storm water drains (https://www.thehindu.com). It was found that all thattukadas have waste bin or garbage bags arranged for putting the waste, among them two persons have made separate arrangement for putting food and nonfood waste. Thattukadas use trash receptacles like plastic cans in which the top portion is removed, polythene bags, sacks, plastic buckets, metal drums etc. for garbage disposal which are kept near the cooking area / dining area / hand washing area.

Used plates, glasses and other vessels are kept in heaps near the washing areas and even near the place where food is stored and displayed for consumption. Food waste is kept in open bins. Thattukadas does not cover trash receptacles thus attracting flies and others insects creating the possibility of contamination of cooked foods. Water which contains food residues after washing plates and utensils are disposed into the nearest public drainage openings mostly near to the vending premise itself. Food wastes are even thrown into vacant plots nearby.

Three thattukadas provide their food waste to biogas units, one to pig farms and one person has a composting barrel where he dumps all the food waste. Four persons dispose the nonfood waste at their home premises by burying or burning.

Remaining thattukadas after the business, ties both the food and nonfood waste in garbage bags and dispose at the nearest garbage picking point for the local bodies to remove the waste from the street side. It was noticed that three thattukadas donate their surplus food to needy person's usually taking shelter on the footpath, road median, shop front etc. before closing. One person monitor the expiry date of perishable items and use them first using the FIFO (first-in, first-out)method for reducing the wastage of unused food raw materials.

Serving healthy menu

Most of the thattukada persons do not wear gloves, hairnets or aprons. Lot of flies is present in the area especially on the prepared food which is kept open without any covers; this may be due to keeping the food waste left open. The food was served by bare hand and in some places customers also use their bare hands to take food. Drinking water is also kept in pots, steel vessels and buckets with a cover, but they dip plastic jugs into it for refilling the drinking water. Consumers eat food by sitting in the open air, shelter made with tarpaulins, used flex or banners. The waysand manners street foods are being prepared, handled and vended predispose them to recontamination, cross contamination and transmission of pathogens and food borne illnesses (Alimi, 2016).

Majority of street vendors use non-disposable plates, cups and cutleries for serving foods (Muyanja et al, 2011) which are usually washed with washing solution and rinsed in water, such that the same washing solutions and water are used throughout the day without changing. Used plates and glasses are washed in water kept like this and these vessels and buckets contain water that has become dirtier with repeated use.

The environment under which street foods are being prepared, vended and consumed are exposed to dust, emissions from vehicles moving through the road, openings in the public drainage system on the road side, waste accumulated on the road side, unpleasant smell, insects and rats. Most of the street food vendors lack refrigeration facility to stock fish, meat, milk and vegetables. They keep it unrefrigerated for a long period of time during their business. They reheat the food and do not properly wash vegetables. Thattukadas in order to reduce the cost and make street foods affordable use cheap and unsafe ingredients that may be detrimental to the health of the consumers (Alimi, 2016).

Three thattukadas claimed that they use organic or natural produce raw materials for preparing food, five persons claim that they avoid coloring agents, taste enhancers etc. One person makes food using ingredients based on the seasons. All of them include more whole foods and less processed foods in their menu.

Processed foods that they serve are limited to soft drinks, sausages, packaged snacks, cheese, bread, milk etc. One person is found to use canned instant soup. Two persons claimed that they avoid re-usage of the cooked oil. Eight persons source milk directly, among that one person purposefully reduces the use of sugar to prepare the menu.

Using energy efficient equipments

12 thattukadas use LEDs for energy efficient lighting and one person uses an energyefficient commercial gas burner and dosa plate.

Usage of eco-friendly products

For the consumers thattukadas mainly provide plastic chairs and tables. It was noticed that five thattukadas uses steel plates, while three thattukadas uses degradable paper plates, two people uses silver color paper plate and one person green cardboard plate to serve food. One person uses recycled degradable organic plate and eco-friendly cleaning products to wash utensils. Others uses plastic plates. About 4 thatuukadas uses plastic spoons.

Fuel used

LPG is used by sixteen thattukadas, Firewood by one and Kerosene by threepersons as fuel to cook food.

Water usage

Most of the thattukadas capture rainwater and use the same during rainy season for washing purposes. For cooking purpose they are using clean water taken from the tap or buy packaged drinking water. Since public water taps are not present in city, they have to bring tap water from their home or purchase the same. Association of cost on water makes thattukadas to use the same water for washing many times.

Toilets are not present in thattukadas. For washing the hands of the customers running water facility is not available in 15 thattukadas as they keep water in buckets or big aluminum or steel bowls with a mug in it. Five thattukadas have a plastic barrel filled with water placed on a stand and a steel wash basin for the customers to wash their hands. Two thattukadas only bring drinking water to customers who specifically request for it.

7. CONCLUSION

This study was undertaken to empirically evaluate the environmentally sustainable practices of 'thattukadas'. focusing on food packaging, managing food and non food waste, serving healthy menu, using energy efficient equipments, usage of eco-friendly products, fuel used and water usage. To achieve the objectives of the study, observation and semi structured interview were administered to twenty respondents in the area of study and it was found that there are environmentally sustainable practices adopted by them that will have a positive impact on the environment

like one thattukada encourage customers to bring their own food or drink containers by offering small discounts for people who bring their own. All thattukadas have waste bin or garbage bags arranged for putting the waste, three thattukadas provide their food waste to biogas units, one to pig farms and one person has a composting barrel where he dumps all the food waste. It was noticed that three thattukadas donate their surplus food to needy person's usually taking shelter on the footpath, road median, shop front etc. before closing. One person monitors the expiry date of perishable items and uses them first using the FIFO (first-in, first- out) method for reducing the wastage of unused food raw materials. Three thattukadas claimed that they use organic or natural produce raw materials for preparing food, five persons claim that they avoid coloring agents, taste enhancers etc. One person makes food using ingredients based on the seasons. All of them include more whole foods and less processed foods in their menu. Processed foods that they serve are limited to soft drinks, sausages, packaged snacks, cheese, bread, milk etc. Two persons claimed that they avoid reusing the cooked oil. Eight persons source milk directly, among that one person purposefully reduces the use of sugar to prepare the menu.

12 thattukadas use LEDs for energy efficient lighting and one person uses an energy efficient commercial gas burner and dosa plate. Five thattukadas uses steel plates, while three thattukadas uses degradable paper plates, two people uses silver color paper plate and one person green cardboard plate to serve food. One person uses recycled degradable organic plate and eco- friendly cleaning products to wash utensils. Most of the thattukadas capture rainwater and use the same during rainy season for washing purposes. Two thattukadas only bring drinking water to customers who specifically request for it.

In order to make the activities of street food vendors positive to the environment, government and NGOs should establish proper training and awareness programs toaddress certain points like avoiding plastic thin sheets for packing hot food, encourage the usage of biodegradable food packaging materials, collecting and using the food waste from thattukadas in biogas units or composite units, train them to remove food residues from the water before disposing it into public drainage system, reducing reusage of cooking oil,

wearing gloves, hairnets or aprons, keeping the prepared food in closed containers, using cost effective refrigeration system to stock fish, meat, milk and vegetables, avoiding reheating the food, properly washing vegetables, using solar lighting systems, using eco- friendly cleaning products to wash utensils and arranging running water facilities for washing hands etc. Special local monitoring team should be set up to monitor the performance of thattukadas and provide orientation to sensitize them on environmentally sustainable standard hygienic practices.

REFERENCE

[1.] Alimi, B. A. (2016). Risk factors in street food practices in developing countries: A review. Food science and human wellness, 5(3), 141-148.

[2.] Hajela, Soumya. (2017) "Comparative study on effectiveness of nutrition counseling for eco- friendly packaging of street foods in rural and urban areas in lucknow city, india." International Journal of Applied and Pure Science and Agriculture (IJAPSA) Volume 03, Issue 7,p81.

[3.] https://www.thehindu.com/news/cities/Kochi/flooding-of-city-high-court-warns- of-action- against-kochi-corporations-assistant-engineers/article66912614.ece https://www.newindianexpress.com/cities/kochi/2023/Mar/11/eateri es-to-appoint- privateagency- to-handle-garbage-in-kochi-2554920.html

[4.] Liu, Z., Zhang, G., and Zhang, X. (2014). Urban street foods in Shijiazhuang city, China: Current status, safety practices and risk mitigating strategies. Food Control, 41, 212-218.

[5.] Muyanja, C., Nayiga, L., Brenda, N., and Nasinyama, G. (2011). Practices, knowledge and risk factors of street food vendors in Uganda. Food control, 22(10), 1551-1558. Muzaffar, A. T., Huq, I., & Mallik, B. A. (2009). Entrepreneurs of the streets: An analytical work on the street food vendors of Dhaka City. International journal of Business and Management, 4(2), 80-88.

[6.] Ohiokpehai, O. (2003). Nutritional aspects of street foods in Botswana. Pakistan Journal of Nutrition, 2(2), 76-81.

[7.] Report on Survey on Thattukada in Kerala (2015) available at https://www. ecostat.kerala.gov.in/storage/publications/357.pdf

[8.] Sezgin, A. C., and Şanlıer, N. (2016). Street food consumption in terms of the foodsafety and health. Journal of Human Sciences, 13(3), 4072-4083.

[9.] Yakubu, M., Gaa, P. K., Kalog, G. L. S., and Mogre, V. (2023). The competence of street food vendors to provide nutritious and safe food to consumers: a cross-sectional survey among street food vendors in Northern Ghana. Journal of Nutritional Science, 12, e83. doi:10.1017/jns.2023.65

Developing Unified Performance Metrics for Assessing Green-Lean Integration in Manufacturing Industries

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ABSTRACT

This paper develops a unified performance metrics framework to assess the integration of lean and green manufacturing practices, focusing on economic, environmental, and social dimensions. The framework identifies Key Performance Parameters (KPPs) that align these practices and employs a Multi-Criteria Decision-Making (MCDM) approach to indicators, Unified metrics. prioritize them. Through a hypothetical case study in the automotive sector, the paper demonstrates the application of the framework and its potential to enhance operational efficiency and sustainability. The findings underscore the importance of combining lean and green metrics for comprehensive performance evaluation and suggest directions for future research, including empirical validation and industry-specific adaptations.

Keywords: Green manufacturing, Lean manufacturing, Sustainability, Key performance

1. INTRODUCTION

In recent years, the integration of sustainability and operational efficiency has become a cornerstone of manufacturing strategies worldwide. The combined adoption of lean and green practices offers a unique opportunity to balance environmental stewardship with economic competitiveness (Singh et al., 2020). Lean manufacturing emphasizes waste reduction and resource efficiency, while green manufacturing focuses on minimizing environmental impact (Domingo & Aguado, 2015). Despite their complementary objectives, existing performance measurement systems often evaluate these approaches in isolation, leading to fragmented assessments that fail to capture their synergistic potential (Siegel et al., 2019).

To address this gap, this paper proposes a unified performance metrics framework designed to holistically evaluate lean-green integration. By aligning Key Performance Parameters (KPPs) across the triple bottom line—economic, environmental, and social dimensions—this framework aims to provide a comprehensive tool for assessing and optimizing manufacturing practices.

Notably, the framework incorporates innovative metrics such as the Overall Environmental Equipment Effectiveness (OEEE) (Domingo & Aguado, 2015) and addresses critical failure factors (CFFs) that hinder effective lean implementation (Kumar et al., 2024).

This research highlights the importance of unified metrics in enabling manufacturers to make informed decisions, drive continuous improvement, and achieve sustainability goals. Through a structured methodology and a practical example, the study demonstrates how the framework can be applied to a hypothetical manufacturing scenario, illustrating its relevance and adaptability to diverse industrial contexts.

2. LITERATURE REVIEW

Lean and green manufacturing practices have emerged as critical strategies for addressing the dual challenges of operational efficiency and sustainability in the industrial sector. Lean manufacturing prioritizes waste reduction, resource efficiency, and streamlined processes, while green manufacturing focuses on minimizing environmental impact and promoting social responsibility. While these approaches share complementary goals, their integration necessitates robust frameworks and metrics capable of capturing their combined impact across economic, environmental, and social dimensions. Existing research highlights significant progress in this area, yet critical gaps remain, particularly in the standardization and application of unified metrics.

Lean and Green: Complementary Approaches

Singh et al. (2019) explored the foundational principles of lean and green manufacturing, emphasizing their shared focus on waste elimination and resource optimization. Lean manufacturing, originating from the Toyota Production System, utilizes tools such as Just-in-Time (JIT), 5S, and continuous improvement to enhance operational efficiency. In contrast, green manufacturing seeks to address environmental and social challenges through practices such as eco-design, life cycle assessment, and waste minimization. The study identified key performance parameters (KPPs) that align with both approaches, such as material efficiency, energy usage, and waste reduction, while highlighting challenges in reconciling lean's operational focus with green's broader sustainability objectives.

Bottani et al. (2020) advanced this integration by developing a Lean, Agile, Resilient, and Green (LARG) framework tailored to the food supply chain. Their model incorporated 13 key performance indicators (KPIs) spanning lean, agile, resilient, and green dimensions, addressing metrics such as

operation throughput time (OTT), inventory turnover, energy consumption, and waste reduction. While the framework offered a balanced evaluation of supply chain performance, it also revealed significant gaps in its environmental and social metrics, underscoring the need for a more comprehensive approach.

Development of New Metrics

A major challenge in integrating lean and green practices lies in the development of metrics that adequately capture their combined impact. Braglia et al. (2021) introduced the Overall Emissions Effectiveness (OEmE), a metric designed to assess greenhouse gas (GHG) emissions associated with industrial losses. OEmE expanded the traditional Overall Equipment Effectiveness (OEE) by incorporating environmental dimensions such as emission scopes (direct, indirect, and supply chain-related) and categorizing losses into manageable and unmanageable types. While this metric provided valuable insights into emissions-related inefficiencies, its narrow focus on GHG emissions limited its applicability to broader sustainability concerns.

Building on this work, Domingo and Aguado (2021) proposed the Overall Environmental Equipment Effectiveness (OEEE), which integrates environmental impact directly into OEE calculations. By combining availability, performance, quality, and sustainability factors, OEEE offers a unified metric for assessing lean-green integration. Their action research in a tube fabrication company demonstrated the metric's practical utility, showing reductions in environmental impact, improved process efficiency, and cost savings. However, the study acknowledged the need for further validation across diverse industries and highlighted the limitations of using milli points as a sustainability measure

Implementation Challenges and Critical Failure Factors

The successful implementation of green-lean practices faces significant challenges, particularly in resource-constrained environments such as small and medium enterprises (SMEs). Siegel et al. (2022) identified cultural resistance, lack of management commitment, and inadequate measurement tools as primary barriers to adoption. Their analysis emphasized the underrepresentation of social dimensions, such as employee well-being and community engagement, in existing frameworks. Furthermore, they noted the absence of standardized metrics for evaluating the long-term impact of green-lean practices, particularly in SMEs, where resource constraints often limit the scope of sustainability initiatives.

Kumar et al. (2022) examined critical failure factors (CFFs) in implementing sustainable Lean Six Sigma (LSS) practices in Indian manufacturing industries. Using the Best Worst Method (BWM) to rank CFFs, they identified leadership failures, high implementation costs, and resistance to cultural change as the most significant barriers. Their study highlighted the need for robust frameworks that align

sustainability goals with operational objectives and addressed the importance of leadership in fostering a culture of continuous improvement and innovation.

Integration of the Triple Bottom Line

Huang and Badurdeen (2022) proposed a hierarchical index system for evaluating sustainable manufacturing performance, incorporating the Triple Bottom Line (TBL) and the 6R principles (Reduce, Reuse, Recycle, Recover, Redesign, Remanufacture). Their framework aggregated metrics into indices for production lines and plants, providing a structured approach to sustainability assessment. While the system offered valuable insights into operational and environmental improvements, its reliance on static benchmarks and subjective weighting methods limited its adaptability to dynamic industrial contexts.

The integration of social sustainability into green-lean practices remains underexplored in the literature. Most existing studies focus predominantly on environmental and economic dimensions, overlooking critical aspects such as worker safety, community impact, and stakeholder engagement. Siegel et al. (2022) emphasized the importance of incorporating social metrics into green-lean frameworks, arguing that a holistic approach is essential for achieving meaningful and sustainable outcomes.

Research Gaps and Future Directions

Despite the advancements in green-lean integration, significant gaps persist. Many existing frameworks and metrics remain sector-specific, limiting their generalizability across diverse industrial contexts. Moreover, the reliance on theoretical models without practical validation hinders the applicability of these tools in real-world settings. There is a pressing need for unified metrics that address all three dimensions of sustainability— economic, environmental, and social—while providing actionable insights for manufacturers. This research aims to bridge these gaps by proposing a unified performance metrics framework that integrates and prioritizes KPPs across the triple bottom line. By addressing the limitations of existing metrics and incorporating innovative tools such as OEEE and OEmE, this study seeks to provide a practical and adaptable solution for assessing green-lean practices in manufacturing industries.

3. METHODOLOGY

This study adopts a secondary research methodology, leveraging existing academic literature, industry reports, and case studies to develop a unified performance metrics framework for green-lean manufacturing. The methodology comprises the following key steps:

1. Identification of Key Performance Parameters (KPPs)

The research begins by identifying and categorizing KPPs relevant to green-lean practices. Sources include:

Peer-reviewed journals on lean and green manufacturing. Industry case studies showcasing sustainability metrics.

Metrics frameworks proposed in previous studies, such as the Overall Equipment Effectiveness (OEE), Overall Environmental Equipment Effectiveness (OEEE), and Overall Emissions Effectiveness (OEmE).

The identified KPPs are grouped into three dimensions:

Economic: Metrics related to cost efficiency, productivity, and operational performance. Environmental: Metrics addressing resource usage, emissions, and waste management. Social: Metrics focusing on employee well-being, community impact, and stakeholder engagement.

2. Data Synthesis and Redundancy Elimination

The extracted KPPs are analyzed to eliminate redundancy and identify unique parameters. This step ensures a streamlined and comprehensive set of metrics by:

Comparing overlapping metrics across studies.

Retaining innovative and unique parameters like OEEE and CFFs. Aligning metrics with the triple bottom line to maintain holistic coverage.

3. Application of Multi-Criteria Decision-Making (MCDM)

To prioritize the KPPs, a Weighted Scoring Model is employed:

Criteria Weights: Environmental impact (40%), economic performance (30%), and social impact (30%).

Scoring: Each KPP is evaluated based on its relevance and contribution to the criteria. Ranking: The weighted scores are used to rank the KPPs, forming the foundation for the unified metrics framework.

4. Framework Development

The prioritized KPPs are integrated into a unified performance metrics framework. This framework:

Combines metrics across the economic, environmental, and social dimensions. Incorporates tools like dashboards for visualization and monitoring.

4. ANALYSIS

Python Code for Prioritizing Key Performance Parameters (KPPs) Using MCDM in Green-Lean Manufacturing Framework

```
import pandas as pd
# Data representing Key Performance Parameters (KPPs)
extracted from the list of KPPs, filtered and categorized
kpp_data = [
# Environmental KPPs
```

```
{"KPP": "Carbon Footprint", "Environmental": 1,
"Social": 0, "Economic": 0},
{"KPP": "Energy Efficiency", "Environmental": 1,
"Social": 0, "Economic": 0},
{"KPP": "Waste-to-Production Ratio", "Environmental":
1, "Social": 0, "Economic": 0},
{"KPP": "Overall Environmental Equipment
Effectiveness (OEEE)", "Environmental": 1, "Social": 0,
"Economic": 0},
{"KPP": "Percentage of Renewable Energy Usage",
"Environmental": 1, "Social": 0, "Economic": 0},
# Social KPPs
{"KPP": "Employee Engagement Index",
"Environmental": 0, "Social": 1, "Economic": 0},
{"KPP": "Health & Safety Incidents", "Environmental":
0, "Social": 1, "Economic": 0},
{"KPP": "Community Impact Score", "Environmental":
0, "Social": 1, "Economic": 0},
{"KPP": "Training Hours per Employee",
"Environmental": 0, "Social": 1, "Economic": 0},
# Economic KPPs
{"KPP": "Cost per Unit", "Environmental": 0, "Social":
0, "Economic": 1},
{"KPP": "Inventory Turnover", "Environmental": 0,
"Social": 0, "Economic": 1},
{"KPP": "Productivity", "Environmental": 0, "Social": 0,
"Economic": 1},
{"KPP": "Maintenance Cost", "Environmental": 0,
"Social": 0, "Economic": 1},
# Cross-Dimensional KPPs (appearing in multiple
categories)
{"KPP": "Overall Equipment Effectiveness (OEE)",
"Environmental": 1, "Social": 0, "Economic": 1},
{"KPP": "Lead Time", "Environmental": 0, "Social": 0,
"Economic": 1},
{"KPP": "Material Use Efficiency", "Environmental": 1,
"Social": 0, "Economic": 1},
{"KPP": "Downtime", "Environmental": 0, "Social": 0,
"Economic": 1},
]
# Convert the data to a DataFrame for easier
manipulation and calculations kpp_df =
pd.DataFrame(kpp_data)
# Weights for the dimensions
weights = {"Environmental": 0.4, "Social": 0.3,
"Economic": 0.3}
```

TABLE 1: Prioritized list of Key Performance Parameters

	KPP	Environmental	Social	Economic	Score
0	Material Use Efficiency	1	0	1	0.7
1	Overall Equipment Effectiveness (OEE)	1	0	1	0.7
2	Carbon Footprint	1	0	0	0.4
3	Waste-to-Production Ratio	1	0	0	0.4
4	Overall Environmental Equipment Effectiveness (OEEE)	1	0	0	0.4
5	Percentage of Renewable Energy Usage	1	0	0	0.4
6	Energy Efficiency	1	0	0	0.4
7	Productivity	0	0	1	0.3
8	Lead Time	0	0	1	0.3
9	Maintenance Cost	0	0	1	0.3
10	Training Hours per Employee	0	1	0	0.3
11	Inventory Turnover	0	0	1	0.3
12	Cost per Unit	0	0	1	0.3
13	Community Impact Score	0	1	0	0.3
14	Health and Safety Incidents	0	1	0	0.3
15	Employee Engagement Index	0	1	0	0.3
16	Downtime	0	0	1	0.3

Final Prioritized Key Performance Parameters (KPPs)

Below is the ranked list of KPPs based on their **weighted scores**, categorized into the three dimensions (Environmental: 40%, Social: 30%, Economic: 30%). The prioritization reflects their overall contribution to the **unified framework**:

Top Prioritized KPPs (Score = 0.7)

- **Material Use Efficiency**: Combines environmental and economic benefits through optimized resource usage.

- **Overall Equipment Effectiveness (OEE)**: Measures operational efficiency while addressing environmental and economic goals.

High-Impact Environmental KPPs (Score = 0.4)

- **Carbon Footprint**: Focuses on reducing greenhouse gas emissions.

- **Waste-to-Production Ratio**: Aligns with waste minimization and environmental sustainability.

- **Overall Environmental Equipment Effectiveness (OEEE):** Extends OEE by integrating environmental metrics.

- **Percentage of Renewable Energy Usage**: Highlights the adoption of renewable energy sources.

- **Energy Efficiency**: Reduces energy consumption per unit of production.

Moderate-Impact Economic and Social KPPs (Score = 0.3)

- **Productivity**: Evaluates the output per unit of input.

- **Lead Time**: Measures the time taken for production processes, impacting efficiency.

- **Maintenance Cost**: Focuses on reducing operational expenses.

- **Training Hours per Employee**: Addresses workforce development and sustainability awareness.

- **Inventory Turnover**: Measures the efficiency of inventory management.

- **Cost per Unit**: Tracks manufacturing cost efficiency.

- **Community Impact Score**: Evaluates corporate social responsibility (CSR) efforts.

- **Health & Safety Incidents**: Ensures employee well-being and workplace safety.

- **Employee Engagement Index**: Reflects workforce involvement and satisfaction.

- **Downtime**: Captures production interruptions affecting economic performance.

Structured Framework

1. Environmental Dimension (40%)

- **Core Metrics**: Material Use Efficiency, Carbon Footprint, Energy Efficiency, Renewable Energy Usage, Waste-to-Production Ratio, OEEE.

- **Focus**: Sustainability performance, resource conservation, and waste reduction.

2. Social Dimension (30%)

- **Core Metrics**: Health & Safety Incidents, Training Hours per Employee, Employee Engagement Index, Community Impact Score.

- **Focus**: Workforce safety, engagement, and community impact.

3. Economic Dimension (30%)

- **Core Metrics**: OEE, Cost per Unit, Lead Time, Productivity, Maintenance Cost, Inventory Turnover.

- **Focus**: Operational efficiency, cost-effectiveness, and productivity.

Steps to Calculate an Overall Sustainability Score

1. Weight Each KPP by Its Dimension:

- Assign the weights to Environmental (40%), Social (30%), and Economic (30%) dimensions.

- Distribute these weights across the KPPs based on their contribution to the respective dimension.

2. Normalize KPP Scores:

- Normalize the scores of individual KPPs to a scale (e.g., 0 to 1) for consistency.

3. Calculate Dimension Scores:

- Aggregate the scores of all KPPs within each dimension, weighted by their relative importance.

4. Compute the Overall Score:

- Combine the dimension scores using the assigned weights (Environmental: 40%, Social: 30%, Economic: 30%).

5. Interpret the Results:

- The final score (on a scale of 0 to 1) will indicate how close the company is to its sustainability goals. A higher score means better alignment with the goals.

Hypothetical Case Study: Application of Unified Performance Metrics Framework

This hypothetical case study demonstrates the application of the proposed unified performance metrics framework in the **automotive manufacturing industry**. The goal is to evaluate the industry's sustainability performance using the prioritized Key Performance Parameters (KPPs), with insights derived from a calculated **overall sustainability score**.

Case Overview

- **Industry**: Automotive manufacturing.

- **Objective**: Assess sustainability performance and identify areas for improvement using the unified framework.

- **Context**: A mid-sized automotive plant producing 10,000 vehicles annually, having recently implemented lean and green practices.

Application of Metrics

The unified framework integrates the prioritized KPPs across the triple bottom line dimensions—economic, environmental, and social. The following table presents the evaluated metrics and their hypothetical results:

TABLE 2: Hypothetical Results of a Hypothetical Company

KPP	Dimension	Hypothetical Result	Insights
Material Use Efficiency	Environmental, Economic	85%	Optimized raw material usage; potential for further waste reduction.
Overall Equipment Effectiveness (OEE)	Environmental, Economic	78%	Highlights equipment inefficiencies; opportunities to improve uptime.
Carbon Footprint	Environmental	1.2 tons CO_2 per vehicle	Moderate emissions; renewable energy adoption could reduce this.
Waste-to-Production Ratio	Environmental	0.15 kg of waste per unit	Reflects effective waste management practices.
Energy Efficiency	Environmental	12 kWh per vehicle	Slightly above industry benchmarks; energy audits recommended.
Training Hours per Employee	Social	10 hours annually	Meets basic standards; focus needed on sustainability training.
Health & Safety Incidents	Social	2 minor incidents annually	Indicates a safe workplace; continuous monitoring required.

KPP	Dimension	Value	Notes
Community Impact Score	Social	80/100	Active local community engagement through CSR initiatives.
Cost per Unit	Economic	$20,000 per vehicle	In line with industry standards; lean practices can further reduce costs.
Lead Time	Economic	5 days	Efficient production scheduling and inventory management.

Findings from the Unified Framework

1. Environmental Dimension:

- Strong performance in **material efficiency** (85%) and **waste management** (0.15 kg per unit).

- Improvement needed in **energy efficiency** (12 kWh per vehicle) and **carbon footprint** (1.2 tons CO_2 per vehicle).

2. Social Dimension:

- Positive results in **community impact score** (80/100) and **health & safety** (only 2 minor incidents).

- Focus required on **sustainability training** for employees to improve engagement.

3. Economic Dimension:

- Efficient metrics like **cost per unit** ($20,000) and **lead time** (5 days).

- Equipment-related inefficiencies reflected in **OEE** (78%), needing improvement.

Overall Sustainability Score

The overall score aggregates the KPPs using the MCDM approach, with weights assigned to the dimensions—Environmental (40%), Social (30%), and Economic (30%). The calculations are as follows:

TABLE 3: Weightage Calculation as per Normalized Score

KPP	Score (Normalized)	Dimension	Weight (%)	Weighted Contribution
Material Use Efficiency	0.85	Environmental, Economic	10 (Env) + 10 (Econ)	0.085 + 0.085
Overall Equipment Effectiveness (OEE)	0.78	Environmental, Economic	10 (Env) + 10 (Econ)	0.078 + 0.078
Carbon Footprint	0.60	Environmental	8	0.048
Waste-to-Production Ratio	0.85	Environmental	8	0.068
Energy Efficiency	0.70	Environmental	8	0.056
Training Hours per Employee	0.67	Social	7.5	0.050
Health & Safety Incidents	0.90	Social	7.5	0.068
Community Impact Score	0.80	Social	7.5	0.060
Cost per Unit	0.75	Economic	10	0.075
Lead Time	0.80	Economic	10	0.080

Dimension Scores:

- **Environmental**: 0.085 + 0.078 + 0.048 + 0.068 + 0.056 = 0.335
- **Social**: 0.050 + 0.068 + 0.060 = 0.178
- **Economic**: 0.078 + 0.075 + 0.080 = 0.233

Overall Score:

Overall Score = (0.335*0.4) + (0.178*0.3) + (0.233*0.3) = 0.257

The **overall score (0.257)** indicates that the plant has achieved 25.7% of its sustainability potential, leaving substantial room for improvement, particularly in energy efficiency and sustainability training.

Insights from the Case Study:

1. Practical Utility:

The unified framework allows comprehensive assessment across environmental, social, and economic dimensions, helping managers identify performance gaps.

2. Targeted Improvement Areas:

- Environmental: Focus on reducing carbon footprint and improving energy efficiency.

- Social: Increase training hours per employee to strengthen sustainability awareness.

- Economic: Enhance OEE to optimize equipment usage.

3. Holistic Decision-Making:

- Integrating the triple bottom line provides balanced insights for aligning operational efficiency with sustainability goals.

5. LIMITATIONS

This study relies on secondary data, limiting real-world validation of the proposed framework. While designed for broad applicability, industry-specific nuances may require customization. Static benchmarks and a lack of real-time monitoring reduce the framework's adaptability to evolving sustainability standards. Social metrics, though included, could be expanded to address broader aspects such as cultural diversity and employee satisfaction. Lastly, the hypothetical case study uses assumed data, which may not fully capture real-world complexities.

6. CONCLUSION AND FUTURE RESEARCH AGENDA

7. CONCLUSION

This study addresses the critical need for a unified performance metrics framework to evaluate green-lean integration in manufacturing industries. By prioritizing Key Performance Parameters (KPPs) across the triple bottom line—economic, environmental, and social dimensions—the framework provides a holistic tool for assessing sustainability performance. The research emphasizes the significance of metrics such as Overall Equipment Effectiveness (OEE), Material Use Efficiency, and Overall Environmental Equipment Effectiveness (OEEE), demonstrating their relevance in achieving operational efficiency and environmental stewardship.

The hypothetical application of the framework in an automotive manufacturing context illustrates its practicality and adaptability, offering actionable insights for improving sustainability performance. The findings underscore the dominance of environmental metrics in green-lean integration while highlighting areas for further enhancement, particularly in energy efficiency, training programs, and equipment utilization.

Despite its contributions, the study acknowledges certain limitations, such as reliance on secondary data, the need for industry-specific customization, and the absence of real-time validation. These limitations pave the way for future research

aimed at strengthening the framework and broadening its applicability.

Future Research Agenda

1. **Empirical Validation**: Pilot studies across industries to test and refine the framework.

2. **Dynamic Benchmarking**: Integrate real-time monitoring systems to adapt to evolving standards.

3. **Industry-Specific Adaptations**: Tailor the framework for sector-specific challenges and regulations.

4. **Expanded Social Metrics**: Incorporate metrics for employee satisfaction and cultural diversity.

5. **Emerging Technologies**: Leverage IoT and AI for enhanced data collection and analysis.

6. **Cost-Benefit Analysis**: Quantify the economic feasibility of framework implementation.

8. DECLARATION

I, Dheeraj Zope, hereby confirm that the manuscript titled " Developing Unified Performance Metrics for Assessing Green-Lean Integration in Manufacturing Industries" authored by Dheeraj Zope, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspective Conference 2025 (IIM Sambalpur).

I declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] **Singh, C., Singh, D., & Khamba, J. S. (2020).** Understanding the key performance parameters of green lean performance in manufacturing industries. *Materials Today: Proceedings, 46(Part 7), 111-115.* https://doi.org/10.1016/j.matpr.2020.06.328

[2.] **Bottani, E., Bigliardi, B., & Rinaldi, M. (2022).** Development and proposal of a LARG (lean, agile, resilient, green) performance measurement system for a food supply chain. *IFAC-PapersOnLine, 55(10), 620–625.* https://doi.org/10.1016/j.ifacol.2022.10.074

[3.] **Kanan, M., Dilshad, A. R., Zahoor, S., Hussain, A., Habib, M. S., Mehmood, A., Abusaq, Z., Hamdan, A., & Asad, J. (2023).** An empirical study of the implementation of an integrated Ergo-Green-Lean framework: A case study. *Sustainability, 15(13), 10138.* https://doi.org/10.3390/su151310138

[4.] **Braglia, M., Di Paco, F., Gabbrielli, R., & Marrazzini, L. (2024).** A new set of lean indicators to assess greenhouse gas emissions related to industrial losses. *International Journal of*

Productivity and Performance Management, 73(11), 243–269. https://doi.org/10.1108/IJPPM-05-2023-0271

[5.] **Domingo, R., & Aguado, S. (2015).** Overall Environmental Equipment Effectiveness as a metric of a lean and green manufacturing system. *Sustainability, 7(7), 9031–9047.* https://doi.org/10.3390/su7079031

[6.] **Huang, A., & Badurdeen, F. (2018).** Metrics-based approach to evaluate sustainable manufacturing performance at the production line and plant levels. *Journal of Cleaner Production, 197, 1095–1107.* https://doi.org/10.1016/j.jclepro.2018.04.234

[7.] **Siegel, R., Antony, J., Garza-Reyes, J. A., Cherrafi, A., & Lameijer, B. (2019).** Integrated green lean approach and sustainability for SMEs: From literature review to a conceptual framework. *Journal of Cleaner Production, 240, 118205.* https://doi.org/10.1016/j.jclepro.2019.118205

[8.] **Afonso, H., Silva, R., & Oliveira, J. (2022).** Developing and prioritizing lean key performance indicators for plastering supply chains. *Production, 32(1), 001-017.* https://doi.org/10.1590/0103-6513.20220054

[9.] **Kumar, S., Kumar, R., Phanden, R. K., Kumar, A., Bala, J., Bharath Kumar, S., Giri, J., Sathish Rao, U., Agrawal, A., & Vishwanatha, H. M. (2024).** A study on critical failure factors for implementation of sustainable Lean Six Sigma from Indian manufacturing industries perspective using BWM technique. *Frontiers in Mechanical Engineering, 10, 1451568.* https://doi.org/10.3389/fmech.2024.1451568

[10.] **Zehra, K., Mirjat, N. H., Shakih, S. A., Harijan, K., Kumar, L., & El Haj Assad, M. (2024).** Optimizing auto manufacturing: A holistic approach integrating overall equipment effectiveness for enhanced efficiency and sustainability. *Sustainability, 16(7), 2973.* https://doi.org/10.3390/su16072973

[11.] **Sahu, A. K., Sharma, M., Raut, R. D., Sahu, A. K., Sahu, N. K., Antony, J., & Tortorella, G. L. (2023).** Decision-making framework for supplier selection using an integrated MCDM approach in a lean-agile-resilient-green environment: Evidence from the Indian automotive sector. *The TQM Journal, 35(4),* 964–1006. https://doi.org/10.1108/TQM-12-2021-0372

[12.] **Belhadi, A., Touriki, F. E., & El Fezazi, S. (2018).** Benefits of adopting lean production on green performance of SMEs: A case study. *Production Planning & Control, 29(11), 873–894.* https://doi.org/10.1080/09537287.2018.1490971

[13.] **Kanan, M., Dilshad, A., Zahoor, S., Hussain, A., Habib, M., Mehmood, A., Abusaq, Z., Hamdan, A., & Asad, J. (2023).** An Empirical Study of the Implementation of an Integrated Ergo-Green-Lean Framework: A Case Study. *Sustainability.* https://doi.org/10.3390/su151310138.

[14.] **Cherrafi, A., Garza-Reyes, J., Belhadi, A., Kamble, S., & Elbaz, J. (2021).** A readiness self-assessment model for implementing green lean initiatives. *Journal of Cleaner Production,* 309, 127401. https://doi.org/10.1016/J.JCLEPRO.2021.127401.

[15.] **Da Silva Barbosa Gama, M., & Bonamigo, A. (2023).** Sustainable lean manufacturing as long-term strategy: performance framework development and prioritization. *Journal of Strategy and Management.* https://doi.org/10.1108/jsma-05-2023-0104.

[16.] **Farias, L., Santos, L., Gohr, C., De Oliveira, L., & Da Silva Amorim, M. (2019).** Criteria and practices for lean and green performance assessment: Systematic review and conceptual framework. *Journal of Cleaner Production.* https://doi.org/10.1016/J.JCLEPRO.2019.02.042.

[17.] **Kumar, N., Kaliyan, M., Thilak, M., & Acevedo-Duque, Á. (2021).** Identification of specific metrics for sustainable lean manufacturing in the automobile industries. *Benchmarking: An International Journal.* https://doi.org/10.1108/bij-04- 2021-0190.

[18.] **Afum, E., Zhang, R., Agyabeng-Mensah, Y., & Sun, Z. (2020).** Sustainability excellence: The interactions of lean production, internal green practices, and green product innovation. *International Journal of Lean Six Sigma, 12(2),* 265–292. https://doi.org/10.1108/IJLSS-07-2020-0109

[19.] **Rahmani, F., Galankashi, M. R., Rahmani, A., Amiri, A. B., & Imani, D. M. (2023).** Performance measurement with lean, agile, and green considerations: An interval-valued fuzzy TOPSIS approach in the healthcare industry. *International Journal of Supply and Operations Management, 10(1), 1–18.* https://doi.org/10.22034/IJSOM.2023.109689.2581

[20.] **Rosengart, A., Granzotto, M., Wierer, R., Pazzaglia, G., Salvi, A., & Dotelli, G. (2023).** The Green Value Engineering methodology: A sustainability-driven project management tool for capital projects in the process industry. *Sustainability, 15(20), Article 14827.* https://doi.org/10.3390/su152014827

India's Competitiveness in Exporting Green Products and Promoting Sustainability

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ABSTRACT

Going Green is both a necessity and an opportunity for all the firms and industries. Rising awareness among consumers for the safety of the environment has forced the economies around the world to produce products that have no negative or harmful impact on the environment. The current research paper attempts to provide an insight into the competitiveness of the Top 10 green products for the last 5 years from 2019-2023 in India using the Revealed comparative advantage method and found that the competitiveness of India in green products is either stagnant or deteriorating. There is a need for a paradigm policy shift in green products as far as export competitiveness is concerned. India should proactively encourage the manufacturing and export of green products and take comprehensive measures for the disadvantaged products by using new and sustainable technologies.

Keywords: export competitiveness, green products, sustainability, Revealed comparative advantage, eco-friendly, HS6 classification, sustainable technologies, green manufacturing, green growth, GDP growth

1. INTRODUCTION

The impact of trade on the environment has always been a subject of debate. The patterns of growth we have at present are not only unsustainable but also ineffective. For this reason, they act as barriers to the progress of sustainability and its goals in environmental, social and economic forms.[1]

There has been a gradual shift in the dynamic interaction between economy and ecosystem. Since the convening of the 'United Nations Conference on Human Environment' held in Stockholm in 1972, policymakers have been considering global environmental issues, and environmental sustainability has become a priority for the political agendas of most nations. There has been a significant rise in global consumer demand, which has fuelled economic expansion leading to over utilization of natural and scarce resources causing environmental degradation. The causes of damage to the environment are overpopulation and overutilization of natural resources, pollution in (air, water, land), deforestation, burning fossil fuels, poor waste management and many more. Around 40 % of environmental degradation is due to the consumption activities of private households [2].

The environmental strain on businesses is rising because of consumers and other stakeholders' growing awareness of environmental issues. They understand and are conscious of the environment's impact to their families, societies and civilizations. It is therefore imperative for businesses to maintain the environmental sustainability of their products and services[3]. An era of "Going Green" has begun and many policies has been introduced and being developed to address the need of environmental challenges. Nowadays, becoming environmentally friendly is both a necessity and also an opportunity for the businesses and firms. Environmentally friendly products and promotional strategies are being adopted globally because of the increasing pressure to consider the human activities impact on nature.

Many academics, researchers and policymakers has recognised the need to foster economic development while openly acknowledging environmental issues. Addressing environmental challenges successfully could lead to improved core business endeavours and new competitive opportunities. Thus, methods that have been included into practices of green management include eco-efficiency, cleaner production, and environmental management systems [4].

Many definitions on green growth have been proposed by different organisations and institutions.

The World Bank states green growth as "growth that is efficient in its use of natural resources, clean in that it minimises pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters" [1]

The Organization for Economic Cooperation and Development (OECD) states that "green growth means fostering economic growth and development while ensuring

that natural assets continue to provide the resources and environmental services on which our well-being relies" [5]

The last few decades there has been a gradual shift in consumers awareness regarding environmental issues and due to increased sense of consciousness and accountability for the environment there has been a remarkable growth in international market for the demand of green products.

1.1 Green products:

"The term "green products" is used commonly to describe the products that seek to protect or enhance the environment during production, use, or disposal by conserving resources and minimizing the use of toxic agents, pollution, and waste. Therefore, green products offer potential benefits to the environment and human health[6]."

Geen products are defined as products that "use less resources, have lower impacts and risks to the environment and prevent waste generation already at the conception stage" and aims at a "new growth paradigm and a higher quality of life through wealth creation and competitiveness" [7]

The terms 'green products' and 'green services' refer to products or services depending on energy which principally focus on one or both of these objectives: energy conservation and preservation of other natural resources, or pollution prevention. [8]

"Green is a product (tangible or intangible) that minimizes its environmental impact (direct and indirect) during its whole life cycle, subject to the present technological and scientific status"[9]

Businesses can minimize cost on water usage, utility bills, and material consumption if they adopt green product practices. Consequently, there will be a reduction in the price of capital assets, government penalty or fines, litigation/legal costs, and labour. However, organizations' sources of income will also increase [10]

Businesses can boost productivity and market presence by implementing innovative green technologies [11]. A firm's approach to incorporate green innovation and green products is essential to overcome external forces like regulators, competitors, and customers.

Environmental performance enables companies to save on inputs, energy and resource consumptions, and costs [12]. But arguably the single biggest hurdle to encouraging a better tomorrow is this false dichotomy; that economy and sustainability are somehow ever in conflict. While the ecological footprint of developing countries is less than that of rich nations, they must still take huge decisions since they are required to promote economic development and end inequality simultaneously [13]. Environmental regulations can encourage green exports from developing nations and

reduce the export of filthy goods. Thus, there are more opportunities to establish win-win scenarios for underdeveloped nations and sign trade agreements that include environmental clauses to maximize the benefits of both the environment and the economy.

1.2 Concept of Competitiveness:

The entire economics is based on the question "how to allocate the scarce resources so that maximum social welfare, full employment and high living standards can be achieved". To measure how a particular sector can use its resources at utmost level and contribute to the economic development of a nation, concept of competitiveness can be used as a basis for analysis.

Competitiveness is a multidisciplinary area with relevance across levels: country, industry and firms.(Momaya, 2001) .Competitiveness has become necessary for the businesses to develop, maintain balances and sustain. It can be defined as a "country's share of world market for its products "(Adriana C Anca). The Organisation for Economic Cooperation and Development (OECD) has defined competitiveness as "... the ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis"[16]. Competitiveness has be assessed at various levels: nation, firm, industry.

"National competitiveness can be understood as a country's capability to establish itself in foreign markets due to price or other factors, but also an economy that can achieve a high level of real earnings, a low unemployment rate and long-term sustainable growth" [17]

The research done on the firm level competitiveness suggests that "international firms possess competitive advantages and can often achieve greater national market performance by creating effective international operations" [18].

Economies having higher level of competitiveness would have greater possibilities of generating higher exports [19].

1.2 Export competitiveness can be defined "as the capability to produce and sell goods and services at the required place at competitive prices when compared to other suppliers" [20] .

The "export competitiveness" of a nation or firm refers to its "market development and possession ability" also "profit making ability" in the international market where its commodities are exchanged[21]. Any capable firm that wants to expand internationally must possess export competitiveness.

2. LITERATURE REVIEW

Literature which is relevant to our present study is given below:

[22] in his study gave an innovative approach for comparing national capacities for green manufacturing. The study examines and identifies industry in a wider range of green products using independent policy sources and global agreements. The findings indicate that agreements to promote trade in green and renewable energy items may be significant but the share of trade in these products has not increased over the last 20 years. It offers an established and unison list of Green Goods that may be used to research and guide policies in the green economy. [13] pointed out that while low-income countries worry that wealthy countries will exploit environmental clauses in trade agreements to advance "green protectionism", the study discovered that environmental clauses don't significantly reduce developing nations' exports. Environmental measures can aid in cut down on polluted exports and encourage green exports from emerging nations. Thus, there are more opportunities to generate situations where both parties benefit. [9] gave a comprehensive definition of Green Products. [10] gave evidence in favor of a mutually beneficial reasoning behind using eco-friendly product development techniques. The findings in this study demonstrate how implementing an environmentally friendly approach to product development as a transformative capacity can improve the efficacy of the company's division for product development. [3] concluded that the commercial success of the firm depends on green product innovation. This is so that companies may draw in new customers while retaining their present ones. [23] suggested that for businesses to become less polluted, they should receive outside stimulation from both domestic governments and consumers as well as from governmental restrictions and customers in the nations that their goods are intended for. To hasten the development of affordable cleaner technologies, it is critical to encourage cooperation between the scientific and commercial communities. This partnership may change how businesses perceive environmental friendly actions from being an added expense to a means of enhancing business performance in global markets. [24] measured the competitiveness of ASEAN-5 economies using Revealed Comparative Advantage in electric machinery.

3. RESEARCH METHODOLOGY AND DATA SOURCES:

The study is based on secondary data covering time period from 2019-2023.

Mainly because it is conceptually and practically challenging to define products that are environment friendly and classify them under the trade and industrial categorization, there is still not a worldwide consensus on products and services which are clean for environment. In this paper we will be using classification of green products as given by [22] who compiled data from various organisations and groups such as APEC, OECD and WTO into a structured collection of organised data lists that was classed at the 6-digit level,

providing a helpful benchmark of possibly green products. The analysis is done using the Product complexity Index (PCI). Lower PCI values products correspond to ecologically cleaner products, many of which are biodegradable. Green products with the greatest PCI values typically relate to concentrated solar technologies and gadgets used for observation and evaluation of issues of environment [22]

This study is constructed on the data of export issued by Trade Map and WITS (World Integrated Trade Solutions). For this analysis HS 6-digit classification is used for products which are identified as green that India exports to the rest of the world.

There are many methods to measure export competitiveness such as:

- Revealed comparative advantage

- Trade competitiveness Index

- Dynamic RCA

- Nominal protection coefficient (NPC)

- Lafay Index

- Dynamic shift share analysis

In this paper, RCA approach will be used to measure the India's competitiveness in export of green products.

This research aims to study the international competitiveness of India in green products covering the top ten green products as given by [22] . The top 10 green products based on product complexity index are:

TABLE 1: Top Green Products

RANK	HS6 CODE	PRODUCT DESCRIPTION
1	901380	Optical, appliances and instruments, nes
2	902790	Instruments/apparatus for physical or chemical analysis, or checking viscosity.
3	847989	Machines and appliances for machines , nes
4	902730	Machines like Spectrometers, spectrophotometer using optical radiations
5	902780	Physical or chemical analysis apparatus, or for measuring or checking viscosity
6	680690	Mixtures and articles of heat-insulating, sound- insulating or

		absorbing mineral materials
7	902720	Chromatographs and electrophoresis instruments
8	902710	Gas or smoke analysis apparatus
9	847990	Parts of machines and mechanical appliances nes
10	848360	Clutches and shaft couplings, incl. universal joints, for machinery

Source:[22]

3.1. Revealed comparative advantage:

In the economic literature, the idea of comparative advantage is frequently employed to examine the comparative advantages of the products produced by countries with strong market competitiveness.

Balassa (1965) developed a technique that came to known as Revealed Comparative Advantage or RCA. Based on this index, comparative advantage of commodities can be done. RCA as suggested in (Balassa,1965). theory of "the stages approach comparative advantage" uses the "static commodity composition of trade as the reference pattern to gauge anticipated changes in a comparative advantage based on changes in a country's factor endowment used to achieve the objectives" [25].

RCA lies between zero and positive infinity. If RCA value is greater than one it implies that the particular commodity under consideration possesses a comparative advantage in case of country's relevance while if the RCA value falls to be lesser than unity, then this will represent scenario where international trade has been disadvantageous.

The RCA index formula is given by,

$$RCA_{st} \frac{X_{st}/X_s}{X_{wt}/X_w}$$

Where; RCA_{st} = Revealed comparative advantage of country s in product t
X_{st}= exports of commodity t by country s; X_s= total exports of country s.
X_{wt}= world exports of commodity t; X_w= total world exports.
In this way, country 's' will have revealed comparative advantage in the export of good t if RCAst is greater than one.

TABLE 2: RCA Index Range of Export Competitiveness

Index Range	Interpretation
RCA ≥ 2.500	Very Intense export competitiveness
1.250 = RCA < 2.500	Intense export competitiveness

0.800 = RCA < 1.250	Average export competitiveness
RCA < 0.800	Weak export competitiveness

Source: [21]

4. RESULTS AND DISCUSSION:

Firms all around the world have realised the importance of introducing green products in the market to prevent the environment. Also, the rising awareness of consumers regarding the conserving environment has forced the producers to make products that don't harm the ecosystem. In midst of all this it becomes necessary for an economy to look on its export basket and analyse the competitiveness of its products which are green as in the future the demand for green products is going to rise.

Table 3 elucidates that RCA index of top ten green products of India from the year 2019 to 2023 which shows that the RCA index of product code 848360 is highest and is greater that 1 for all the years studied. Also, the RCA of 847990 is greater than 1 for all the years. Products 902730 has the lowest RCA value which shows that this product has weak competitiveness in the international market. In 2019 out of total 10 products, 4 products have RCA which is greater than 1and in 2023, 5 out of 10 products have RCA which is greater than 1, signifying that India is increasing its competitiveness in green products.

TABLE 3: RCA Index of Top 10 Green products from 2019 to 2023

PRODUCT CODE	RCA 2019	RCA 2020	RCA 2021	RCA 2022	RCA 2023
'901380	0.0114	0.0466	0.0133	0.0651	0.0527
'902790	0.4017	0.3563	0.3683	0.3285	0.4927
'847989	1.7211	1.7747	2.0046	1.3472	1.1023
'902730	0.3674	0.3102	0.3804	0.3000	0.3830
'902780	0.5528	0.4468	0.4465	1.2714	1.7410
'680690	1.5000	1.7276	1.1329	1.0017	1.0922
'902720	0.5366	0.3843	0.4367	0.2508	0.6176
'902710	0.3716	0.4706	0.3209	0.3631	0.4611
'847990	2.1518	1.9947	1.8107	1.3273	1.4376
'848360	2.6019	2.9887	2.5783	1.7659	1.6783

Source: Calculated from Trade map and WITS data

Clutches and shaft couplings product have performed very well with RCA of 2.9 in 2020 indicating a very high export competitiveness. But 2021 the RCA value has been showing a declining trend. Mineral Heat or sound insulating materials has shown an increasing trend of its RCA value.

Fig 1 enumerates that product codes 901380, 902790 and 902730 have very weak competitiveness having RCA values less than 0.5. Product code 848360 has performed very well in international market for all the years studied but its RCA

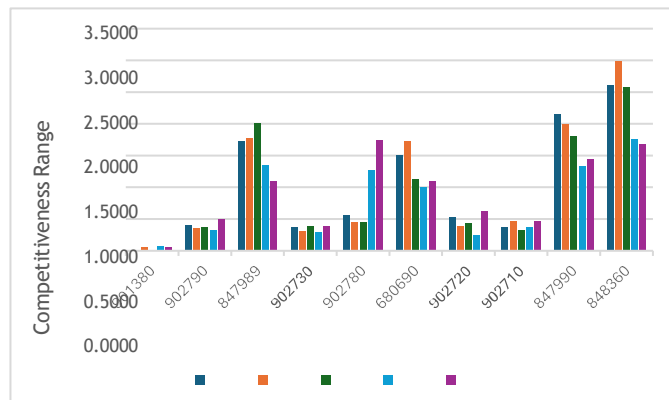value has declined from 2022 but still its greater than 1.5(Fig1)

Fig1: Category wise Top 10 Green products

Source: Authors calculation based on data from Trade Map and WITS

TABLE 4: RCA Index range of competitiveness among Top 10 Green Products

YEAR	RCA≥2.500	1.250 = RCA < 2.500	0.800 = RCA < 1.250	RCA < 0.800
2019	1	3	0	6
2020	1	2	1	6
2021	1	2	1	6
2022	0	4	1	5
2023	0	3	2	5

Source: Authors calculation based on data from Trade Map and WITS

TABLE 4 elucidating the competitiveness of Green Products which will present a more microscopic analysis of India's Green products competitiveness. There has been decline in the products which has very intense export competitiveness. In 2019, 2020 and 2021 there was only 1 product which had very strong export competitiveness but after 2021 there was no product with RCA≥2.5. There has been no rise in the products which exhibit strong export competitiveness. Further Table 4 enunciates that India's last 5 years has fetched no gain in case of export of most of the products and has remained stagnant.

TABLE 5: Analysis of RCA index for Top 10 Green Products from 2019 to 2023

PRODUCT CODE	MEAN	MEDIAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
'901380	0.0378	0.0422	0.019806	0.0114	0.0651
'902790	0.3895	0.3789	0.05191	0.3285	0.4927
'847989	1.5900	1.6555	0.295435	1.3472	2.0046
'902730	0.3482	0.3578	0.032834	0.3000	0.3830
'902780	0.8917	0.7222	0.48323	0.4465	1.7410
'680690	1.2909	1.2119	0.254258	1.0017	1.7276
'902720	0.4452	0.4410	0.115228	0.2508	0.6176
'902710	0.3975	0.3846	0.053618	0.3209	0.4706
'847990	1.7444	1.7776	0.289273	1.3273	2.1518
'848360	2.3226	2.4505	0.47014	1.7659	2.9887

Source: Authors calculation based on data from Trade Map and WITS

The mean of RCA is highest for product code 848360 and lowest for product code 901380 for the 5 years. The maximum RCA value recorded is 2.9887 of product 848360 as illustrated in Table 5.

Further mean of RCA values of 10 green products from year 2019 to 2023 are as follows:

848360>847990>847989>680690>902780>902720>902710>902790>902730>901380

5. CONCLUSION

This study is an attempt to measure the export competitiveness of India in green products using the RCA analysis for the 5 years from 2019-2023. The results show that out of the ten products studied major of the products have stagnant growth in terms of competitiveness.

There is only one product that has very strong export competitiveness. To improve the export competitiveness of green products and promote sustainability, there is a need of paradigm policy shift. A properly designed green growth strategy, along with comprehensive "greening" of economy will enable the economy to move gradually towards sustainable development.

REFERENCES

[1.] The World Bank: Inclusive Green Growth: The Pathway to Sustainability Development. (2012)
[2.] Chen, T.B., Chai, L.T.: Attitude towards the Environment and Green Products: Consumers' Perspective. Management Science and Engineering. 4, 27–39 (2010)
[3.] Pinem, R.J., Listyorini, S.: Green Business Strategy: Optimization of Green Products towards Export Opportunities of SMEs Products. (2022)
[4.] Mutuku, M., Muthoka, B.M.: Influence of green product design on performance of manufacturing enterprises in Kenya's export processing zones. Print) International Journal of Social Science and Humanities Research. 11, 332–337 (2023). https://doi.org/10.5281/zenodo.8031791
[5.] OECD: Towards Green Growth. OECD (2011)
[6.] Bhardwaj, A.K., Garg, A., Ram, S., Gajpal, Y., Zheng, C.: Research trends in green product for environment: A bibliometric perspective. Int J Environ Res Public Health. 17, 1–21 (2020). https://doi.org/10.3390/ijerph17228469
[7.] Commission of the European communities: Green paper on Integrated Product Policy. (2001)
[8.] U.S. Department of Commerce, E. and S.Administration.

(2010) M. the G.Economy.R. 7 F. 2017, from http://www. esa. doc. gov/sites/default/files/ greeneconomyreport_0. pdf/: Measuring the Green Economy. (2010)

[9.] Sdrolia, E., Zarotiadis, G.: A comprehensive review for Green Product term: from definition to evaluation. J Econ Surv. 33, 150–178 (2019).

[10.] https://doi.org/10.1111/joes.12268

[11.] Katsikeas, C.S., Leonidou, C.N., Zeriti, A.: Eco-friendly product development strategy: antecedents, outcomes, and contingent effects. J Acad Mark Sci. 44, 660–684 (2016). https://doi.org/10.1007/s11747-015-0470-5

[12.] Novitasari, M., Agustia, D.: Competitive advantage as a mediating effect in the impact of green innovation and firm performance. Business: Theory and Practice. 24, 216–226 (2023). https://doi.org/10.3846/btp.2023.15865

[13.] Uddin, M.: Exploring Environmental Performance and the Competitive Advantage of Manufacturing Firms: A Green Supply Chain Management Perspective. (2021)

[14.] Brandi, C., Schwab, J., Berger, A., Morin, J.F.: Do environmental provisions in trade agreements make exports from developing countries greener? World Dev. 129, (2020). https://doi.org/10.1016/j.worlddev.2020.104899

[15.] Momaya, K.S.: International competitiveness: Evaluation and enhancement_Chapter2. (2014)

[16.] Adriana, G., Anca, D.: Globalisation and export competitiveness: A theoretical approach. (2009)

[17.] Hatzichronoglou, T.: Globalisation and Competitiveness: Relevant Indicators. (1996). https://doi.org/10.1787/885511061376

[18.] Čekmeová, P.: Konkurecieschopnosť ako ciel hospodárskej politiky. Polit Ekon. 64, 338–350 (2016). https://doi.org/10.18267/j.polek.1074

[19.] Mitchell will, Shaver myles J, Yeung Bernard: Getting there in a global industry: impacts on performance of changing international presence. (1992)

[20.] Siddiqui, A.H., Syed, Ali, A., Usmanazhar: IBT Journal of Business Studies (IBT-JBS) Global Competitiveness and Potential for Higher Exports. (2019). https://doi.org/10.46745/ILMA.jbs.2020.161.01

[21.] Paul, J., Dhiman, R., Juan, S., Rico, P., Singh Parmar, Y.: Three decades of export competitiveness literature: systematic review, synthesis and future research agenda. (2021). https://doi.org/10.1108/IMR-12-2020- 0295/full/html

[22.] Long, Y.: Export competitiveness of agricultural products and agricultural sustainability in China. Regional Sustainability. 2, 203–210 (2021). https://doi.org/10.1016/j.regsus.2021.09.001

[23.] Mealy, P., Teytelboym, A.: Economic complexity and the green economy. Res Policy. 51, (2022). https://doi.org/10.1016/j.respol.2020.103948

[24.] Shershunovich, Y., Mirzabaev, A.: Clean, competitive, and productive? The impact of environment-friendly technologies on exporting and productivity of the manufacturing companies in Belarus. Nat Resour Forum. (2024). https://doi.org/10.1111/1477-8947.12525

[25.] Maqbool, M.S., Bashir, F., Rehman, H. ur, Ahmad, R.: Revealed Comparative Advantages and Exports Competitiveness of ASEAN-5 Countries in the

[26.] Global Market. Review of Economics and Development Studies. 7, 267–276 (2021). https://doi.org/10.47067/reads.v7i2.360

[27.] Sarin, V., Kaur, N.: Competitiveness of India's Agricultural Export: An Empirical Analysis. International Journal of Agricultural and Statistical Sciences. 19, 323 (2023). https://doi.org/10.59467/IJASS.2023.19.323.

TRACK 5: INFORMATION SYSTEM MANAGEMENT

Automation for Sustainability in the Apparel Industry in India: An Expert Opinion

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ABSTRACT

Purpose: Sustainable development goals have become an essential part of the apparel industry and countries worldwide are adopting automation to attain their sustainability targets. However, the authors find India may not be on par with these nations. The study focuses on analyzing the reason for this gap.

Methodology: The researchers adopted the PRISMA Framework to analyze the literature systematically. The gaps identified were framed into an interactive questionnaire for an in-depth interview with 15 experts from the Indian automation industry- 10 academicians from premium fashion institutions of Delhi NCR and 5 professional designers and/or entrepreneurs were interviewed to understand their opinions on the impact of automation on efficiency and sustainability in the Indian apparel industry in different stages- pre-production, production, and post- production, barriers preventing Indian apparel manufactures from adopting automation, the response of Gen-Z customers towards sustainable apparels, comparing online stores with offline stores for sustainability parameters and more. Later, qualitative content analysis was conducted on the response received.

Finding and Analysis: The study revealed that India is a leading manufacturer and exporter of both textile and finished apparel, employing a large population of the nation in this industry. Accordingly, the Indian apparel industry is a major contributor to the country's environmental degradation and workforce exploitation. Experts suggest that with the advent of Industry 4.0, prominent apparel manufacturers in the country have adopted automated tools and techniques for paperless designing, efficient and low-waste production, online retail with virtual trials, and more. However, the adoption rate is prolonged, especially amongst the MSMEs in this industry, building a major gap between the sustainability standards in India and the West. Key factors hindering the MSMEs from adopting automation include- huge investments, low and slow returns on investments, high risk, and an unsupportive customer base.

Originality: The study successfully elaborates on the ground reality of the Indian apparel industry regarding sustainability and automation and explains why India fails to adopt automation for sustainability to stand on par with the world's global sustainability standards.

Keywords: Automation, Sustainability, Indian Apparel Industry, Gen-Z, Automation Adoption Barriers.

1. INTRODUCTION

Apparel Industry: a multi-billion-dollar multinational industry that is committed to the designing, manufacturing, distribution, marketing, retailing, and advertising of garments (ranging from casual wear to formal wear, loungewear to outer-wear like coats and jackets, and more) and accessories (including footwear, bags, belts, hats, jewels, and more). *(Nayak, R., & Padhye, R. 2015)*

However, *(Islam, M. M., et.al, 2021)* noted that the apparel industry is different from the fashion industry. While the Apparel Industry is production-centric and focuses on designing and manufacturing daily wear garments and accessories for the masses, the Fashion Industry is a wider concept and encompasses design, manufacturing, marketing, and distribution of all types of apparel- from the most rarefied and expensive designer couture to ordinary everyday clothing.

Studies suggest that sometimes, the fashion industry refers to myriad industries and services that employ millions of people internationally. It includes brands ranging from Hermes, Gucci, Prada, etc that deal in luxury garments and accessories to fast fashion brands like H&M, Zara,

Shien, etc that make affordable garments and accessories for the masses. It also includes parallel industries that associate themselves with fashion like retail stores, offline (like Pantaloons, Westside, Lifestyle), and online (like Myntra, Nykaa Fashion, Ajios, and more). It includes fashion reporting magazines like Vogue and Business of Fashion, companies that host fashion shows hosted by Lakme, international fashion models like the Hadid sisters, and stakeholders directly or indirectly associated with fashion.

Generation-Z Towards the Apparel Industry: Generation-Z (also called Gen-Z, zoomers, i- generation, post-millennials) is identified by the Pew Research Centre as the generation of people born between the years 1997 and 2012. As of May

2023, this generation contributes to a total of 20.67% of the world's population. (*Pew Research Center*, n.d.)

Gen-Z is truly unique. Being the first digital natives, their formative years have been unlike that of previous generations, creating a greater cultural difference between Gen-Z and older generations. While Millennials (the generation born between 1981 and 1996) (*Pew Research Center*, n.d.) are old enough to remember a less digital world, Gen-Z is much more pragmatic and woke- growing up with easier access to media and being exposed to issues like climate crisis, pressing global movements like "Me Too" and "Black Lives Matter", the Covid-19 pandemic and others- Age of Realism. *(Seyfi, S., & Hall, C. M. (2024)).*

A report by BoF Insights (*BoF Insights,* 2022) studying 1000 Gen-Z respondents from the USA to understand their relationship with fashion reveals that 89 percent of the survey participants rate fashion as important for boosting confidence, while 82 percent say fashion is important for establishing their identities. For Gen-Zs, fashion is less about being trendy or denoting status. It is an extension of their personalities. Accordingly, Gen-Z associate fashion with what they ethically believe in.

Another report by McKinsey and BoF, 2019 (*The State of Fashion 2019*) highlights that nine out of every ten Gen-Z customers is sensitive towards sustainable living. They believe companies have a responsibility to address environmental and social issues. This viewpoint is crucial as Gen-Z contributed to 40% of the global consumers in 2020. Addressing this, fashion companies are adopting Sustainability as their fundamental business ethos. (*BoF Insights, 2022*)

Need for Sustainability in the Apparel Industry: The United Nations Organization defines sustainability as the "*ability to meet the demand of the present generation without compromising the ability of the future generation to meet their demand*". In the industrial reference, it is the ability of any given business model to ensure growth and development along with environmental, social, and economic welfare of the present and the future world. (*SDG-UNDP*)

According to a report by the American Chemical Society, apparel production has doubled since 2000 and it will likely triple by 2050. (*The State of Fashion 2020*) The use of cheap textiles like polyester, a large-scale production unit, and low-wage workers help fast-fashion brands make inexpensive and low-quality clothes, that are later easily discarded. This in turn creates demand for new clothes.

A survey by McKinsey and BoF (*The State of Fashion 2020*) found that 20% of clothing in the US is never worn; in the UK, it is 50%. The ease of online shopping has made impulse buying and returning items more frequent. According to the survey, an average consumer buys 60% more than they did in 2000 and keeps it half as long. In 2017,

(The State of Fashion 2017) McKinsey Global Institute. It was estimated that 41% of young women felt the need to wear something different whenever they left the house. The power of social media trends has also encouraged fast-changing fashion, tailored garments, etc. In response, some brands have increased their production leading to environmental (impact on water, climate change, landfills, micro-plastic pollution, etc) and social damages (low-wage workers, extreme work hours, gender-equality, body-positivity, Pride Campaign, etc).

McKinsey Report 2019 (*The State of Fashion 2019*) clearly states that "For the fashion players, 2019 will be a year of awakening. The ones who will succeed will have to take an active stance on social issues and environmental impact of their business practices". The report warns the apparel manufacturing and retailing brands that present-day customers can easily differentiate between a genuine stand and a marketing gimmick. Additionally, they expect complete transparency across the value chain. To regain the trust and ensure consumer loyalty, fashion players cannot afford to be insensitive. This has led them to adopt the Sustainable Business Model using Industry 4.0. (*Gen Z Statistics, 2023*)

Automation for Sustainability in the Industry 4.0 Model: the 4th Industrial Revolution (4IR), since the early 2000s has been characterized by an explosion of automation across all sectors of the economy, driven by AI, robotics, IoT, and advanced data analytics. This shift has helped reduce the per unit cost of production and total delivery time, improving factory efficiency and productivity, facilitating customization of the products for customer satisfaction, shifting towards more sustainable practices to reduce waste, and creating a sustainable competitive advantage. (*Suits You - and the Planet*, 2021)

IBM defines automation as *the application of technology, programs, robotics, or processes to achieve a desired outcome with minimal human inputs*. It can be **basic automation** (takes simple, repetitive tasks and automates them to help eliminate errors and speed up transactional work); **process automation** (complex and multi-step process performed to increase productivity and efficiency within business), and **intelligent automation** (most advanced level of automation that combines with artificial intelligence (AI) and machine learning (ML) capabilities to enables machines to continuously learn and *make/take* better decision and actions based on data from past situations *they have* encountered and analyzed). (*What Is Intelligent Automation?* n.d.)

A study on metacognition for AI Systems gives a diagrammatic representation of the relationship between Intelligent Automation, Artificial Intelligence, and Machine Learning and elaborates that automation is a super-set of the other two. *(Johnson, 2022)* The Venn diagram below elaborates on it:
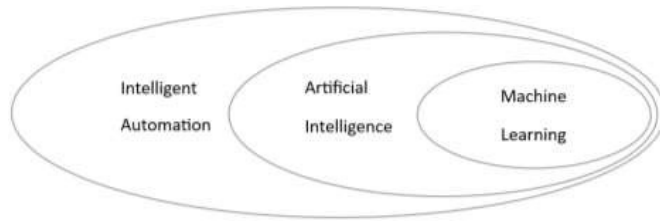
Diagram 1.0: the diagram has been referred from a study by (Johnson, 2022)

Automation for Sustainability in the Apparel Industry 4.0: Automation in a fashion-based firm can not only help boost the overall production function of the firm but also increase profitability, establish consumer trust and loyalty, and encourage a more flexible business model. It encourages sustainability by reducing waste, promoting energy conversion, improving working conditions, regulating the supply chain, ensuring real-time production, and more. *(Imran, A., 2024))*

Automation tools like blockchain, 3D printing, AI, and more when adopted in the fashion industry 4.0 can help ensure sustainability in multiple ways. *(Imran, A., 2024)).* Diagram 2.0 gives a diagrammatic representation of the various automation tools adopted in fashion industry

4.0 for planning, designing, manufacturing, retailing, and consuming fashion products.
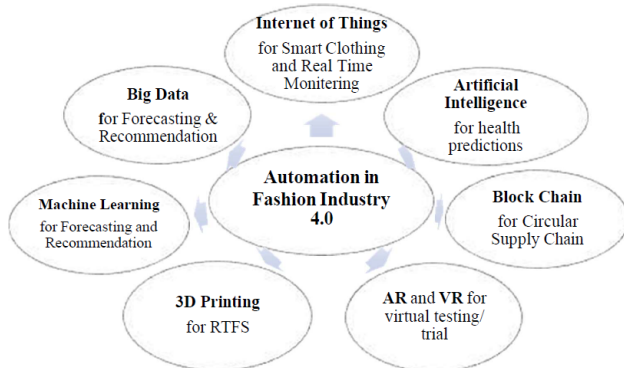
Diagram 2.0: diagrammatic representation of automation in fashion industry 4.0 for the production of sustainable and smart fashion products.

While there is sufficient literature that studies the impact of automation on sustainability in the apparel industry 4.0, this study focuses on the ground reality of the current state of sustainability in the Indian apparel industry and how is automation influencing the narrative.

2. LITERATURE REVIEW

Apparel Industry in India: (*Kar, M. 2015*) suggests that the Indian apparel industry is poised for robust growth, driven by technological advancements, government initiatives, and a rising focus on sustainability.

An update on the website of the Ministry of Commerce and Industry, Government of India *(Commerce, n.d.)* quotes that the market was valued at $197.2 billion in 2023 and is expected to increase at a CAGR of 12.6% between 2024 and 2032. Rising investments in automation, novel manufacturing techniques, and the adoption of sustainable practices, such as employing ethically sourced materials and energy-efficient procedures, support this expansion.

(Textile, 2023) suggests that India enjoys a reputation as one of the largest textile producers globally, with a wide-ranging industry employing a major portion of the Indian population in one of the many sectors ranging from spinning, weaving, dyeing, and finishing. The report highlights that cotton and synthetic products are used for domestic and international trade, making India the world's second-largest exporter of textiles (after China).

Additionally, India is one of the top ten exporters of finished apparel in the world. *(IBEF, n.d.)* states that in 2023, both apparel and textile exports were estimated at around 40 billion USD with the United States, Europe, and the Middle East being its major markets. In 2024, the same organization published a report on the Textile and Apparel Industry *(IBEF, Indian Textile and Apparel Industry Analysis, 2024)* and quotes that the domestic apparel market was valued at over 50 billion USD in the same year and is expected to continue expanding, making it an important market for both domestic and international apparel brands.

(Sanghavi, M, 2018) explains the impact of the Jio revolution in 2016 on digitization in India. The study explains how digitalization has made e-commerce a popular mode of sale and purchase in the Indian market, making Indian consumers open to both domestic and international fashion with the convenience of a click. *(Kalia, P., 2018)* states that while global giants like Amazon, Shopify, and eBay have established a strong hold on the Indian market, domestic e-commerce platforms like Flipkart, Myntra, Ajios, Nykaa Fashion and others are dominating the online apparel stores.

Need for Sustainability in the Indian Apparel Industry: India has a rapidly growing economy, a massive population, and an excellent internet infrastructure. These factors combine to increase India's demand for fast-fashion products, which in turn impacts the country's sustainability standards. *(Ahmed, S. M. A.,2022)*

The constant demand for cheap, low-quality, mass-produced garments leads to overproduction, which generates waste and contributes to the depletion of natural resources. *(Garg, P., 2020)* explain how fast fashion practices encourage disposable consumption, where clothes are worn briefly and discarded quickly, increasing textile waste in landfills. Since textiles are not biodegradable, they remain in landfills for years, contributing to long-term environmental harm. *(Niinimäki, K., 2020)* Indian textile industry is highly water-intensive where processes like cotton cultivation use gallons

of water causing water wastage and the textile dyeing process uses toxic chemicals that later contaminate water bodies. *(Yang, S., 2017).*

Additionally, problems concerning the exploitation of labor are also associated with the Indian apparel industry where poor labor conditions, child labor, unfair wages, and unsafe working conditions (mostly in especially in informal sector) with limited to no access to healthcare, social security, and other benefits are witnessed. *(Köksal, D., 2017)*

(Yang, S., 2017) states that now with the country moving mostly towards digital shopping, problems concerning careless shopping on e-commerce platforms, frequent return of garments, etc have added to the problem of carbon emissions, landfill waste (the infamous Amazon effect), and more.

Sustainability Initiatives in the Indian Apparel Industry: The government of India has recognized these problems and introduced schemes to promote sustainability in India- the National Resource Efficiency Policy and Make in India initiative are encouraging companies to adopt cleaner, greener technologies. *(Islam, M. M., 2021) e*xplains how the Indian government has also introduced the Production-Linked Incentive (PLI) Scheme to boost manufacturing in the textile and apparel sectors, which could include incentives for adopting sustainable practices.

Moreover, a study by *(Kara, A., 2024)* suggests that the younger demographic in India, particularly Millennials and Generation Z, is becoming increasingly conscious of ethical consumption and is more inclined to purchase from brands that offer eco-friendly products, support fair labor practices, and promote sustainable manufacturing. Other prominent studies by *(Kumar, A., 2021)* and *(Seyfi, S., 2024)* support the claim and say that social media has played a significant role in educating Indian consumers about the environmental and social impacts of the fashion industry. It adds that thrift fashion is also gaining popularity.

Studies by *(Desore, A., 2018)* and *(Kannan, D. 2018)* state how in response to this shift in demand towards sustainable produce, major Indian fashion houses and affordable local Indian designers are designing, manufacturing, marketing, and retailing their products considering sustainability standards.

Automation for Sustainability in the Indian Apparel Industry: with the advancement in technology, the Indian apparel industry is leveraging automation in different stages of production of apparel- pre-production, production, and post-production. *(Nayak, R., 2018), (Akram et al., 2022)*

Studies by *(Silva, C.,2020) and (Nayak, R.,2018)* elaborate on the multiple stages of apparel production about automation. Starting with fabric production- automated weaving, knitting, and dyeing technologies are used to minimize waste and optimize the use of water, energy, and

chemicals. Next, *(Pereira et al., 2022)* adds how tools like CAD software and 3D design systems are used in the design stage to maximize fabric utilization, reduce off-cuts, and eliminate the need for physical prototyping. *(Marques et al., 2020)* mentions that advanced technologies such as laser cutting machines and sewing robots improve precision and uniformity in cutting and stitching, significantly reducing material waste. Additionally, *(McCann, 2022)* states that Machine Learning and Data Analysis are used to forecast the ever- changing trends and demands amongst the target set of consumers. *(Agrawal, T. K.,2021)* and *(Fu, B., 2018)* discusses how the Internet of Things and Blockchain help trace inventory and ensure sustainable sourcing practices. In addition, fiber-to-fiber recycling technology and automated recycling sorting systems promote the circular economy by turning waste textiles into reusable fibers. *(de Haro & Wang, 2021)* and *(Lee, 2021)* mention that custom-fit automation and AI-powered suggestions encourage eco-friendly decisions and lower returns in the retail industry.

In summary, studies suggest that to reduce resource consumption, increase recycling efficiency, and improve working conditions, Indian apparel manufacturing units like Raymond, Welspun, and Arvind Limited are implementing these advanced tools and technologies, which will make the sector more economically and environmentally sustainable.

However, leveraging automation for sustainability is not very common in India. *(De Alwis, 2024)* discusses how only a handful of fashion houses use these technologies to ensure optimum utilization of resources, reduce waste, and increase efficiency, creating a major gap between the state of sustainability in the Indian apparel industry in comparison to the rest of the world.

3. RESEARCH GAP

The literature identifies that even though India is making a conscious effort to go sustainable, with efforts flowing in from the government, the conscious customers, and the designers and entrepreneurs in the apparel industry, there lies a significant gap between India and the rest of the world in context to the sustainability standards. Besides, the rate of adoption of automation in the Indian apparel industry is relatively low given that the Indian apparel industry leads as one of the top manufacturers and exporters of both textile and finished apparel in the world.

4. RESEARCH FOCUS

This study focuses on understanding the current state Indian apparel industry in the context of automation and sustainability. The Venn diagram (Diagram 3.0) given below diagrammatically represents the same. The intersection of the circles represents the impact of automation in the Indian apparel industry to enhance sustainability. Here, the focus is paid to understating the true state of the Indian apparel industry- in the context of automation for productivity, efficiency, and sustainability when applied in the Indian

apparel units, the barriers to the adoption of automation by the majority of apparel manufacturing units, the approach of the Indian Gen-Z customers towards sustainable apparels, and the gap between India and the rest of the world in terms of sustainability.
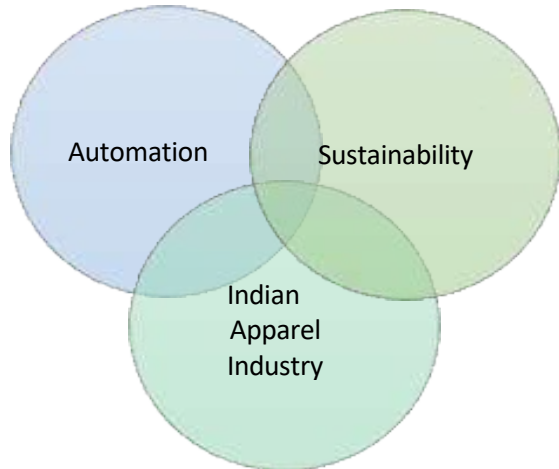

Diagram 3.0: diagrammatically represents the focus of the given research

5. RESEARCH METHODOLOGY

Review of Literature: This research adopted a systematic approach to the literature review. Scientific papers with the keywords "Automation" and "Sustainability" or "Sustainable Development" or 'SDGs' and "Apparel Industry or "Garment Industry" and "Fashion Industry" were identified on the Scopus database.

Next, the PRISMA Framework was applied to filter the total search results to the most relevant ones. First, the time frame was set from "2014 to 2024" to ensure focus on the most recent data. Next, research articles published in journals in the English language were shortlisted to ensure credibility and usefulness. Later, the country of publication was reduced to "India" to ensure the validity of the given research. The total results came down to 63.
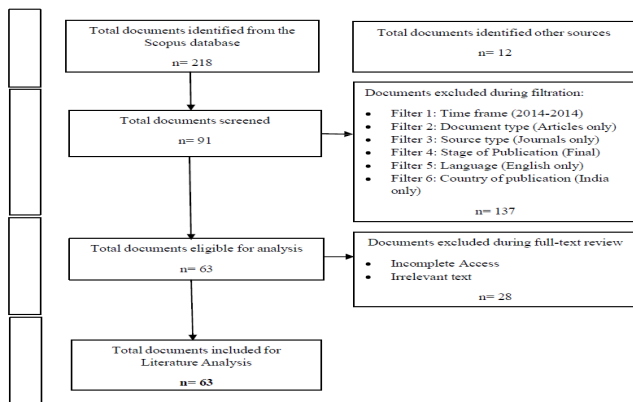
Chart 1.0: PRISMA flowchart for the Systematic Literature Review conducted on the Scopus database.

In addition to this, relevant reports published by McKinsey and Business of Fashion, Pew Research Centre, etc, were referred for establishing a better understanding of the fundamental concepts.

Later, these scientific studies were analyzed to understand the current state of the Indian apparel industry in the context of the total output, global contribution, stakeholder's approach towards sustainability, adoption of automation, and more. A gap was identified in the process.

In-depth Interviews: To study the gap in the literature, one-on-one conversations were conducted with 15 experts from the subject domain. 10 academic experts from premium fashion institutions of Delhi NCR and 5 fashion designers and/or entrepreneurs were requested to share their experiences, observations, feelings, and opinions on the impact of automation on sustainability in the Indian apparel industry.

Type of Research	Qualitative
Method of Data Collection	In-depth interviews
Tool of Data Collection	Structured questionnaire
Target Respondents	Academic and Industry experts from the Apparel Industry in Delhi-NCR
Sampling Technique	Convenience and Snowball Sampling
Sample Size	15 (10 academic experts; 5 industry experts)

Focus was paid to analyzing why the Indian apparel industry, despite being a leading global manufacturer and exporter, fails to stand at par with the rest of the world in the context of both automation and sustainability. The questionnaire for the interview is attached in Annexure.

Data Analysis: The data collected during the in-depth interviews went through a rigorous content analysis. Here, the prominent and re-occurring concepts discussed in the interviews were categorized based on specific parameters. Each of these categories was scanned for a frequency test (evaluating how many times a certain concept has been mentioned) in the interview recordings.

Later, the relationship between each attribute was formulated to understand the true state of the Indian apparel industry in the context of automation for sustainability, barriers to the adoption of automation, the response of the prime customer base towards sustainability, and the reason for India lagging behind the world in terms of sustainability in the apparel industry.

6. FINDINGS AND ANALYSIS

Content analysis was conducted on the data collected during the in-depth interviews. Here, the focus was to identify the re-occurring words, concepts, and phrases, categorize them into certain attributes, and evaluate the total frequency (word count), as given in Table 1.0

TABLE 1.0: content analysis of the in-depth interview conducted during this research

S No	Attributes		Parameters for Categorisation of Each Attribute	Frequency
a)	Automation for Efficiency		• Increase in Productivity Time efficiency Optimum Utilisation of Resources Fewer man-hours	45
b)	Automation for Sustainability	Positive Impact	• Optimum Utilisation of Resources Less Waste generated	38
		Negative Impact	• Replacing Human Capital (causing unemployment) Increased dependency on non-renewable fuel Increase in Carbon Emission	29
c)	Automation Adoption Barriers		• Huge Investment	12
d)	Gen-Z towards Sustainability	Sustainability Conscious	• Sustainability Awareness amongst Gen-Z Positive contribution of social media and sustainability influencers	11
		Irresponsible Buying Behaviour	• Impulsive buying Impact of Influencer Marketing FOMO Ease of online shopping	29
e)	Customer Duality		• Price Sensitivity Other Connivance	14

Impact of Automation on Efficiency in the Apparel Industry: both academic and industry experts working in the apparel industry suggest that the application of automated tools and technologies for the production of finished garments has not only ensured an efficient usage of the resources- raw material, manpower, time, water, electricity,

paper and more, reduced the waste generated in the process, and also yield more outputs at an optimum cost. For instance, automated cutting machines have replaced manual procedures, boosting cutting speed and decreasing fabric waste, both of which help fulfill strict production deadlines. Similarly, sewing robots are leveraged to improve clothing assembly by reducing mistakes and preserving uniform quality, which is especially advantageous for large-scale manufacturing. Moreover, by guaranteeing precise material tracking and replenishment, automated inventory systems simplify supply chain management.

Impact of Automation on Sustainability in the Apparel Industry: experts suggest that automation has a positive impact on sustainability too. Advanced automated machines used in the apparel industry are designed to enhance efficiency, productivity, and quality of the product, and reduce the waste generated during the production process thereby combating problems related to the accumulation of landfills, contamination of water bodies, un-reasonable dependency on paper, un-due work-load on labor, and more.

Automated fabric cutters (like blade cutters, plasma cutters, laser cutters, and water jets), automatic sewing machines, pocket-attaching machines, etc are designed to reduce man-hours invested in the job, enhancing efficiency and accuracy, thereby reducing waste generated due to negligence or other human errors. Computer-aided designing software (CAD) and other digital mechanisms are a sustainable investment to design paper and fabric-free illustrations again.

However, experts highlight that too much inclination toward automation can also encourage this industry to replace its human capital with technology and robots, causing a major employability crisis in India. Additionally, it must be noted that most automated machines run on fossil fuels. This not only increases our dependency on non-renewable energy but also contributes to carbon emissions—a major factor in environmental degradation.

Automation Adoption Barriers in the Indian Apparel Industry: despite the benefits offered by an automated apparel factory to its owner, the rate of adoption of automation in the apparel industry is very low in India. Huge investments are required to buy and constantly update advanced machines and other equipment. While large-scale companies can easily afford that expense, medium-small-micro-scale enterprises that contribute to 60-65% of the total production in the Indian apparel industry, don't have sufficient funds to make those purchases. Although the government is extending financial assistance to these MSMEs, businesses are concerned about the time it takes to see returns on their investments, especially given the competitive pricing in the industry.

Gen-Z towards Sustainability: Gen-Z is truly unique. Our literature analysis highlights that Gen-Z was raised in the era of environmental and social crisis making them increasingly

conscious of ethical consumption and is more inclined to purchase from brands that offer eco- friendly products, support fair labor practices, and promote sustainable manufacturing.

However, experts justify that Gen-Z were raised in the era of abundance and easy access. They are spoilt by multiple choices, constantly changing fashion trends, social pressure, and the influencer culture for going maximalist, making this generation impulsive buyers. This later leads to the demand for affordable, poor quality, unsustainable fast fashion clothing. Additionally, the ease of online shopping- doorstep delivery and returns make them careless buyers too. They think less about the wastage of fuel, excessive carbon emission, and other environmental side effects of at-home delivery.
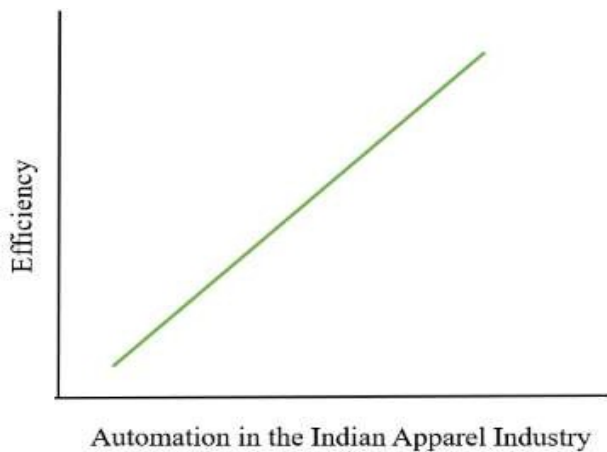
Graph 1.1: linear graph representing the Positive relationship between Automation in the Apparel Industry and Efficiency.

Customer Duality: experts suggest that Gen-Z's approach to sustainability is controversial. They can be sustainable when sustainability is convenient for them and careless at other times, creating a dual approach. While Gen-Z understands the significance of sustainability, they are also inclined towards more affordable products, leading to a rise in demand for fast fashion and a dip in demand for expensive sustainable clothing.

7. RESULT AND DISCUSSION

Based on the data analyzed earlier, the research formulated equations to describe the relationship between this study's major attributes. Table 2.0 gives a detailed review of these equations.

**TABLE 2.0: tabular representation of the relationship between various attributes of the study.**

S. No	Attribute 1	Attribute 2	Relationship
1	Automation	Efficiency	Positive
2	Automation	Sustainability	Positive
3	Automation	Adoption in India	Negative
4	Sustainability	Gen-Z Purchase Behaviour	Undefined
5	Convenience	Sustainable Purchase Behaviour	Negative

In the first equation, research suggests that automation adopted in the Indian apparel industry **positively** impacts efficiency. This means that as apparel manufacturing units in India adopt automation at different stages of production, their efficiency in terms of the optimum utilization of resources (land, labor, capital, entrepreneurs, and raw material) tends to increase, later maximizing productivity and minimizing cost. Graph 1.1 explains the same.

In the next equation, research signifies a **positive** relationship between automation in the Indian apparel industry and social and environmental sustainability. This indicates that as Indian entrepreneurs and designers adopt automation for the production of garments, resources are used to the best of their capacity, generating the least waste and later helping combat issues concerning landfill accumulation, water contamination, and more. Additionally, automation assists the human resources applied in the production unit, reducing their workload and encouraging social sustainability. Graph 1.2 explains the same.

However, it must be noted that with the adoption of automation, human capital must learn to collaborate with automation to keep their skills relevant and irreplaceable.
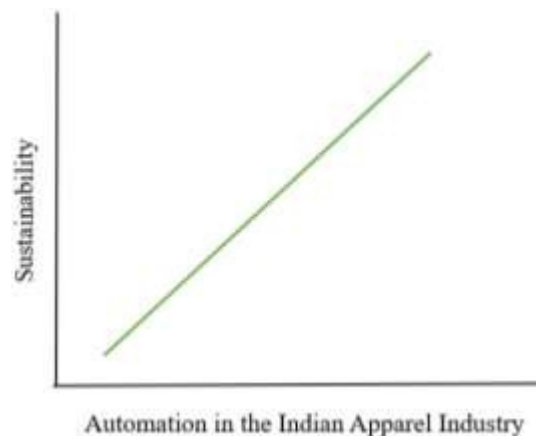
Graph 1.2: linear graph representing the Positive relationship between Automation in the Apparel Industry and Sustainability.

Later, the research focuses on building an equation between Automation in the Indian Apparel Industry and its rate of adoption among mass manufacturers and designers and labels it as **Negative**. It explains how, despite financial assistance from both government schemes and private

lenders, MSMEs fail to adopt automation at various stages of production in an apparel manufacturing unit. Fear of low and late returns on investments, lack of acceptance from customers who are mostly inclined towards affordability rather than sustainability, and more. Graph 1.3 represents the same.
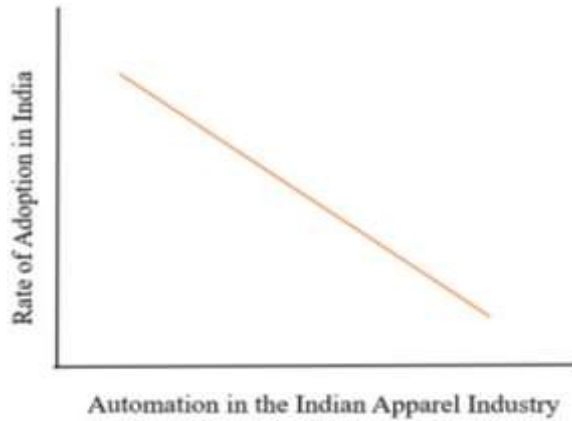
Graph 1.1: linear graph representing the Negative relationship between Automation in the Apparel Industry and the Rate of Adoption of Automation in the Apparel Industry.

Furthermore, sustainability is studied in the context of Gen-Z purchase behavior in the apparel industry, and the research fails to establish a relationship between the two, emphasizing the dual approach of Gen-Z customers. While Gen-Z is aware of the side effects of fast fashion and impulsive and careless shopping, it is highly influenced by the latest trends, the social media ecosystem, cheap quality affordable products, and the convenience of online browsing, at-home delivery, and easy returns, thereby failing to fit in one of the binary relations. Graph

1.4 represents Gen-Z Customer Duality.
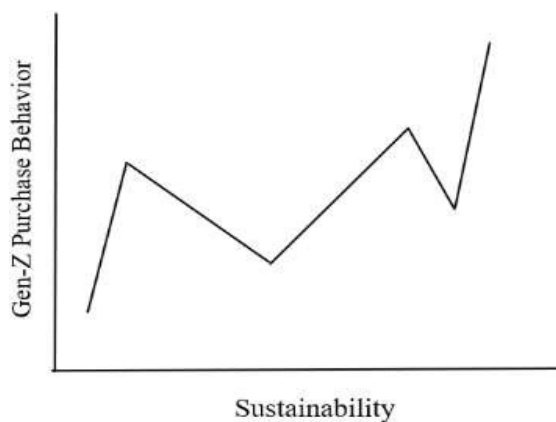
Graph 1.4: linear graph representing an Undefined relationship between Sustainability and Gen-Z Purchase Behaviour.

At last, this research recognizes a **Negative** relationship between the convenience of apparel shopping in the present day and age in the context of the Gen-Z Sustainable Purchase Behaviour. This explains how fast fashion and online shopping have made access to affordable garments very easy, spoiling the customers for choice. Additionally, the convenience of online browsing, at-home delivery, and easy returns have encouraged irresponsible buying. Moreover, it must be noted that most of these garments are low quality and have a short shelf life, as a result, they retire soon, creating demand for a new stock of cheap, affordable, and unsustainable garments. Graph 1.5 represents the same equation.
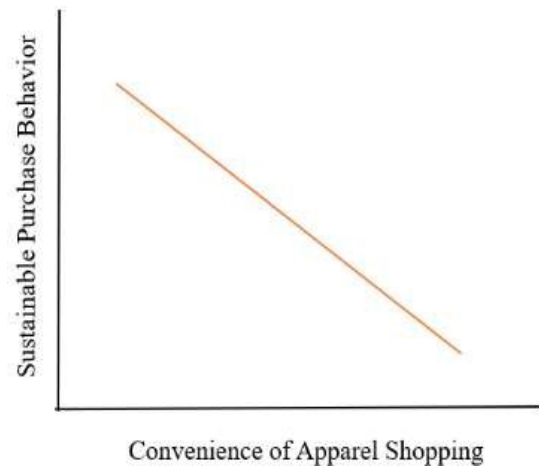
Graph 1.1: linear graph representing the Negative relationship between Convenience of Apparel Shopping and Sustainable Purchase Behaviour amongst Customers.

8. CONCLUSION

Being one of the leading manufacturers and exporters of both textile and finished apparel in the global apparel industry, India produces a large portion of goods every year, which in turn leads to the exploitation of both environmental and social resources. The ever-growing demand for fast fashion goods (heavily influenced by Gen-Z) causes over-consumption of resources, waste generation, contamination of waterbodies, landfill accumulation, and labor exploitation by employing them for long hours in inadequate working conditions and on low wage-pay.

To combat these problems, Indian designers and fashion entrepreneurs have started adopting sustainability standards, but the progress is very slow. Big fashion houses leverage automation to optimize the usage of resources, reduce waste, enhance efficiency, and combat environmental concerns associated with apparel production, but the number is too small.

The huge investment required to go automated discourages MSMEs in the apparel industry. Despite the financial

assistance extended by the government and private financial institutions, the fear of low returns on investments is a major con.

Adding to this list, the customer base is not very cooperative. While Gen-Z understands the significance of sustainability, they are easily influenced by the latest fashion trends and are more inclined towards cheap quality garments that cost less and have a short shelf life, leading to a rise in demand for fast fashion and a dip in demand for expensive sustainable clothing.

9. FUTURE SCOPE OF RESEARCH

While this study successfully elaborates on the ground reality of the Indian apparel industry regarding sustainability and automation and explains why India fails to adopt automation for sustainability to stand on par with the world's global sustainability standards, it opens the door for more research in the future.

To begin with, this study can be leveraged to identify the barriers to the adoption of automation for sustainability in the Indian apparel industry and prepare policies to combat the issue. Additionally, this research gives its readers the most refined perspective of a set of experts (both academicians and industry experts) in the apparel industry based in Delhi, NCR. To expand the horizon, future research on the same subject but collect opinions from experts all across India, giving their study a more dynamic approach. Researchers can also focus on understanding the behavior of other generations of apparel customers in India towards sustainable fashion.

Furthermore, research focusing on identifying the gap in the government's effort to help one of India's biggest industries become automated and sustainable can be conducted. Policies and strategies can be formulated to help India bridge the gap in terms of global sustainability standards.

10. DECLARATION

I, Tooba Rahman Khan, hereby confirm that the manuscript titled "Automation for Sustainability in the Apparel Industry in India: An Expert Opinion" authored by Tooba Rahman Khan, Amirul Hasan Ansari, and Dr. Deepshikha, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to the "International Management Perspective Conference (IMPeC-2025), at IIM Sambalpur".

I declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Agrawal, T. K., Kumar, V., Pal, R., Wang, L., & Chen, Y. (2021). Blockchain-based framework for supply chain traceability: A case example of textile and clothing industry. *Computers & industrial engineering*, *154*, 107130.

[2.] Ahmed, S. M. A. (2022). Digitalisation and Development in India: An overview. *The Routledge Handbook of Smart Technologies*, 644-663.

[3.] Akram, S. V., Malik, P. K., Singh, R., Gehlot, A., Juyal, A., Ghafoor, K. Z., & Shrestha, S. (2022). Implementation of Digitalized Technologies for Fashion Industry 4.0: Opportunities and Challenges. *Scientific Programming*, *2022*. Scopus. https://doi.org/10.1155/2022/7523246

[4.] *BoF Insights | Gen-Z and Fashion in the Age of Realism.* (2022, October 11). The Business of Fashion. https://www.businessoffashion.com/reports/retail/gen-z-fashion-in-the-age-of-   realism-bof-insights-social-media-report/

[5.] Commerce, D. o. (n.d.). *Ministry of Commerce and Industry.* Retrieved from Government of India: https://www.indiantradeportal.in/vs.jsp?lang=0&id=0,31,24100,24102

[6.] De Alwis, A. M. L., De Silva, N., & Samaranayake, P. (2024). Industry 4.0-enabled sustainable manufacturing: current practices, barriers and strategies. *Benchmarking: An International Journal*, *31*(6), 2061-2089.

[7.] de Haro, C. V., & Wang, Y. (2021). FASHION 4.0: A Potential Solution to a More Sustainable Fashion Industry. *Lecture Notes in Electrical Engineering*, *737*, 380–386. Scopus. https://doi.org/10.1007/978-981-33-6318-2_47

[8.] Desore, A., & Narula, S. A. (2018). An overview on corporate response towards sustainability issues in textile industry. *Environment, Development and Sustainability*, *20*, 1439-1459.

[9.] Fu, B., Shu, Z., & Liu, X. (2018). Blockchain enhanced emission trading framework in the fashion apparel manufacturing industry. *Sustainability (Switzerland)*, *10*(4). Scopus. https://doi.org/10.3390/su10041105

[10.] Garg, P. (2020). Introduction to fast fashion: environmental concerns and sustainability measurements. *Environmental Concerns and Sustainable Development: Volume 2: Biodiversity, Soil and Waste Management*, 409-427.

[11.] *How intelligent automation can power sustainable economies.* (2021, September 22). World Economic Forum. https://www.weforum.org/agenda/2021/09/how-intelligent-automation-can-power-sustainable-economies/

[12.] IBEF. (2024). Retrieved from Indian Textile and Apparel Industry Analysis: https://www.ibef.org/industry/indian-textiles-and-apparel-industry-analysis-presentation

[13.] IBEF. (n.d.). *Apparel and Garment Industry and Exports.* Retrieved from https://www.ibef.org/exports/apparel-industry-india

[14.] Imran, A. (2024). Digitalization Impact on Sustainability in Garments Industry. In *Garment Sizing and Pattern Making* (pp. 275-287). Singapore: Springer Nature Singapore.

[15.] Islam, M. M., Perry, P., & Gill, S. (2021). Mapping environmentally sustainable practices in textiles, apparel and fashion industries: a systematic literature review. *Journal of Fashion Marketing and Management: An International Journal*, *25*(2), 331-353.

[16.] Islam, M. M., Perry, P., & Gill, S. (2021). Mapping environmentally sustainable practices in textiles, apparel and fashion industries: a systematic literature review. *Journal of*

Fashion Marketing and Management: An International Journal, *25*(2), 331-353.

[17.] Johnson, B. (2022). Metacognition for artificial intelligence system safety -An approach to safe and desired behavior ☆. *Safety Science*, *151*. https://doi.org/10.1016/j.ssci.2022.105743

[18.] Kalia, P., Kaur, N., & Singh, T. (2018). E-Commerce in India: evolution and revolution of online retail. In *Mobile commerce: Concepts, methodologies, tools, and applications* (pp. 736-758). IGI Global.

[19.] Kannan, D. (2018). Role of multiple stakeholders and the critical success factor theory for the sustainable supplier selection process. *International Journal of Production Economics*, *195*, 391-418.

[20.] Kar, M. (2015). *The Indian Textile and Clothing Industry: An Economic Analysis*. Springer India.

[21.] Kara, A., & Min, M. K. (2024). Gen Z consumers' sustainable consumption behaviors: influencers and moderators. *International Journal of Sustainability in Higher Education*, *25*(1), 124-142.

[22.] Karl, C. (2017). *The State of Fashion 2017*. McKinsey Global Institute.

[23.] Köksal, D., Strähle, J., Müller, M., & Freise, M. (2017). Social sustainable supply chain management in the textile and apparel industry—A literature review. *Sustainability*, *9*(1), 100.

[24.] Kumar, A., Prakash, G., & Kumar, G. (2021). Does environmentally responsible purchase intention matter for consumers? A predictive sustainable model developed through an empirical study. *Journal of Retailing and Consumer Services*, *58*, 102270.

[25.] Lee, Y. K. (2021). Transformation of the innovative and sustainable supply chain with upcoming real-time fashion systems. *Sustainability (Switzerland)*, *13*(3). Scopus. https://doi.org/10.3390/SU13031081

[26.] Majumdar, A., Garg, H., & Jain, R. (2021). Managing the barriers of Industry 4.0 adoption and implementation in textile and clothing industry: Interpretive structural model and triple helix framework. *Computers in Industry*, *125*, 103372.

[27.] Marques, A. D., Marques, A., & Ferreira, F. (2020). Homo Sustentabilis: Circular economy and new business models in fashion industry. *SN Applied Sciences*, *2*(2). Scopus. https://doi.org/10.1007/s42452-020-2094-8

[28.] McCann, J. (2022). Preparation for smart clothing production. In *Smart Clothes and Wearable Technology, Second Edition* (pp. 371–404). Scopus. https://doi.org/10.1016/B978-0-12-819526-0.00013-8

[29.] Nayak, R., & Padhye, R. (2015). Introduction: the apparel industry. In *Garment manufacturing technology* (pp. 1-17). Woodhead Publishing.

[30.] Nayak, R., & Padhye, R. (2018). Introduction to automation in garment manufacturing. In *Automation in garment manufacturing* (pp. 1-27). Woodhead Publishing.

[31.] Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, *1*(4), 189-200.

[32.] Portal, I. T. (n.d.). *Indian Trade Portal*. Retrieved from Ministry of Commerce and Industry, Government of India: https://www.indiantradeportal.in/vs.jsp?lang=0&id=0,31,24100,24102

[33.] Sanghavi, M., Sanghavi, K., & Khivsara, B. The Jio Revolution: Transforming India's Digital Landscape. *JOURNAL OF TECHNICAL EDUCATION*, 139.

[34.] Seyfi, S., & Hall, C. M. (2024). Is gen Z a pro-SDG generation? A critical review and reflection. *The Elgar Companion to Tourism and the Sustainable Development Goals*, 246- 258.

[35.]

[36.] Seyfi, S., & Hall, C. M. (2024). Is gen Z a pro-SDG generation? A critical review and reflection. *The Elgar Companion to Tourism and the Sustainable Development Goals*, 246- 258.

[37.] Silva, C., & Chi, T. (2020, December). Automation Trends in Apparel Manufacturing. In *International Textile and Apparel Association Annual Conference Proceedings* (Vol. 77, No. 1). Iowa State University Digital Press.

[38.] *Suits you - and the planet: Why fashion needs a sustainability revolution*. (2021, September 22). World Economic Forum. https://www.weforum.org/agenda/2021/09/fashion-sustainability-revolution-sdis21/

[39.] *Sustainable Development Goals | United Nations Development Programme*. (n.d.). UNDP. Retrieved October 7, 2023, from https://www.undp.org/sustainable-development-goals

[40.] Textile, M. o. (2023). *Annual Report 2022-2023*. Government of India.

[41.] *The State of Fashion 2019*. (2019).

[42.] *The State of Fashion 2020*. (2020).

[43.] *What is Intelligent Automation? | IBM*. (n.d.). Retrieved October 2, 2023, from https://www.ibm.com/topics/intelligent-automation

[44.] Yang, S., Song, Y., & Tong, S. (2017). Sustainable retailing in the fashion industry: A systematic literature review. *Sustainability*, *9*(7), 1266.

Annexure

Questionnaire for the In-depth Interview:

1.   Impact of automation on sustainability in the apparel industry. (with examples)

2.   Difference between conventional and sustainable methods of production in the apparel industry-
     a.   Pre-Production Stage
     b.   Production Stage
     c.   Post Production Stage

3.   What is discouraging the Indian apparel designers and manufacturers in adopting automation for production?

4.   Comparative study on sustainability in the apparel industry– India vs. abroad (Europe and United States)

5.   Do you think Generation Z is more responsive towards sustainable fashion than other generations? If yes, why?

6.   In the age of fast fashion (with high demand from Gen-Z apparel customers), how can we leverage automation for the following-

     a.   expand the life of an apparel.

     b.   Sustainable disposal of apparel.

7. In marketing we observe that any customer undergoes three stages of the Customer Journey (CJ), namely- pre-purchase, purchase, and post-purchase. Each stage is marked with a unique Customer Experience (CX).

   Do you think that the use of automation for sustainability in the apparel industry can help Generation-Z customers enhance their experience (CX) in each stage? If yes, how?

8. Comparison between traditional and online shopping– which is more sustainable?

9. Since this research follows a snowball approach for identifying and approaching the target respondents for the in-depth interviews, can you please suggest two experts from this domain- academic experts from fashion institutions like NIFT, Pearl Academy, and/or designers/entrepreneurs from apparel manufacturing units in Delhi NCR? (Kindly provide their contact details too).

Systematic Mapping of Breakbone Fever: A Scientometric Analysis

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ABSTRACT

A viral infection spread by mosquitoes, dengue fever has become a major global public health issue, with over 2.5 billion individuals at risk in more than 60 countries. This bibliometric study aims to systematically analyse the existing research landscape on dengue fever, with a focus on publication trends, geographic contributions, and thematic areas. Using a scientometric approach, the study investigates the chronological growth of dengue-related research, identifies major contributing countries and their collaborative networks, evaluates India's research position, and highlights the most preferred journals in the field. Findings reveal a significant rise in research activity correlating with the global surge in dengue incidence, especially in endemic regions. The study underscores the critical need for advanced predictive tools, real-time surveillance, and international collaboration to address the challenges posed by dengue. The analysis provides valuable insights for policymakers, researchers, and healthcare practitioners, contributing to the global effort to mitigate the socioeconomic and health impacts of this escalating public health crisis.

Keywords: Dengue, Fever, Viral borne Disease, Scientometric Analysis

1. INTRODUCTION

Dengue fever, a mosquito-borne viral infection, has become a significant global health concern, with over 2.5 billion people in more than 60 countries at risk. Between January and August 2024, India reported a substantial rise in cases, mirroring global trends, with January marking peak levels of dengue cases in the region. In the state of Telangana alone, over 6,400 cases were recorded in this period. As of mid-2024, more than 12.3 million dengue cases and 6,500 deaths were reported worldwide, with India being a major contributor in South-East Asia. he economic burden of dengue in India is considerable, with costs associated with healthcare, hospitalizations, and lost productivity. A study estimated the economic toll at $5.71 billion between 2013 and 2016, highlighting its significant impact on healthcare systems and household incomes. Since the beginning of 2024, more than 7.6 million dengue cases have been reported to WHO (including 3.4 million laboratories confirmed cases), with over 16 000 classified as severe and over 3000 deaths, as of 30 April 2024. Dengue fever is a mosquito-borne virus that has emerged as a major public health threat; however, dengue cases have been hit worldwide, with the Region of the Americas experiencing the largest increase with more than seven million reported cases through the end of April 2024, up from the 4.6 million annuals high in 2023. Dengue fever, a virus transmitted by mosquitoes, is now a major public health challenge around the world, which points to the growing speed of this pandemic, since it is its tripled number compared to the previous one.

Humans contract the dengue virus when bitten by an infected mosquito. The majority of cases are asymptomatic or cause a moderate feverish sickness. serious dengue, which can cause shock, serious bleeding, or severe organ dysfunction, will emerge in certain cases, though. The disease's escalating prevalence, coupled with its severe health and socioeconomic impacts, underscores the urgent need for effective predictive tools and management strategies. Challenges such as the absence of specific antiviral treatments, the limited efficacy of existing vaccines, and the role of environmental factors like climate change and urbanization further complicate efforts to combat dengue.

Dengue fever, a mosquito-borne viral illness, is rapidly emerging as a major world health problem, to enhance global surveillance and understand temporal trends and the incidence of the disease, WHO has established a global surveillance network with monthly reporting from all the WHO Regions. Now, 103 (29%) countries were caught (Fig. 1), among them 28 with no reporting
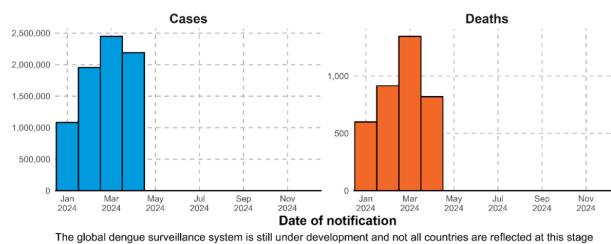

Figure 1. Trend of Dengue Fever

Dengue fever, a common mosquito-borne viral infection, is a major public health concern worldwide, Dengue remains a global public health problem as outbreaks are currently large and there is potential for further international spread and complexity in the mechanisms governing transmission Thus, the overall risk is still considered high. Moreover, mathematical models have shed light on the driving forces behind the transmission of dengue, highlighting the roles of the environment and vaccination efforts (Derouich et al., 2003).

Predictions suggest that by 2085, up to 60% of the global population could face dengue transmission risks due to climate and demographic changes (Hales et al., 2002). These findings underscore the necessity of integrating advanced predictive technologies into public health strategies to address the growing burden of dengue fever.

Despite these advancements, the global research landscape on the Dengue fever prediction remains underexplored. Dengue fever, a mosquito-borne viral infection, has become a significant global health concern, not all of the 90 nations where dengue is now believed to be actively spreading in 2024 have been officially reported. Furthermore, the total global dengue impact is underestimated because many endemic nations lack robust detection and reporting systems. Improved real-time surveillance and other prediction mechanisms are needed, but also to better address issues regarding unrecorded travel movements, co-circulation and misdiagnosis as other arboviruses and possible undiagnosed cases (such as for dengue); all of this to control transmission. Such issues may lead to unrecognized disease spread and make a case for the risk of local transmission in non-endemic countries. This study aims to fill this gap by reviewing the literature to discover research trends, assess geographical and thematic contributions, and discuss other possible approaches available in the future in the, combating, prediction. By doing so, it aims to provide valuable insights for public health policymakers, researchers, and practitioners in the fight against dengue fever.

2. LITERATURE REVIEW

Dengue fever continues to pose significant public health challenges, affecting over 2.5 billion people across 60 countries, with increasing incidence and severity due to issues in vector control, pathophysiology, and the absence of effective vaccines or therapies (Rajapakse et al., 2012). Diagnosis remains largely presumptive, relying on supportive care while antiviral treatments are still under investigation (Wiwanitkit, 2014). Historical outbreaks, such as in Hawaii, highlight the importance of mosquito control and surveillance, as demonstrated by the containment of 122 cases without severe outcomes (Effler et al., 2005). Vaccine development remains critical, especially to avoid antibody enhancement, ensuring broader efficacy for infants and naïve individuals (Khetarpal & Khanna, 2016). The rising prevalence in adolescents and adults, driven by urbanization

and tourism, underscores the need for focused research on severe case management (Tantawichien, 2013). In Indonesia, a significant rise in dengue-related publications over the last decade indicates progress, though further efforts are needed to align research with strategic goals (Maula, 2018). Globally, the correlation between research output and dengue case burden reflects the scientific community's responsiveness, supported by international collaboration (Ho, 2018). Mathematical models provide insights into dengue's dynamics, emphasizing the influence of environmental factors and the potential of vaccination strategies (Derouich et al., 2003). Projections suggest that climate and population changes could increase the population at risk for dengue from 35% to 60% by 2085 (Hales et al., 2002). Diagnostic advancements like ultrasound have enhanced the ability to predict disease severity through features such as gallbladder wall thickening and pleural effusion (Venkata Sai et al., 2005). Comparisons of liver involvement between classic dengue and dengue haemorrhagic fever further deepen understanding of disease progression (Wahid et al., 2000). The global reemergence of dengue, driven by expanded geographic spread and increased epidemic activity, emphasizes the necessity of sustainable prevention measures (Gubler, 1998). International travelers also play a critical role in the pandemic, acting as both victims and vectors, with severe cases often leading to high mortality (Jelinek, 2000). Regional studies in South Asia attribute outbreaks to climatic factors such as rainfall and temperature, with DEN2 and DEN3 being dominant serotypes (Raheel et al., 2011). Clinical research highlights immune-mediated complications like dengue maculopathy, found in 10% of hospitalized patients, stressing the importance of understanding associated risk factors (Su et al., 2007). GIS-based approaches have also proven effective in correlating environmental variables with dengue incidence, offering predictive tools for outbreak management (Nakhapakorn & Tripathi, 2005). Early detection and management strategies, including fluid resuscitation, significantly reduce mortality rates, showcasing the importance of proactive healthcare measures (Ratageri et al., 2005).

3. OBJECTIVE OF THIS BIBLIOMETRIC STUDY

The goal of this study is to analyse the existing literature on Dengue & Fever.

1. To analyse the chronological growth of research in the field of Dengue Fever.

2. To identify the countries and its collaborative partners publishing more research articles in this area.

3. To figure out India's position in the publication of research in the emerging topic.

4. To find the most preferred journals.

A major global health concern is dengue fever, a virus spread by mosquitoes. Section 2 presents the research methodology,

which includes data collecting and analysis. Network and citation analysis is presented in Section 4 after the statistics data in Section 3. Part 5 discusses the study's limitations and analysis, while Section 6 offers the conclusion.

MATERIALS AND METHODS

4.1 Source of Bibliometric Data and Search Strategy

SLE research publications were located using the Web of Science (WoS) database. Dengue fever, a virus spread by mosquitoes, has grown to be a major global health concern. The Science Citation Index Expanded from the WoS Core Collection online database was used. The search methodology used in this inquiry was as follows: TS stands for both fever and dengue. The search took place on November 23, 2023. Only products that were released between 2022 and 2023 were taken into consideration because a one-year timeframe was set. To ensure appropriate interpretation of the data, the publication language was also restricted to English. Only original articles were included in the bibliometric analysis; publications that were classified as both articles and other types of materials were excluded.

4.2 Bibliometric Analysis

Dengue fever, a mosquito-borne viral infection, has become a significant global health concern, The purpose of bibliometric analysis tools is to help scholars map scientific knowledge and identify trends in scholarly writing. Understanding trends, assessing the impact of research, and visualizing the relationships between authors, institutions, and fields all depend on these tools. We used Bibliometric (a R package) for analysis in this paper. Additionally, the Web of Science data was examined in accordance with the goal after it was extracted.

4.3 Main Information about Data

An extensive overview of the 677 publications that were chosen is given in Figure 1. The fact that these papers are spread among 352 journals suggests that the publication landscape for this subject is varied. A noteworthy increase in the amount of work based on the application of machine learning to dengue fever is indicated by the publications' notable yearly growth rate of 287.05%. These articles were the result of the combined efforts of 5096 authors, with an average author count of about 8.02%. Interestingly, 19 documents were written by a single person, highlighting the variety of viewpoints and areas of knowledge in this sector. Additionally, 25.26% of the documents show evidence of international collaboration, demonstrating the worldwide scope of study in this field. A total of 24,089 references were used in the chosen publications, with an average of 0.6012% of citations per document. This suggests that contemporary research initiatives are informed by a solid foundation of knowledge and a vigorous engagement with previous literature.

Figure 1. Summary of the Data set

4. RESULT & ANALYSIS

Figure 2 shows a Linear Growth, i.e persistent, linear increase in the number of scientific articles published annually from 2022. This indicates consistent growth in research output in the studied domain, suggesting either increasing interest in the topic, advancements in the field, or increasing ease of publication processes. The trend suggests that scientific production doubles or increases significantly over time, highlighting how the academic focus on this domain has expanded. A rising trend in publications suggests a topic of growing academic or societal importance. It may indicate more funding, international collaboration, or technological advancements enabling more research. The trend could also help researchers identify the most productive or emerging years in a specific field.
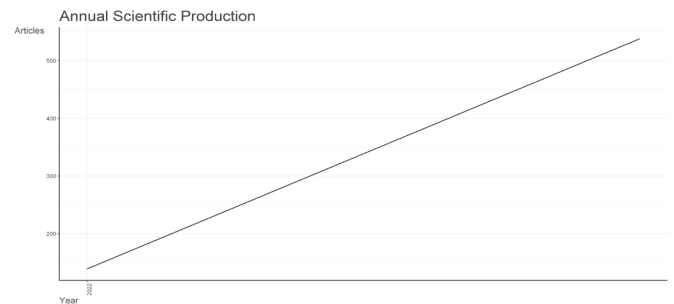

Figure 2. Annual Number of Documents

The most represented journals were "journal of biomolecular structure & Dynamics", "European journal of Pediatrics" and "Microbiology Spectrum" with a total number of publications of 27,20 and 20, respectively.
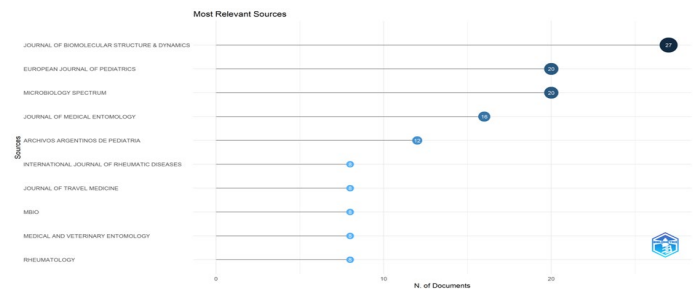

Figure 3. Most Relevant Sources

The Sankey diagram was created in 1898 by Captain Matthew Sankey. The Sankey flow diagram is a data visualization approach that illustrates transition of data from one circumstance or time to another. It was first used to illustrate energy flow in physics and engineering, but it has since become popular in business and economics for understanding complex multi-step processes. Figure 4 shows which "Cited References" are most frequently written on the theme. The sources are shown on the left, the authors are in the middle, and the keywords are on the right. Keywords like "fever" and "mediterrian fever" have the largest edge thicknesses, as shown in Fig. 4, suggesting that a wide range of authors and journals utilize these terms in their works. Haslak F and Kasapcopur are also at the top of the list.
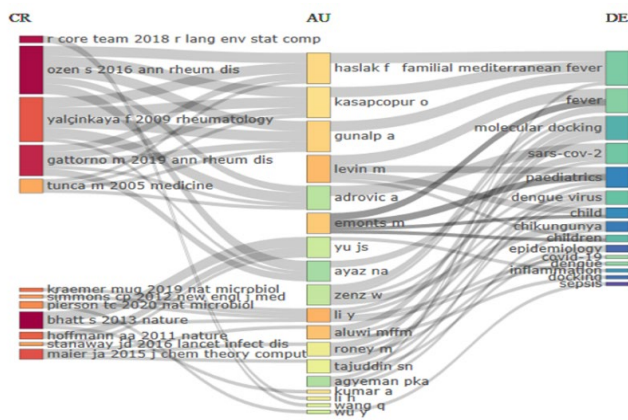

Figure 4. Three field Plot

Both the percentage of multiple country publications (MCP) and the percentage of single country publications (SCP) have been used to illustrate international collaboration. According to Sweileh, Sawalha, Al-Jabi, et al. (2016), the MCP stands for inter-country collaboration, whilst the SCP symbolizes intra-country collaboration. While the USA has the biggest number of articles among many countries, China is ranked first. Furthermore, Figure 5 indicates that the MCP ratios of the United States, China, India, Germany, and the United Kingdom are higher. These nations collaborate more, or perhaps they have good financing options to draw papers and other collaborative research activities. In terms of production per nation, India comes in third.
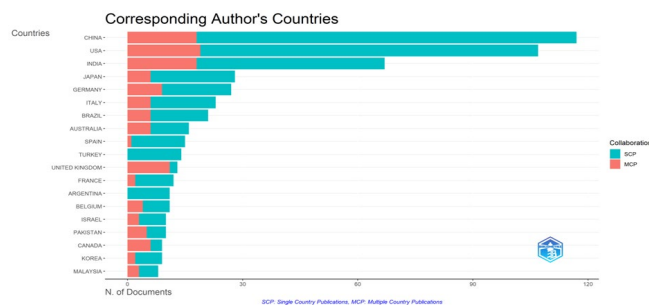

Figure 5. Collaboration of Author Countries

As seen in Figure 6, we generated a frequency distribution using the authors' supplied keywords. "Infection (42)," "fever (39)," "children(36)," "disease(34)," and "dengue(31)" are the pertinent terms that come up. Risk, virus, management, diagnosis, efficacy, and a few more related terms come next. To perform data mining and data analysis on the high frequency keywords of the study papers, keywords with a word frequency of 10 or above were chosen and created as a word Tree Map using the Biblioshiny application (Figure 6). According to the chart, some of the most often used terms when researching the relationship between dengue and fever are infection, fever, children, disease, and dengue.
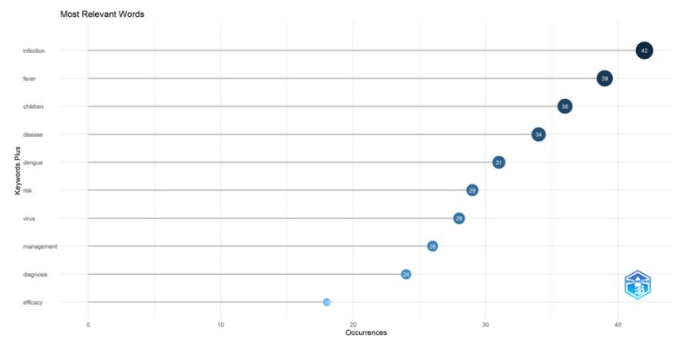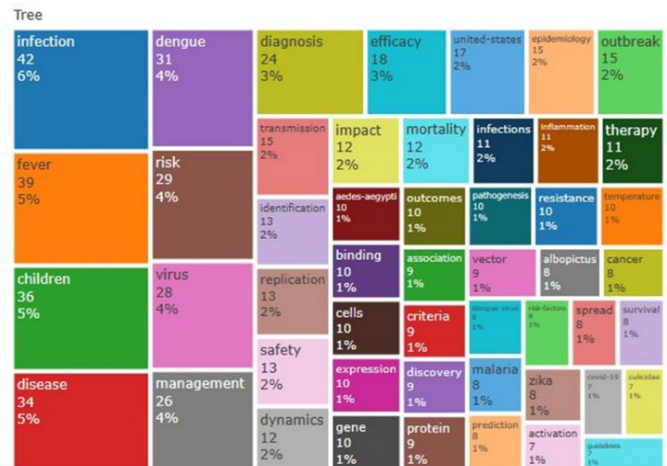

Figure 6. Most Relevant Words

Figure 7. Tree Map Analysis

Bradford's law was applied to predict which journals will publish articles about dengue fever. According to Bradford's 1948 idea, there are a few extraordinarily productive journals, a greater number of midding producers, and an even greater number of journals with steadily declining output for each topic area. The articles that are most commonly cited in this field's study are displayed in the core source section, which increases the likelihood that disciplinary scholars will find them interesting. The European Journal of Pediatrics, Biomolecular Structure & Dynamics, and Microbiology Spectrum
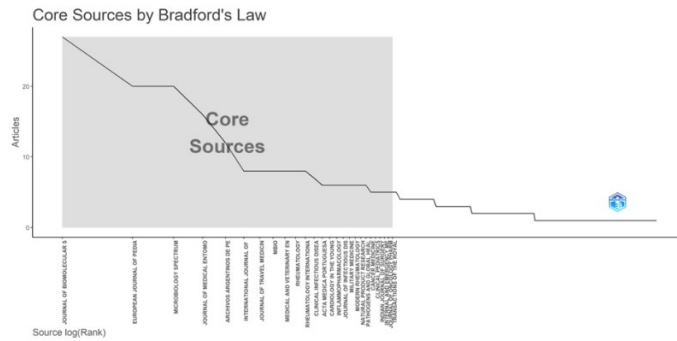
Figure 8. Bradford's Law

The "driving" motifs are important for more study because of their great density and prominence in the upper right quadrant. The themes "transmission," "spotted fever," and "ticks," which are underrepresented in the top left quadrant and have a high density but low centrality, imply that they are still in the early stages of development. The lower left quadrant has terms like "immunogenicity," "acetaminophen," "clinical features," and "pharyngitis." Although these ideas have been employed, their density and importance suggest a tendency toward decline. Last but not least, the lower right quadrant displays fundamental themes with high centrality but low density; these subjects, which include "disease," "children," and "fever," are important for examination as broad issues.
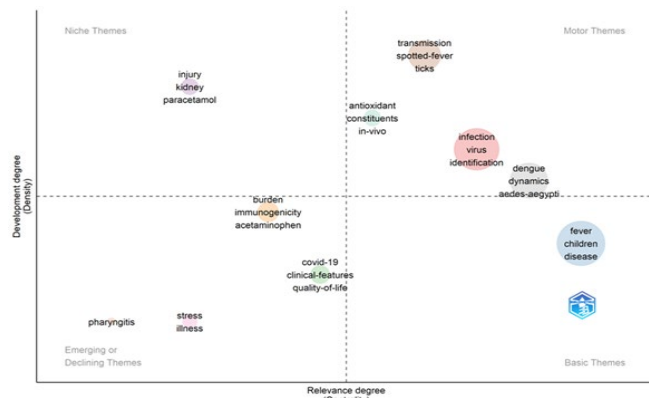

Figure 9. Thematic Analysis

5.   CONCLUSION

In this study, we conducted a comprehensive bibliometric analysis on Dengue Fever Prediction, uncovering key patterns and developments in this area. The analysis utilized data from the Web of Science, one of the most widely used and reliable academic databases. The findings highlight an increasing trend in publications post-2022, reflecting growing academic and societal interest in this field. The upward linear trend in the annual number of publications underscores its significance as a burgeoning research topic.

The *Journal of Biomolecular Structure & Dynamics* emerged as a leading platform for relevant publications linking dengue and fever. Figure 11 illustrates Sankey diagrams depicting the top 10 cited references, authors, and author keywords, showcasing their primary contributions to dengue-related research. Notably, keywords such as *Mediterranean Fever*, *Fever*, and *Molecular Docking* were identified as particularly influential. The diagram's link thickness signifies a robust flow of information among key values.

Our analysis also examined publication outputs by country, revealing that China leads in single-country publications, while the USA dominates multi-country collaborations. Together with India, these countries drive global research productivity in this field. However, India's third-place ranking in single-country output suggests limited international collaboration, as much of its research is self-published. Keyword analysis revealed *Infection*, *Fever*, and *Children* as the most commonly used terms in dengue-related research, reflecting key focus areas.

The three most productive journals in this field were identified as the *Journal of Biomolecular Structure & Dynamics*, the *European Journal of Pediatrics*, and *Microbiology Spectrum*. Thematic mapping of keywords showed under-researched areas like *Transmission*, *Spotted-fever*, and *Ticks*. These topics exhibit high density but low centrality, indicating they are nascent and warrant further exploration to drive research advancement.

6.   LIMITATIONS

This study has some limitations. First, we relied exclusively on the Web of Science Core Collection (WoSCC) for data. While WoSCC is a comprehensive and multidisciplinary database, using a single source introduces potential bias and may not fully capture the breadth of literature in this field. Additionally, the list of keywords used for document retrieval may not be exhaustive, despite referencing relevant literature and books. Some generic keywords, like "binding," were excluded as they lacked specificity or relevance to subfields, limiting their analytic value.

Another limitation is the focus on high-impact publications, which may overlook the originality and recency of less-cited works. This approach is typical in bibliometric studies but may underrepresent emerging research trends. For the first time, this study employed bibliometric techniques to summarize all publications on machine learning in Dengue Fever Prediction, offering insights into the evolution of this domain since 2011.

7.   FUTURE DIRECTIONS

To further advance this field, future studies should explore broader applications of artificial intelligence (AI) in dengue prediction, integrate data from multiple databases, and emphasize real-world clinical applications using multimodal data. Expanding this analysis to include diverse methodologies and international collaborations could also enrich findings.

Despite significant advancements in understanding dengue's etiology, pathogenesis, and management, the disease continues to pose challenges, particularly regarding its comorbidity and impact on health-related quality of life. This bibliometric analysis provides a foundation for strategizing future research and publication efforts, with the ultimate aim of improving dengue prevention and treatment.

REFERENCES

[1.] Anno, S., Hara, T., Kai, H., Lee, M. A., Chang, Y., & Oyoshi, K. (2019). Spatiotemporal dengue fever hotspots associated with climatic factors in Taiwan including outbreak predictions based on machine-learning. *Global Health*, *14*(2). https://doi.org/10.4081/gh.2019.771

[2.] Guo P, Liu T, Zhang Q, Wang L, Xiao J, Zhang Q, et al. (2017) Developing a dengue forecast model using machine learning: A case study in China. PLoS Negl Trop Dis 11(10): e0005973. https://doi.org/10.1371/journal.pntd.0005973

[3.] Rajapakse, S., Rodrigo, C., & Rajapakse, A. (2012). Treatment of dengue fever. *Infection and Drug Resistance, 5*, 103-112. https://doi.org/10.2147/IDR.S21435

[4.] Wiwanitkit, V. (2014). Dengue fever: Diagnosis and treatment. *Expert Review of Anti-infective Therapy, 12*(7), 841-845. https://doi.org/10.1586/eri.10.53

[5.] Effler, P. V., et al. (2005). Dengue fever, Hawaii, 2001–2002. *Emerging Infectious Diseases*, 11(5), 742–749. https://doi.org/10.3201/eid1105.041063

[6.] Khetarpal, N., & Khanna, I. (2016). Dengue fever: Causes, complications, and vaccine strategies. *Journal of Immunology Research*, 2016, 6803098. https://doi.org/10.1155/2016/6803098

[7.] Tantawichien, T. (2013). Dengue fever and dengue haemorrhagic fever in adolescents and adults. *International Journal of Infectious Diseases*, 22-27. https://doi.org/10.1179/2046904712Z.00000000049

[8.] Maula, A. W., Fuad, A., & Utarini, A. (2018). Ten-years trend of dengue research in Indonesia and South-east Asian countries: A bibliometric analysis. *Global Health Action, 11*(1), 1504398. https://doi.org/10.1080/16549716.2018.1504398

[9.] Ho, Y.-S., Siu, E., & Chuang, K.-Y. (2016). A bibliometric analysis of dengue-related publications in the Science Citation Index Expanded. *Future Virology, 11*(10), 631–648.

[10.] Derouich, M., Boutayeb, A., & Twizell, E. H. (2003). A model of dengue fever. *Biomedical Engineering OnLine, 2*(1), Article 4. https://doi.org/10.1186/1475-925X-2-4

[11.] Venkata Sai, P. M., Dev, B., & Krishnan, R. S. (2005). Role of ultrasound in dengue fever. *British Journal of Radiology, 78*(929), 416–418. https://doi.org/10.1259/bjr/54704044

[12.] Wahid, S. F. A., Sanusi, S., Zawawi, M. M., & Ali, R. A. (2000). A comparison of the pattern of liver involvement in dengue hemorrhagic fever with classic dengue fever. *Southeast Asian Journal of Tropical Medicine and Public Health, 31*(2), 259–263.

[13.] Gubler, D. J. (1998). Dengue and dengue hemorrhagic fever. *Clinical Microbiology Reviews, 11*(3), 480–496. https://doi.org/10.1128/cmr.11.3.480

[14.] Jelinek, T. (2000). Dengue fever in international travelers. *Clinical Infectious Diseases, 31*(1), 144–147. https://doi.org/10.1086/313889

[15.] Sweileh, W. M., Al-Jabi, S. W., Sawalha, A. F., & Zyoud, S. H. (2016). Bibliometric profile of the global scientific research on autism spectrum disorders. SpringerPlus, 5(1), 1480. https://doi.org/10.1186/s40064-016-3165-6

Mindful Consumption of used Fashion Apparel among GenZ on Thrift Stores: Theorizing Relationship as a Construct

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ABSTRACT

The COVID-19 pandemic has fuelled Gen Z to spend more time online on various Social Networking Sites. This study proposes that relationship as a construct contributes to mindful consumption to measure the sustainable consumption of used fashion apparel among Gen Z through web platforms, commonly called online thrifting. Thrifting is a means of shopping at a thrift store, garage sale, or flea market where gently used items at discounted prices are obtained. With internet disruption, this business model is scaled to a digital platform with names like e-commerce market, social networking sites and omni-channel platforms. This research adopts the definition of smart living to represent the use of any digital platform or application (app) that can be leveraged to for seeking reused fashion apparel. Smart living moderates the relationship between mindful consumption and the effect variable, sustainable consumption. Qualitative research technique, Grounded theory is adopted to gain respondent insights and further to theorize the dimension of relationship. Three sets of primary data are collected; focus group, in-depth interviews and questionnaire forms. The researchers validated the data independently and with discussions collated the constructs. The results demonstrate that Gen Z preferred to purchase used apparel in cognizance with the variables of the relationship construct and further propose a conceptual framework illustrating the variables of the construct relationship on sustainable consumption. This research contributes to practitioners in understanding the importance of relationship as a construct to measure young cohorts perception towards reused fashion and habits towards adopting mindful consumption leading to sustainable consumption.

Keywords: Relationship as a construct, Grounded theory, Online thrift, stores, Sustainable consumption.

1. INTRODUCTION

Thrift stores are gaining online traction on social media platforms due to their reach, richness and reliability. Reach, due to the number of Gen Z on social media platforms. Richness owing to the images, audio, and video media to present the resold product and reliability as the Social Networking Sites (SNS) (Facebook, Instagram etc.) are free digital platforms and interacations are peer to peer (P2P) with high engagement.

SNS like Instagram acts as an intervention to enhance thrifting behaviour and therefore stoke up sustainable consumption as an attitude and lifestyle (Lee and Chow, 2020). These digital platforms are not only social networking sites, for example Instagram thrift store is also an online platform where people have access to thrift, pre-owned and upcycled items of clothing and accessories. Instagram thrift stores have become a great medium for people to get interesting pieces (Shrivastava et al., 2021) who might not have access to such stores in their city and shop.

Human action towards urban ecosystems is critical and therefore being a young citizen, Gen Z's perspective towards sustainability is a key lens. Gen Z's outlook as young citizens and their perspective of human actions towards the urban ecosystem is critical for the future. According to Su et al. (2019), Gen Z's increased purchasing power,

understanding of sustainable living, and desire for greater quality of life drive academics to further examine Gen Z's purchasing intention. More importantly such an action from young cohorts as Veleva (2021) positions that it overcomes the vicious cycle, where the stylish but cheap garment that degrades and reduces landfills and making consumers buy less.

Most research have studied many generations who have used SNS and its impact on their wellbeing for mostly its negative impact, however the digital natives are raised using these digital tools (Sultan et al., 2023). Lim (2017) states that although enough research exists in all domains as to how consumers choose sustainable products, there is insufficient research in understanding how society could be motivated towards sustainable patterns of consumption. The United Nations website noted that the growth of the world's population and production, combined with unsustainable consumption patterns, is putting increasing pressure on the earth's life-sustaining capacities (UNEP, 1987). Considering sustainable development to be the end goal of the United Nation's plan for the planet many countries have agreed to achieve the sustainable development goals (SDGs) (Linnér and Selin 2013; Bexell and Jönsson, 2017). Achieving economic growth and sustainable development requires that we urgently reduce our ecological footprint by changing the way we produce and consume goods and resources states

UNEP. McKinsey sustainability report (2016) points to some alarming shifts in fashion

retailing, across nearly all apparel categories consumers are using clothing only for half the time compared to 15 years ago when a low-priced garment does not last beyond seven to eight wears. More than ever, we need to make an urgent plea for a co-responsible, balanced, and wise way of living by intervening in postmodern lifestyle and consumer behaviour patterns inside the modern society (Lubowiecki-Vikuk et al., 2021).

This research contributes to the development of a preliminary research framework for studying morals & values and faith & belief. Young cohorts' purchase intention towards sustainable re-used apparel in an urban ecosystem. Will technology such as Social Networking Sites (SNS) impact the attitude of GenZ towards thrifting leading to sustainable consumption? The primary research question being addressed is, will reusing fashion apparel become a sustainable lifestyle habit among the GenZ?

In this research context, Gen Z will be the lens as they are the future generation. The proposed research paper is structured as follows; the section two proposes a theory to develop the construct relationship to measure its impact on SC. Generational cohort and their purchasing intention towards reused apparel on SNS and its impact on mindfulness leading to sustainable consumption. The research gap briefly describes the reason for this research. The methodology section describes the qualitative research design and analyses the primary data obtained through in-depth, focus group (FG) studies and questionnaire survey with the literature. Further data is validated by the researchers independently and collated to draw up the findings of the *relationship* construct and its influence on *mindful consumption*. This section proposes that digital platforms, defined as *smart living* moderates the constructs mindful consumption and the effect variable sustainble consumption (SC). The research concludes by stating the implications of the research for academia, policy makers and practitioners. The next section describes the limitations of the research and the final section summarises the impact of relationship constructs on mindful consumption leading to sustainable consumption behaviour among Gen Z using social media platforms such as Instagram to purchase reused fashion apparel and recommends for future research.

2. CONCEPTUALIZING THE CONSTRUCT RELATIONSHIP: GEN Z'S PERSPECTIVE

Sustainable Consumption (SC) a solution to Sustainable Development (SD) (Lim, 2017) is shaping and satisfying consumer needs to continuously reduce negative impact of consumption on the environment and the wider society (Tunn et al., 2019). Consumer, demand side is considered in this research over supply side as (Nayak, 2016) argues that relationship is a human endeavour and engagement in

sustainability stems from their nature and state of *relationships*. Hence the premise of this research is drawn from the argument that *relationship* should be explored from the perspective of end consumers. At the micro level, SC research aims to reduce or refine consumption practices from the demand side (Haider et al., 2022). A micro-level analysis lens for mindful consumption expedites a sustainable lifestyle that inspires sustainable consumption needs to consider the volatile actor; the human in a central role due to the interdependence of living and non-living (Nayak, 2017).

Relationship

The construct relationship is influenced by measures of "(…*sense of interdependence, notion of wellbeing, mental construct, morals and values and faith and belief. The five factors of the relationship dimension address relationships at different levels, Nayak, 2016, pp. 6)*". Additionally, this research applies the lens of micro-level analysis of sustainability (Nayak, 2016).

The following section explores the interlinkages between the measures. Abundant research has catered to the study of SC from a "rational and scientific perspective" (Nayak, 2016). The author however argues for the consideration of values as a foundation that can be a stimulus to sustainability at the micro level. Watkins et al. (2016) state the need to analyse the consumers' morals and beliefs in the context of SC as it necessitates the need for behavioural change. Milne et al. (2020) explores the impact of mindful consumption (MC) and proposes three broad views. Further their research states that such a consumer could belong to three segments where first the consumer can make conscious consumption decisions, second they are aware of the needs and wants and then makes choice decisions rather than impulsive decisions and finally they completely understand the process of the impact of the products on the environment and therefore their MC decisions are all about changing the consumption habits for individual and societal wellbeing.

The volatile consumers or actors in this context are Generation Z. "They are born after 1995, and they live in an era of economic crisis and technological evolution. They have an eight-second attention threshold in which they can decide what is interesting and what is not for them, Gazzola, Pavione, Pezzetti and Grechi, 2020, pp. 8)". Furthermore, they are currently entering the workforce and are smart with the usage of technology (Sultan et al., 2023).

GenZs engagement with the community: Sense of interdependence

The growth of the digital landscape and its influence on e-commerce and online purchase and engagement of consumers through digital marketing on SNS (Gazzola et. al., 2020) has impacted the fashion and retail industry. One of the key drivers in consumers' purchase of apparel is their attention towards sustainability and circular economy, however, the growing emergence of fast fashion due to the

demand from consumers has led to an impact on the natural ecosystem (Gazzola et al, 2020).

GenZ as a conscious customer: Notion of well being

To increase sustainability in lifestyle it is important to understand well-being based on relations between society, humans and overall societal orientation altering from wealth and capital to *notion of wellbeing* which consumers perceive as considerably more important than wealth (Helne and Hirvilammi, 2015).

GenZ's cognitive influence: Mental construct

Education, training and experience shape our *mental construct.* Training enhances GenZ's to think about their consuming habits, cause and impacts of consumption and explore the ethical aspect of reducing the social and ecological impacts of human activities (Heiss and Marras 2009; Huckle and Wals 2015).

GenZ's orintation to Value system: Morals & Values and Faith & belief are the ideas

that moral concern has a great impact on clothing purchasing decisions among GenZ, they were more motivated to resist desires, crucial when making the decision when moral considerations were activated (Nielsen and Hofmann 2021). The significance of morality is to encourage more ethical and ecological purchase choices. See Table I for the operational definition of constructs of the dimension *Relationship* (Nayak, 2016).

Mindful consumption is the application of mindfulness to inform the choices consumers make in the world. The application of mindfulness through mindful consumption is one approach advocated to change society, the marketplace, and individual well-being. When mindful consumption is viewed as a process it requires consumers to pay attention to their bodily sensations, thoughts, and emotions with the attitude of acceptance as an ongoing process of inquiry to make consumption choices that are based on one's direct experience of needs, values, and insight (Bahl et al., 2016).

Used fashion Online thrift stores spurs sustainable consumotion: Smart living

Second-hand shopping intensively supports a sustainable lifestyle. A sustainable lifestyle is more than simple routines and conducts, is more about the expression of the identified pattern of thinking, being, and acting integrated with sociological realities (Böhme, Walsh, & Wamsler, 2022). Lubowiecki-Vikuk, Dąbrowska, & Machnik (2021) propose *smart living* as a process where the consumer will employ new technology to pursue a stress, hassle free life as part of their integral everyday life. Due to this, their access to internet-based information about products and services has led to informed decision-making. Social shopping, a trend in Western and European nations is gathering awareness and acceptance in emerging nations. Young cohorts on these

social platforms are part of virtual groups, have conversations, and are influenced by opinion leaders commonly called influencers, leading to academia referring to this as *smart living.*

Does mindful consumption lead to sustainable consumption (SC)?

A sustainable lifestyle is a specific set of practices that the participants attempt to take on and reduce their impacts on the environment and other people (Dimitrova et al., 2021).

Sustainable consumption is the use of goods and related products which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations (Norwegian Ministry of Environment, 1994, cited in OECD, 2002).
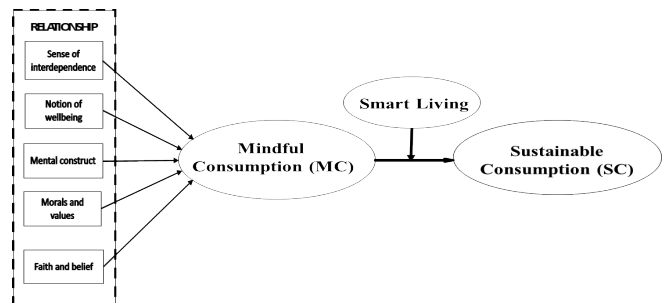

Figure I: A conceptual model to analyse relationship as a construct on Instagram thrift stores

3.   RESEARCH GAP IDENTIFICATION

Most research papers conceptualize SC with theoretical perspectives that are drawn from behavioural and psychological dimensions. However, in the actions towards SC on the role of humans, the consumer who represents the demand side is ignored in literature. Hence understanding their perception towards used fashion in the cultural context of *relationship* is important. This study conceptualizes the construct *relationship* through variables; sense of interdependence, notion of wellbeing, mental construct, morals &values and faith&belief to understand if consumers culture leads to mindful and sustainable consumption.

4.   METHODOLOGY

This paper adopts a qualitative research methodology to gain insights and meanings and explore the phenomenon of the impact of mindful consumption of used fashion apparel by GenZ on the relationships on sustainable consumption. To address the key objective of theorizing the construct relationship, a micro level research analysis is conducted using qualitative data. The analysis is grounded-on Reynold's (1971) research-to-theory strategy that rests on analysing the phenomenon. Further, this research proposes to ideate the first stage, conceptual development, and

operationalization. The latter stages which are confirmation or disconfirmation, and application (Lynham, 2002) are beyond the scope of this research.

Purposive sampling technique is used in selecting the respondents for the qualitative study. This sampling technique is adopted by researchers to deliberately include "outliers" to enable the selection of those respondents who may add value and insights (Barbour, 2001). The respondents from two different levels of the university are selected to use the constant comparative method to enable comparison between the two cohort groups (Barbour, 2001). The qualitative research technique is adopted in the exploratory stage of research to gain insights from the respondents and incorporate any other dimension, construct or variable to be tested further to theorize the dimension of relationship towards purchase intention of thrift fashion among GenZ in India leading to sustainable consumption.

5. ANALYSIS AND DISCUSSION

TABLE 1: Operational Definitions of Measures for Relationship as a Construct

Constructs	Definitions (Nayak, 2016)	Operational definition (analysis)
Sense of interdependence	A sense of interdependence is an outcome of the relationship with neighbours and in one's small community, other life and matter in one's ecosystem	A sense of interdependence is an outcome of the relationship with friends on SNS community and SNS ecosystem
Notion of wellbeing	The notion of wellbeing is the overall societal orientation towards what is perceived as capital and wealth	The notion of wellbeing is the overall societal orientation towards mindful decisions while using smart living tools like SNS and applications
Mental construct	An outcome of our education, training, and experience	An outcome enhanced education, training, and experience through SNS
Morals & Values	Morals and values are an outcome of relationships at a family level	Morals and values are an outcome of relationships at a family level and SNS friends community
Faith & belief	Faith and belief are at the core of an individual.	Faith and belief are at the core of an individual and influenced through SNS

Qualitative data collected from the research participants included. Three sets of data from in-depth interviews and questionnaire forms were created to collect basic demographic data through e-mail. The researchers asked the following questions; are you aware of online second-hand / used fashion apparel/ thrifts store online and the preliminary data are collected from students (43) and working (10) who are undergoing undergraduate (BBA and sports) among the postgraduate students (PG) of the MBA program two sets of focus group (FG) studies were conducted with ten in first FG and eight respondents in the second FG study. The data was collected in January 2023 and illustrated in Table 2. 9

TABLE 2: Demographic summary

Data Set	Data collection method	No. of respondents	Student (S) /Employed (E)	Aware of second hand / Used fashion apparel		Purchase intention second hand / used fashion apparel		
				Yes	No	Yes	No	May Be
Set-1	In-depth interview (in persons)	12	S	8	4	5	3	4
Set-2	In-depth interview (Google form)	41	S-31, E-10	28	13	5	15	21
Set-3	Focus Group	2 groups	S	22	0	5	14	0

Data validation

The two researchers validated the data independently and coded the empirical indicators by analysing the three data sets as illustrated in Annexure 1. The researchers decided that data that was incoherent and those that did not contain more than a line as an answer to the interview question asked were deleted as they did not add any value to the data analysis. Hence the results depict that GenZ preferred to purchase used or second-hand apparel for the reasons illustrated in Table 3. A few respondent statements as documented in column three align with the five factors describing the concept; Relationship. The secondary data obtained through literature validated the primary qualitative research.

Hence GenZ has a high awareness of the consequences of fast fashion on the ecosystem. As a consequence, their *sense of interdependence* conforms to the stated definition. The factor *notion of well-being* is indicated through statements such as if a special occasion demanded premium wear they preferred to rent it for the occasion rather than buy or own it.

Consciousness towards hygiene and cleanliness of the used apparel is a major concern among the respondents. Majority of respondents are emphatic in mentioning the word "NO" to used apparel bought on-line. However, they are willing to purchase them in physical stores. The GenZ are highly knowledge able about the online thrift stores to the extent of seeking information about the details of the product and would prefer rentals, certification of authenticity and prefer to own as a memorabilia.

This explains the respondent's *mental construct*. The key element of the analysis was the influence of the factors' morals & values and faith & belief. During the focus group

studies their personal expression of preference to "OWN" was highly unequivocal. The emphasis of family-oriented values was more visible among the post-graduate students over the undergraduate students. Even though they are aware of the thrift stores as a medium for sustainability their family and personal values and beliefs did not permit the GenZ from using used fashion apparels. The results are in cognizance with study conducted in Italy a developed country (Gazzola et al., 2020) state that economically weaker sections of consumers who cannot afford to buy new clothes tend to purchase used apparels from second-hand stores and point that in developed countries second-handfashion market is niche.

TABLE 3: Data analysis summary

Constructs	Definitions	Literature review statements	Citation	Respondent statements
Sense of interdependence	A sense of interdependence is an outcome of the relationship with neighbours and in one's small community, other life and matter in one's ecosystem	People Reported that there **lifestyles' have a great impact on environment** because they do more number of environmental prctices. "... sustainable consumption to include **changes to consumption behaviour** that can **include socially or ecologically inspired choices to consume** (or not to)..." "Negotiating sustainability at the **community** level – the level where policies are made"	Defra (2007) Peattie & Collins (2009) Goel & Sivam (2015)	I would buy it mostly **because it is good for the environment**, because **atleast a portion of the clothes are getting reused** and they **dont add up to the landfill**… Can find more affordable high end items.It **helps to decrease environmental impact**...
Notion of wellbeing	The notion of wellbeing is the overall societal orientation towards what is perceived as capital and wealth	"To increase the chances of a transition to sustainability, it is necessary to enrich the understanding of wellbeing on the basis of a **relational paradigm, in which the dependency of human wellbeing on the health of the ecosystems** is internalized." **Notion of wellbeing is defined by socio-technical innovations.**	Helne and Hirvilammi (2015) **Mont et.al. (2014)**	I want to became a dancer by profession. I may buy as a costume **if quality and price satisfied me** If I get a good deal. **Cost also matters**.
		"… motivating more sustainable consumption concerns efforts to **communicate with consumers in order to inform** them about the social and environmental consequences of their consumption behaviours …". "The **eco-labels** concept suggests environmental sustainability through substituting purchases leading to more sustainable consumption."	Peattie & Collins (2009) Horne (2009)	They should have good products and offer unique product , **good communication trustworthy**.
Mental construct	An outcome of our education, training, and experience	"...(online) communication among consumers themselves, and how this might be an important mechanism to allow new ideas about sustainable lifestyles** and consumer citizenship to be developed and disseminated. " "... **communication to consider how community-orientated campaigns** using alternative media (in this case, community news media) can generate understanding about, and support for, sustainable consumption." "**... advance learning settings that effectively address both cognitive and affective learning outcomes and promote a reflexive engagement with sustainable consumption challenges.**" "...consumers pursuing a more frugal lifestyle as a reflection of their personal	Peattie & Collins (2009) Peattie & Collins (2009) Peattie & Collins (2009). Lundblad & Davies (2016)	…They should have good products and offer unique product , **good communication trustworthy**. I will purchase them if they are **rare** and cheaper, **I myself own one of these pages**. ...**researched** values of not sharing personal accessoreis and clothing… I prefer **not buy or share** as it is a **strict NO by mother at home**

Constructs	Definitions	Literature review statements	Citation	Respondent statements
		values and search…"		
Morals & Values	Morals and values are an outcome of relationships at a family level	"the research objective of this paper is to explore the values and motivations underpinning frequent sustainable fashion consumption." "... sustainable intention formation is closely linked to altruistic values and long-term perspectives." **"... utilitarian values, such as saving money and maximizing utility, are still the dominant factors in consumers' decisions to pursue access-based consumption such as online fashion renting ...**	Lundblad & Davies (2016) Bauer et. al. (2018) Lee, & Chow **(2020)**	**...Family and self taught** and researched **values** of **not sharing personal accessoreis and clothing** due to association of ENERGY with the cloth or accessory **family value** I would not share or borrow...
Faith & belief	Faith and belief are at the core of an individual.	Some **belief** that can prevent people from acting in an environmentally responcible manner. **"An element of self-consciousness and self- actualization appears to reside within mindful consumption; …"**	Defra. (2007) **Lim (2017)**	I would not buy from Thrift stores as a **personal choice** as **I do not believe** in buying rental apparels I prefer to own my premium fashion apparel as **I do not believe in used or rentals**. wouldn't mind lending but **personally value** I would not share or borrow

TABLE 4: Glossary of key variables reviewed from Literature and through Primary research

Sense of interdependence	Notion of wellbeing			Mental construct	Morals & Values		Faith & belief	
Literature Review Primary Research Key Word Citation Key word	Literature Review Key Word	Citation	Primary Research Key word	Literature Review Primary Research Key Citation Key word Word	Literature Review Key Word	Citation	Primary Research Key word	Literature Key Word Review	Citation	Primary Research Key word
Environment Defra (2007) Environment	eco-system	Helne & Hirvilam mi, 2015	quality	communic communic ation and ation Collins (2009) Peattiea	Personal values	Peattie & Collins (2009)	Family values	Belief	Defra. (2007).	personal choice
Social Peattie & reused Collins (2009)	Socio-technical innovation	Mont et.al. (2014).	price	eco-labels Horne (2009) friends	altruistic values	Bauer et. al. (2018)		self-consiousness	Lim,(2017	personal beliefs
Ecological			good deal	Advance Stanszus family learning et.al. (2017)	utilitarian values	Lee & Chow (2020)		self-actualisation	)	
Community Goel & Sivam (2015)				Website self tought						

6. IMPLICATIONS

To the academia this research contributes in understanding buying behaviour of the future generation and theorizes *relationship* as a dimension and validates the factors of the concept *relationship* using qualitative research. Hardly any research has applied relationship as a construct to measure the effect variable, SC. To the policy makers an understanding of Gen Z buying habits enables in designing policies in conformance to UNSDG's such as designing policies for business operating in reused and sustainable fashion business sector on SNS and online. Develop strict quality policy measures on fashion retailers selling fast fashion brands on digital platforms. Further practitioners of small business will find insights of SC among Gen Z, their market segment and design marketing plan for online used fashion.

7. LIMITATIONS

A limitation of this research is to enhance its rigour using qualitative software to enhance the rigour of data analysis and adopt mixed method research to test the developed scale and measure the causal construct relationship and its effect on SC.

8. FURTHER RESEARCH AGENDA

The concept of relationship is theorized and its factors are validated using qualitative research. The results obtained through analysis are consistent with the obtained primary

data. An exploratory conceptual model is proposed and operationalized using qualitative research which will be confirmed in future through empirical research. The research proposes to use mixed-method research and further test the proposed framework with an empirical study. Gazzola et al. (2020) state that future research can use Millennials as respondents as Millennials and Gen Z are custodians of green in fashion. 22

9.   DECLARATION

I, Jessy Nair, hereby confirm that the manuscript titled "Mindful consumption of used fashion apparel among GenZ on Thrift Stores: Theorizing Relationship as a construct" authored by Jessy Nair and Rasmita Panda, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspectives Conference 2025 (IMPeC 2025).

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required. 4

REFERENCES

[1.] Bahl, S., Milne, G.R., Ross, S.M., Mick, D.G., Grier, S.A., Chugani, S.K., Chan, S.S., Gould, S., Cho, Y.N., Dorsey, J.D. & Schindler, R.M. (2016). "Mindfulness: Its transformative potential for consumer, societal, and environmental well-being," *Journal of Public Policy & Marketing, 35* (2), 198-210.

[2.] Barbour, R. S. (2001). Checklists for improving rigour in qualitative research: a case of the tail wagging the dog?, *BMJ, 322* (7294), 1115-1117.

[3.] Bexell, M., & Jönsson, K. 2017, January. "Responsibility and the United Nations' sustainable development goals", In *Forum for development studies, 44* (1), pp. 13-29.

[4.] Böhme, J., Walsh, Z., & Wamsler, C. (2022). Sustainable lifestyles: towards a relational approach, *Sustainability science, 17*(5), 2063-2076.

[5.] Defra, D. (2007). Securing a healthy natural environment: An action plan for embedding an ecosystems approach, Department for Environment Food and Rural

[6.] Affairs, London. Available at: http://www.defra.gov.uk/wildlifecountryside/pdf/natural-environ/eco-actionplan.pdf , accessed 20 April 2009.

[7.] Dimitrova, A., Vaishar, A., & Šťastná, M. (2021). Preparedness of young people for a sustainable lifestyle: Awareness and willingness, *Sustainability, 13* (13), 7204.

[8.] Gazzola, P., Pavione, E., Pezzetti, R., & Grechi, D.(2020). Trends in the fashion industry. The perception of sustainability and circular economy: A gender/generation quantitative approach, *Sustainability, 12* (7), 2809.

[9.] Haider, M., Shannon, R., & Moschis, G. P. (2022). Sustainable Consumption Research and the Role of Marketing: A Review of the Literature (1976–2021), *Sustainability, 14*(7), 3999. https://doi.org/10.3390/su14073999

[10.] Heiss, J., and Marras, I. (2009). Educating and engaging youth in sustainable consumption: YouthXchange programme, *Young people, education, and sustainable development: Exploring principles, perspectives, and praxis*, 181-189.

[11.] Helne, T., & Hirvilammi, T. (2015). Wellbeing and sustainability: A relational approach, *Sustainable Development, 23* (3), 167-175.

[12.] Huckle, J., & Wals, A. E. 2015. The UN Decade of Education for Sustainable Development: business as usual in the end, *Environmental Education Research, 21* (3), 491-505.

[13.] Lee, S. H., & Chow, P. S. 2020. Investigating consumer attitudes and intentions toward online fashion renting retailing, *Journal of Retailing and Consumer Services, 52*, 101892.

[14.] Lim, W. M. (2017). Inside the sustainable consumption theoretical toolbox: Critical concepts for sustainability, consumption, and marketing. *Journal of Business Research, 78*, 69-80.

[15.] Linnér, B. O., and Selin, H. (2013). The United Nations Conference on Sustainable Development: forty years in the making, *Environment and Planning C: Government and Policy, 31* (6), 971-987.

[16.] Lubowiecki-Vikuk, A., Dąbrowska, A., & Machnik, A.(2021). Responsible consumer and lifestyle: Sustainability insights, *Sustainable production and consumption, 25*, pp. 91-101.

[17.] Lynham, S. A. (2002). The general method of theory-building research in applied disciplines. *Advances in developing human resources, 4*(3), 221-241.

[18.] Milne, G. R., Villarroel Ordenes, F., & Kaplan, B. (2020). Mindful consumption: Three consumer segment views. *Australasian Marketing Journal, 28*(1), 3-10.

[19.] Mendini, M., Peter, P. C., & Maione, S. (2022). The potential positive effects of time spent on Instagram on consumers' gratitude, altruism, and willingness to donate, *Journal of Business Research, 143*, 6-216.

[20.] Nayak, A. K. J. R. (2017). Efficiency, Effectiveness and Sustainability: The Basis of Competition and Cooperation, *Vilakshan, XIMB Journal of Management, 14*(1), 112-118.

[21.] Reynolds, P. D. (1971). *A primer in theory construction*. New York: Macmillan.

[22.] Shrivastava, A., Jain, G., Kamble, S. S., & Belhadi, A. (2021). Sustainability through online renting clothing: Circular fashion fueled by Instagram micro- celebrities. *Journal of Cleaner Production, 278*, 123772.

[23.] Statista (2024). Distribution of Instagram users worldwide as of April 2024, by age group, https://www.statista.com/statistics/325587/instagram-global-age-group/, accessed on 9th December 2024.

[24.] Su, C. H., Tsai, C. H., Chen, M. H., & Lv, W. Q. (2019). US sustainable food market generation Z consumer segments, *Sustainability, 11* (13), 3607.

[25.] Sultan, M., Scholz, C., & van den Bos, W. (2023). Leaving traces behind: Using social media digital trace data to study adolescent wellbeing, *Computers in Human Behavior Reports, 10*, pp. 100281.

[26.] Tunn, V. S., Bocken, N. M., van den Hende, E. A., & Schoormans, J. P. (2019). Business models for sustainable consumption in the circular economy: An expert study, *Journal of cleaner production, 212*, 324-333.

[27.] Veleva, V. (2021). The role of entrepreneurs in advancing sustainable lifestyles: Challenges, impacts, and future opportunities, *Journal of Cleaner Production, 283*, 124658.

[28.] Watkins, L., Aitken, R., & Mather, D. (2016). Conscientious consumers: a relationship between moral foundations, political

orientation and sustainable consumption, *Journal of Cleaner Production*, *134*, 137-146.

[29.] World Commission on Environment and Development, Our common future (New York,1987).

[30.] https://sdgs.un.org/goals/goal12 accessed on 15th September 2022.

[31.] https://www.pwc.in/ceosurvey accessed on 21th August 2022.

[32.] https://www.un.org/sustainabledevelopment/sustainable-consumption-production/accessed on 24th August 2022.

[33.] https://www.statista.com/statistics/325587/instagram-global-agegroup/. Accessed

Annexure I:

TABLE 5: illustrating Three sets of Qualitative data

I will /will not/ may purchase second hand / used premium fashion apparel (thrift store) from digital platforms (e-commerce platform, Instagram, Facebook...) WHY(At least 5 lines)		
Google form (GenZ)	**Post graduate (Business school cohort)**	**Under-graduate (Sports students)**
I would buy it mostly because it is good for the environment, because atleast a portion of the clothes are getting reused and they dont add up to the landfill and also it is quite budget friendly, because the goods are going to be sold at a discounted price, this is a great step towards reducing expenses.

Second handed apparels or used premium fashion apparel from digital platforms will be priced lower than the original price tag by this I can save some money and still buy an apparel that is from a good brand. Also thrifting has become a trend in recent years, wearing vintage and 2000s style clothes has entered the fashion trends. So thrifting can be seen done often to buy 2000s style clothes. I would thrift for both saving money and to try out 2000s and 2010s styles. Sometimes during thrifting very valuable and expensive stuff were sold at really cheap prices, just because it was second handed. Thrifting sometimes becomes a game of 'finding valuable things for cheap'.

Can find more affordable high end items.It helps to decrease environmental impact.There is potentially higher chances of finding something we love.

Thrifting is a great option when it comes to being economical in buying clothes. And as a student i cannot really spend much on the clothes I want to buy. Also I have the option of reselling it if I get bored of it.

Depends on quality

I personally dont like cloths worn by others and passed on except for few cases

I may buy thrifted clothes or fashion apparel if it satisfies my criteria if it's exceptionally good then I MAY think of buying it Orelse I would mostly prefer buying from branded stores or from websites like (Myntra) but not prefer Instagram for shopping

I may purchase from digital platforms depending upon the brand I am purchasing and it also depends on the type of dress I would buy and also the cost involved in purchasing those.

I may buy as they are premium products and may be money saving in second hand than original product

Because as it is pre owned the feeling of the new product will not be there,there might be any damages in the apparel which cannot be returned

When shopping in an actual thrift store, you can see the | prefer to rent for a one time use rather than purchase because of socio cultural factors. Prefer to use / share from immediate family

will not buy, restriction from parents due to hygeine. Rather buy sustainable fashion apparels from known brands – Nishi

First time buy and ownership rather than used apparel, do not buy fashion apparel - Pramod

Hygeine issues would not buy - Veda

Prefer to own rather buy second hand, do not believe in rentals as a concept - Shreyas

used by people, hence would not buy / rent premium apparels = Nikhil

I prefer not buy or share as it is a strict NO by mother at home - Pranav

One time use I prefer to rent rather than buy. If I own it I would prefer to buy even if it is premium - Prasidh

I prefer to own my premium fashion apparel as I do not believe in used or rentals. Family and self taught and researched values of not sharing personal accessoreis and clothing due to association of ENERGY with the cloth or accessory - Vishwas

I would not buy from Thrift stores as a personal choice as I do not believe in buying rental apparels Sagar - Celebrity sports apparels can be bought due to the pride associated with the apparel as a memorablia

No you prefer to own - Supriya, Neha - ownership to the product which I get as satisfaction

Celebrity tag attached to used / rental brand adds value, | if the quality is good and -all good services about the business. They should have good

products and offer unique product , good communication trustworthy website.

I will purchase them if they are rare and cheaper, I myself own one of these pages

ownership

hygiene

I may purchase second hand clothes

I want to became a dancer by profession. I may buy as a costume if quality and price satisfied me

I may purchase second hand clothes which I have to wear for only a single event and won't use anymore. Better to rent for a day.

they would be cheaper and available with my options to choose.

if I get a good deal. Cost also matters. |

condition on the product, which is not possible online.	confidence in the brand. Prefer to buy first hand due to the exquisteness assciated with the first time buy - Yashika	
Personal hygiene and trust issues	One time rental, rather than own as an emergency , awarenss of availability - Yashas	
I would buy used fashion apparel if i want to buy a really expensive brand and i don't want to use it more than once or twice	I prefer not to use premium fashion apparel but if occasions demand I would not mind renting from thrift stores to be part of the occasion - Rakshith	I will purchase if in need. Price will be low and the brand will be same
I may Purchase it. I once tried to get reviews to purchase a second hand apparel for an occasion, however, i didnot buy at that time. Also, I got to know these stores through a friend who knows an online site for these apparels. As, i see it is easier to get Premium clothes at a lower price on a one click go.. i always prefers it. On the other side, i first knew this concept of Trade, online itself. So, i might not hesitate to buy things online , ofcourse with a COD.	Will not - Rishika	
	No, among siblings it is ok, quality - Preet, Swarnim this is not MINE - Neha	trust and quality
	No but would not mind among siblings – Vaibhav would not mind buying for one time use - price, offers, additional information wouldn't mind lending but personally as a family value I would not share or borrow First time buy and ownership rather than used apparel, do not buy fashion apparel - Pramod	
Because we don't know how much they used the product and what reason they are selling the product	Hygeine issues would not buy - Veda	
I may buy	Prefer to own rather buy second hand, do not believe in rentals as a concept – Shreyas used by people, hence would not buy / rent premium apparels = Nikhil	
I have listened about thrift store somewhere, but didn't know about the quality of products but will try and get to know moe. Once there is a liking to it i may continue.	I prefer not buy or share as it is a strict NO by mother at home - Pranav	
Clothes are something which can be bought in second hand because in the western side we have thrift stores. Which help college students or someone who wants buy expensive brands but they couldn't these stores would help. So, If it is available in India I may buy.	One time use I prefer to rent rather than buy. If I own it I would prefer to buy even if it is premium - Prasidh	
	I prefer to own my premium fashion apparel as I do not believe in used or rentals. Family and self taught and researched values of not sharing personal accessoreis and clothing due to association of ENERGY with the cloth or accessory - Vishwas	
Creative designs, export from other state or city sometimes may be country, helping small enterprises for growth, I will	I would not buy from Thrift stores as a personal choice as I do not believe in buying rental apparels Sagar - Celebrity sports apparels can be bought due to the pride associated with the apparel as a memorablia	
I will not buy second hand Ok I have never purchased second hand clothes or used any premium brands in online fashion stores or e-commerce. Because the not last for long and the clothes were used by someone or else they washed clothes that looks new We're not sure about the quality of the product, since i would prefer buying new one rather to second hand.	No you prefer to own - Supriya, Neha - ownership to the product which I get as satisfaction	
	Celebrity tag attached to used / rental brand adds value, confidence in the brand. Prefer to buy first hand due to the exquisteness assciated with the first time buy - Yashika	
I will purchase from thrift store. If the clothes match the vibe and fashion I may buy leather jackets, bags and other accessories.	One time rental, rather than own as an emergency , awarenss of availability - Yashas	
I will not purchase until/ unless i find it good mostly i will not purchase on digitl plat form becauss we cNt even ask if the product has been damaged or not in a good quality. Trust issues	I prefer not to use premium fashion apparel but if occasions demand I would not mind renting from thrift stores to be part of the occasion - Rakshith	
	Will not - Rishika	
We can go through the product when the quality is good even its one time used that was a premium apparel so we can check quality and buy.	No, among siblings it is ok, quality - Preet, Swarnim this is not MINE - Neha	
I will not purchase second hand or used fashion apparel from digital platforms Because of reviews	No but would not mind among siblings – Vaibhav would not mind buying for one time use - price, offers, additional information wouldn't mind lending but personally as a family value I would not share or borrow	
I may buy the products if at all the platform is certified and also considered the rating and all.		
I will not purchase second hand goods is because the main reason is it used and used clothers are uncomfortable to wear		
Low cost and branded maybe buy used/second hand apparel from online thrift stores depending on the price, quality, brand of the product.		

TRACK 6: STRATEGIC MANAGEMENT

Analyzing Housing Features with PCA and SVM for Market Insights

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ABSTRACT

The current study investigates the application of PCA in predicting house prices in India with an emphasis on simplifying high-dimensional data sets. Important factors that affect the prices of properties include the number of bedrooms, living area, proximity to schools, and distance from airports among others. PCA significantly reduces the dimensionality of the data set while preserving crucial information that drives variability in house prices. Support Vector Machines and K-Nearest Neighbors have also been employed here, a bit from the mainstream machine learning modelling. From the results, it has been seen that PCA serves the purpose to the extent of a simple set of features to ensure efficiency in the predictive model, and good classification results by SVM and KNN bring forth essential results for us in terms of knowing primarily what causes variation in geos in real estate prices at Indian level. In literature Survey paper, they have done with 3 models (Random forest, XGBoost, Multiple linear regression) they got accuracy maximum 88.21% and they use PCA only for one Graph show in the results Profile plot, But in our paper we got excellent accuracy for both models (SVM:95.3%, KNN:91.2%) and We use PCA with reparenting in bar graph Variance Explained by Principal component, Score Plot, Scree Plot, Loading and Profile Plot.

Keywords: Principal Component Analysis, MATLAB, Covariance matrix, House prices in India, application of PCA, Support Vector Machines, K-Nearest Neighbors, KNN, dimensionality reduction, predictive modelling, real estate, machine learning.

1. INTRODUCTION

The Indian housing market has witnessed quite fluctuations with rapid urbanization, population growth, an economic shift, and the changing policies of the government. It is a very diversified and complex market with huge regional disparities. Some cities, like Mumbai, Delhi, Bangalore, and Hyderabad, are witnessing very fast growth while other regions are comparatively slower. Dynamics of house prices in India are complex, hence it needs to be understood through considering different demographic trends, infrastructure development, and macroeconomic variables.

Analysis of house prices is highly important to the investors, policymakers, and homebuyers within the diversity of regional markets in India. Investors can make an informed investment decision knowing trends at local markets, for instance how much different prices are between pin codes like Bengaluru's 560035 or Mumbai's 400076. In our Dataset, the postal codes are Haryana. Key factors that determine house values are proximity to primary amenity features, such as school districts and airports. Houses next to a prestigious school or next to an important transportation hub, for instance Indira Gandhi International Airport at Delhi, are also valuable as they are easier and convenient to access.

Among some other important factors which set house prices are living areas, bathrooms, and years since property was constructed. Newly constructed houses, which have sufficient living areas, bathrooms, and other facilities with good locations, are always costlier compared to the older houses situated in less attractive neighborhoods. In this manner, policymakers would design affordable housing strategies better according to diverse needs. Insights obtained through house price analysis also make homebuyers more responsible in deciding which house fits their budget, preferences, and lifestyle. Understanding this extremely complex relationship can help make one's way through this potentially very promising Indian real estate market.

The dataset comes from Kaggle and is titled "House Prices in India." It has a lot of features related to real estate in India, including number of bedrooms, bathrooms, living area, lot size, state of the house, proximity to schools, etc. The general objective is normally to use these features in order to predict the price of a house [5].

Principal Component Analysis(PCA)

Principal Component Analysis is a technique in data analysis and machine learning that is primarily used to reduce the dimensionality of a dataset by capturing most of its variability. Since its invention by Karl Pearson in 1901, application of PCA has found its way into areas such as image processing, finance, genomics, to mention but a few. It turns out very handy in high-dimensional data, where it is hard to visualize or even interpret. PCA simplifies the

analysis while preserving all the important patterns in the transformation of correlated features to a set of linearly uncorrelated principal components .

Mathematical Underpinning

Mathematically, it is the computation of covariance matrix from the data and its eigenvalues and eigenvectors. The eigenvectors give the directions of the maximum variance, and this is called principal components; the corresponding eigenvalues tell us how much variance each of principal components explains. It then makes it possible to reduce data dimensionality by choosing top eigenvectors based on their eigenvalues using PCA, thereby catching most of the important patterns.

Support Vector Machine(SVM)

Support Vector Machine (SVM) is a supervised algorithm that is used in classification and regression. Its goal is to find the best hyperplane, which can distinguish between different classes in the feature space. In house price prediction, SVM categorizes house prices as low, medium, and high. The algorithm projects the data to a higher-dimensional space using the kernel function, which allows it to detect linear separation between classes even when dealing with complex, non-linear datasets. In this project, we used a Radial Basis Function (RBF) kernel to effectively capture the essence of the non-linear housing price distribution .

K-Nearest Neighbor (KNN)

The K-Nearest Neighbor algorithm is very simple yet powerful. It can be used for both classification and regression purposes. This algorithm works on the basis of using the 'k' nearest training examples closest to the point where prediction needs to be done. This approach estimates the price of houses as the average of the prices of the nearest neighbors in feature space once similar properties are identified for predicting house prices. This does not make an assumption regarding the specific underlying distribution of the data, hence very applicable to scenarios where the relationship between the features and the target variable is complex as noted in non-linear cases. Thus, K constitutes a very important hyperparameter that contributes a lot to the efficiency of this model.

2. LITERATURE SURVEY

Conventional Methods in Machine Learning Used for Housing Price Predictions

This research domain has always been of paramount importance for being of interest to different stakeholders such as home buyers, real estate investors, and policymakers. As a result, scientists shifted from traditional statistical methods to advanced machine learning algorithms in their quest to increase the accuracy and reliability of such predictions. The early research work in this area was largely based on statistical methods, mainly on MLR. These models

treated house prices as a function of independent variables, namely the size of the house, location, and number of bedrooms. While MLR could present some fundamental insights into determinants within housing prices, its inability to model non-linear relationships and its poor capability to model such feature interactions resulted in limited potential to predict the complex and volatile characteristics of these housing markets.

The development of machine learning enabled building of models with the capability to identify complex and nonlinear relationships in data. For instance, RF enhanced predictions by combining multiple decision trees into one model, which showed robustness to noise and less overfitting. Like ensemble techniques, XG Boost has been mostly used because it has proven to be efficient for handling large datasets while keeping predictive accuracy high through the optimization of weak models through an iterative process. Unlike traditional approaches, these machine learning algorithms can detect complex interactions within the data, leading to a substantially improved performance.

Role of Principal Component Analysis

PCA is a highly used prediction technique for housing prices, specifically in high-dimensional datasets. This algorithm helps reduce the dimensionality because it transforms the input feature into uncorrelated principal components; hence, it retains most of the variance found in the dataset. That way, it reduces the model's complexity, increases its interpretability, and reduces the possibilities of overfitting. This PCA is used to find what of its factors affecting the houses regarding price, number of bedroom, bathroom, square feet of room, and house grade, etc. In this modeling, some features, which have low variance are excluded so that the complexity and also calculation may be reduced.

Machine learning Models

Based on the previously collected information, PCA and three machine learning models that include MLR, RF, and XGBoost are to be used in the house price prediction. The data set used contains information from King County, Washington, and had 21 features which included continuous variables like square footage and some categorical variables such as having a view of the water. After the above preprocessing steps, such as removal of outliers and feature scaling, PCA was carried out to find some underlying variables that would be used modeling.

The remaining 20% of the dataset was kept for testing and the rest, 80%, was used to train the machine learning models. Among the models, XGBoost performed well overall with accuracy at 88.72%, lowest mean absolute error at 45,406.8, and the smallest residual standard error at 64,916.9. The Random Forest (RF) model also performed well, though its training process took longer, whereas Multiple Linear Regression provided results much quicker but clearly had

inferior accuracy, which was a limitation because it was not good in fitting nonlinear relationships.

This demonstrates that PCA, with such cutting-edge machine learning models turns out to be an effective housing price predictor. This can be done through PCA in features and XGBoost for making predictions showing the scope of these techniques to overcome the complexity seen in the housing market. Thus, ensemble methods are consequently furnished with a technique for dimensionality reduction, which appears to form a strong foundation for research advancement and implementation of such analytical approaches in the real estate sector.

This paper uses the "kc_housing_data.csv" dataset from Kaggle, focusing on Kings County, Washington, USA

3. METHODOLOGY

- Data Importation: Use any suitable data import tool or function to import the data set for house prices in India.

- Data Cleaning: Clean the dataset of any missing values, outliers, and irrelevant variables. It may need data cleaning functions or tools that can identify and remove missing values, replace outliers with appropriate values, and get rid of variables that do not add any value to the analysis.

a. Standardization:

All numerical columns should be standardized so that all variables will have a mean of 0 and a standard deviation of 1. This step is often necessary so that variables are all on the same scale and thus may be compared with each other directly. Standardization can be done through a suitable standardization function or by some tool.

% Importing data

data = readtable('house prices in india.csv')

% Standardize the data

Standardized Numerical Data= zscore (cleaned Numerical Data);

Standardization Formula:

$$z_i = \frac{x_i - \mu_i}{\sigma_i}$$

Equation 1

Where, zi is the standardized value for the i-th feature, x_i is the original value of the i-th feature, μ_i is the mean of the i-th feature, and σ_i is the standard deviation of the i-th feature.

b. Covariance Matrix Calculation:

It is one of the measures applied to indicate the extent to which each variable in the dataset varies with respect to every other. When the two variables have high covariance,

one makes the conclusion that the variables are highly correlated and vice versa with low covariance, which implies that they are not correlated. This is a square matrix, displaying the covariance of different variables against each other in a dataset. It is computed as. This is the covariance matrix; alternatively, it can be represented as.

$$1 / (n-1) * (X - \mu)^T * (X - \mu)$$

Equation 2

Where:
n the number of data points
X matrix of data points
µ the vector for mean for every variable
 T matrix transposition

c. Eigenvalues and Eigenvectors:

Eigenvalues and eigenvectors are the result of the decomposition of a matrix into its principal components. In that sense, eigenvectors correspond to the variances along which the eigenvalues pertain to, and the eigenvectors are the directions of those principal components. Principal components are taken out from derived eigenvectors that point towards high variance directions, and the corresponding magnitudes depict the corresponding relevance of the basic components. The top few highest eigenvalues give the eigenvectors pointing in the most critical principal component directions.

This is the solution to the following mentioned equation where it gives the eigenvalues and eigenvectors of a given matrix.

$$A * v = \lambda * v$$

Equation 3

where,
A is the matrix
v is the eigenvector
λ is the eigenvalue

d. Extracting Feature vector:

Feature Vector extraction is the initial step towards transforming a dataset into a new space defined by the principal components.

The benefit of extracting a feature vector would be that it includes the most important eigenvectors, selected based on their corresponding eigenvalues.

$$W = [v_1\ v_2 \cdots v_k]$$

Equation 4

where, W is the feature vector matrix composed of eigenvectors v_1, v_2, . . ., v_k, sorted by eigenvalues in descending order, and k is the number of principal components to retain.

e. Data Transformation:

After getting the eigenvalues and the corresponding eigenvectors, we continue to transform the data to its principal components .

Z = (X - μ) * V   Equation 5

Where:
Z-transformed data matrix
X-matrix of data points
μ— vector of variable
means V-matrix of eigenvectors

The transformed data, Z, represents data, Z, in other coordinates, in a new coordinate space defined by the principal components. The first column of Z is the projection of data points—coordinates of points associated with the first principal component—and the second column corresponds to the second principal component, etc.

f. Visualizing the Results:

PCA results were illustrated through scatter plots. First, a scatter plot colored by model year with the first two principal components of the model was made to be able to understand how EVs are distributed over the years in the reduced dimension space. Further on, scatter plots of the first and second principal components were charted against the model years and fitted with linear regression lines to indicate the direction of the trends.

- **Support Vector Machine (SVM):**

In the current research study, SVM technique is used to classify the house price into different categories like low, medium, and high, based on the principal components obtained from the data. The SVM classifier has been trained with the transformed data obtained after applying PCA for the same. RBF kernel is applied to find out the non-linear trend present in the data, hence the SVM model shall be able to classify efficiently even if the data is very complex and possesses high dimension.

Splitting the dataset into 70% for training and 30% for testing. Use the RBF kernel to overcome the nonlinear separation in the data. Training the SVM model on the training set. Evaluate the model's performance on the test set using accurate metrics. It has used visualization of the decision boundary for explaining how the SVM classifier distinguishes the feature space in separate price categories.

- **K- Nearest Neighbour (KNN):**

Another classification algorithm applied to the KNN for this project was that which predicts house prices. This technique makes use of nearest data points in feature space with which it identifies the closest neighbours. For this model, k is set at 5 to mean the algorithm uses 5 nearest neighbours.

The steps undertaken for KNN implementation are:

Split the dataset into training set (70%) and testing set (30%). Prediction of house prices by the KNN model with respect to principal components. The system would be assessed using the test set for the accuracy metrics.

4. RESULTS AND ANALYSIS

Variance explained by each principal component:

```
PC1:  34.53%
PC2:  13.28%
PC3:  11.66%
PC4:  8.62%
PC5:  8.27%
PC6:  7.03%
PC7:  4.97%
PC8:  4.27%
PC9:  3.03%
PC10: 1.91%
PC11: 1.81%
PC12: 0.63%
```

Fig.1. (Principal Component)

PCA results show that the first components explain a lot of the variance in the data set, therefore reducing the dimensionality of the data set while retaining most of the information. The PC1 explains 34.53% of total variance and PC2 explains 13.28%, and the third, PC3, which explains 11.66%. These first six principal components can explain almost 95% of the variance, and therefore, establish its effectiveness for describing the intrinsic structure of the data.

All subsequent machine learning tasks were performed using a subset of the original features, which greatly improved the computational efficiency without loss in terms of accuracy. The reduction yields principal components that could have been used to map data into a lower-dimensional space, which was used for the training of the SVM and KNN models, with excellent performance rates in classification tasks. That would be a proof of PCA in its functionality to improve performance of filtering noise given high dimensions of data.
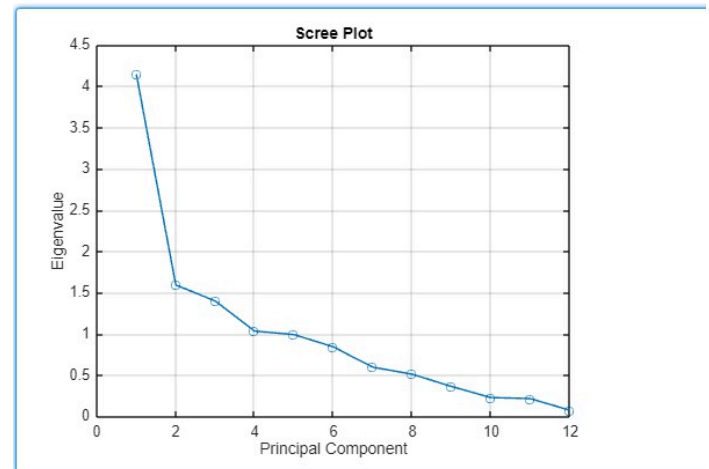

Fig. 2. (Scree Plot)

This is how the scree plot captures the eigenvalues for every principal component and shows contribution from each principal component towards total variance. That the eigenvalues decline very sharply from PC1 to PC3 means that the first few principal components capture the bulk of

variance in each dataset. Beyond PC3, eigenvalues do level out and contribute progressively less toward overall variance.

This describes the "elbow point," roughly around the third or fourth component, which describes how adding additional components results in very little variance explanation at the cost of higher dimension. It verifies that PCA effectively achieves dimensionality reduction with a small set of most components explaining much of the data's variance. Computationally, it optimizes efficiency while not compromising the model on information; thus, when classifying further through SVM or KNN algorithms, the method works adequately well.
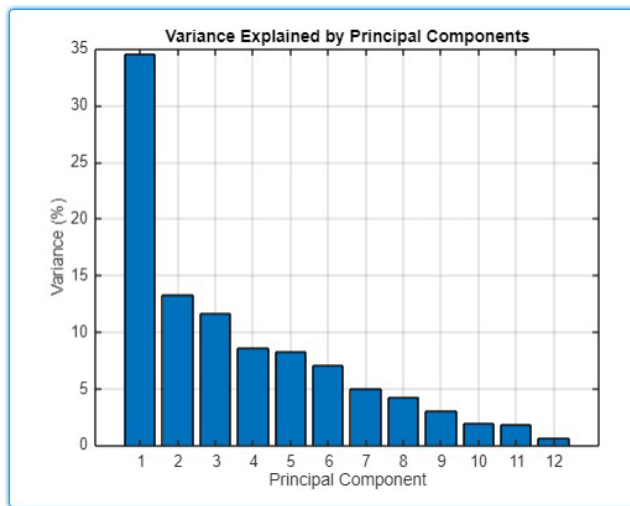

Fig 3 (Bar Graph Variance explained)

X-axis: Represents the principal components, numbered sequentially from 1 to 12.

Y-axis: Represents the percentage of variance explained by each principal component.

- Each bar chart corresponds to the principal component. The high bar chart indicates the variance of the data explained by the principal component.

- The bar chart showing "Variance Explained by Principal Components" shows a percentage of variance represented by each principal component in the dataset. PC1 proves to be the highest contributor, taking up nearly 34% variance, and PC2 and PC3 take up 13% and 11%, respectively. Later, the other components make an increasingly smaller proportion towards the total variance.

This behavior reflects a decreasing return of added components in variance explanation. The first few account for most of the information within the data as a cumulative process. Thus, it elucidates the aspect of PCA as a dimension reduction process. Only the first six components will be needed to explain nearly 95% of the variance to cut the noise

and redundancy present within the data set thereby optimizing its efficiency.
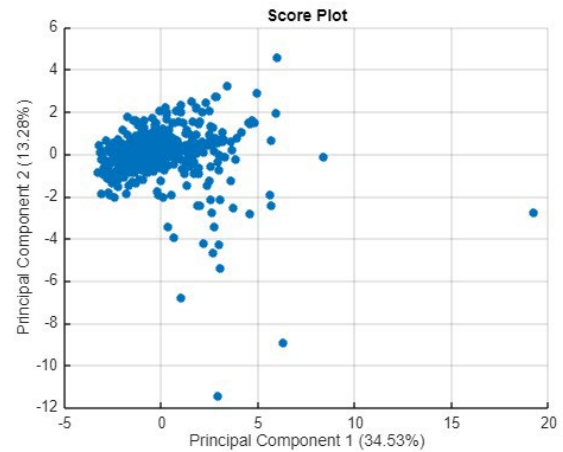

Fig4 (Score Plot)

The score plot represents the data set ordered along the first two principal components, with PC1 explaining 34.53% of the total variance and PC2 adding an additional 13.28%. It is a two-dimensional representation that gives emphasis to the arrangement of the data points and shows the existing patterns or clusters in the data set.

Most of the points fall near the origin, that means most of the variations explained are by the first two principal components, but some data points scattered out there indicate outliers or specific observations. This graph presents how PCA reduces dimensions in the dataset while leaving essential structure, making visualization and interpretation of such complex data easier.
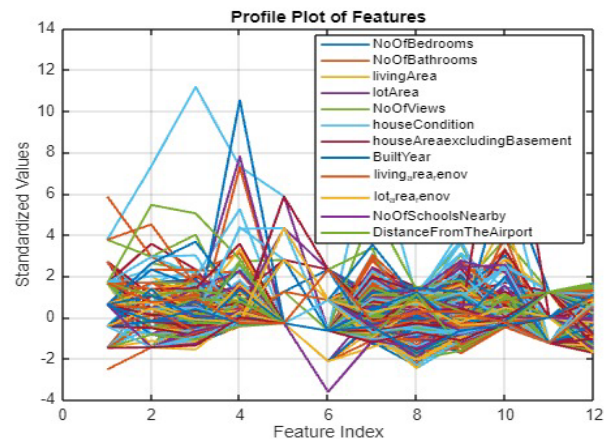

Fig 5 (Profile Plot)

The profile plot of the features plots standardized values of every variable across the dataset. It gives insight into their relative scale and variability. Each line shows a feature and how its values change along data points after standardization. This ensures that all features are on an equal scale, so

comparisons can be made fairly without any bias in analyses like PCA and even in downstream machine learning models.

The plot reveals features that are more variable, such as "lotArea" and "DistanceFromTheAirport," and those which are more consistent in pattern, such as "NoOfBedrooms" and "BuiltYear." Such variations are indicative of the possible importance of certain features in explaining variance in the data.

This representation brings out the need for such techniques as PCA in filtering out information into fewer meaningful dimensions. In this manner, through the analysis of such profiles, you could identify what leads to the most variability, thereby ensuring that PCA really does capture information behind a dataset in an effective way.
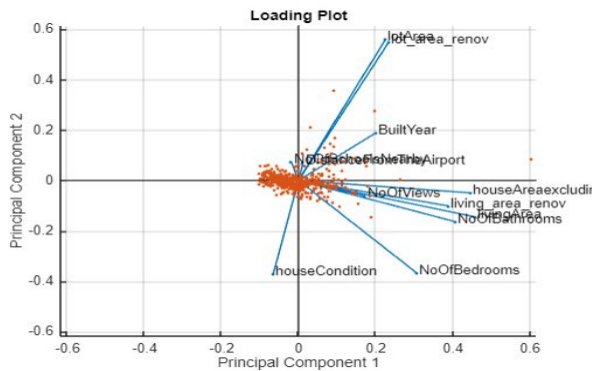

Fig .6. (Loading Plot)

Loading plot This loading plot shows how the original features contribute to the first two principal components, PC1 and PC2, of the PCA analysis. Each vector represents a feature, and its direction and length indicate the degree to which the feature contributes to the principal components and is correlated with other features.

lotArea and lot_area_renov are longer vectors, so these feature variables contributed more towards the explained variance by PC1 and PC2. On the other hand, features like "houseCondition" and "NoOfViews" have a shorter vector, indicating lesser influence on these parts. When features are directed in the same direction as well, such as "living_area_renov"and"houseAreaexcludingBasement,"
they give a positive correlation, showing a tendency to change with one another. Features whose direction is opposite, such as "NoOfSchoolsNearby" and "lotArea," denote negative correlation and thus inverse relationships between features. This plot provides a deep insight into how features of interest influence the principal components and how they work together. It shows what contributes to variance in a data set so that such features in the future will be properly interpreted and given priority for analysis, such as classification or even predictive tasks.
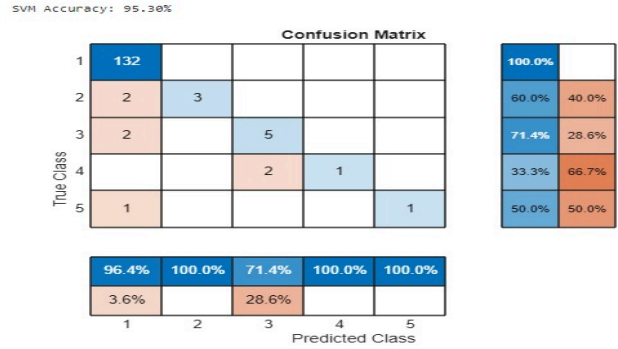
Fig. 7. (Confusion Matrix of SVM)

The confusion matrix is another performance of the SVM model, which in this case, was highly accurate with an accuracy of 95.30%. Clear evidence shows that most predictions were diagonal, which means a correct classification of instances. Class 1, recorded the highest, has its instances correctly classified to stand at 132 with an accuracy of classification of 96.4%. However, there are very minor misclassifications with only very few instances that are Class 2 and Class 3.

For Class 2 and Class 3, the accuracy is less by a little, while in some cases, it makes an error of misclassifying neighboring classes. Classes 4 and 5, which are likely to be less in instances, show perfect precision for all well-classified cases, though there is variability for others because of limited instances.

Overall, the SVM model is excellent in discrimination concerning most classes, especially prominent ones like class 1 - and invariant to PCA dimensionality reduction. Even to the few misclassifications it makes point to probable areas it could be on improvement, probably for some less frequent classes. This now means that the SVM model exploits dimensionality-reduced features to achieve high accuracy performance right.

Fig. 8. (Decision Boundary for SVM)

It is shown that it is indeed possible for the SVM model to classify data in the PCA-transformed space using the first two principal compone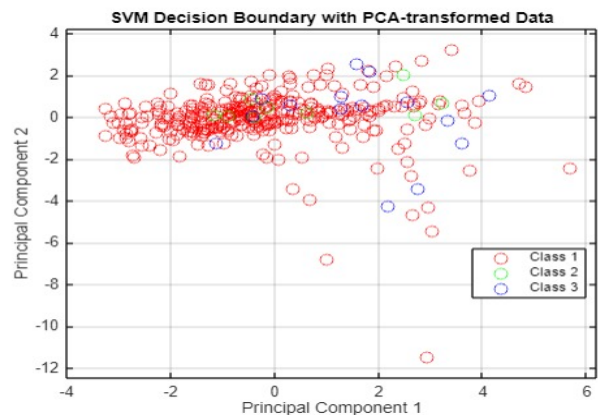nts, which is easily visualized by decision boundary plot. Classes are represented by color and the decision boundaries separate classes as they are distributed in this reduced-dimensional space. As a class with red dots that clearly has minimum overlap with any of the classes, Class 1 should illustrate how strongly the SVMs are suited to separate strongly dominant classes. Classes 2 and 3, presented with green and blue dots, are overlapping in data clusters along regions where two such distributions come together. Nonlinear boundaries drawn by a well-configured RBF kernel have ensured that cases outside of them are rarely observed within classification, thus ensuring this technique performs well in general.

The plot reflects the synergy between PCA and SVM; that is, PCA makes the data simple but preserves the structure, so even with some overlaps in some points, SVM appropriately classifies points, in that performance also comes with a cost of high accuracy as reflected in the confusion matrix.
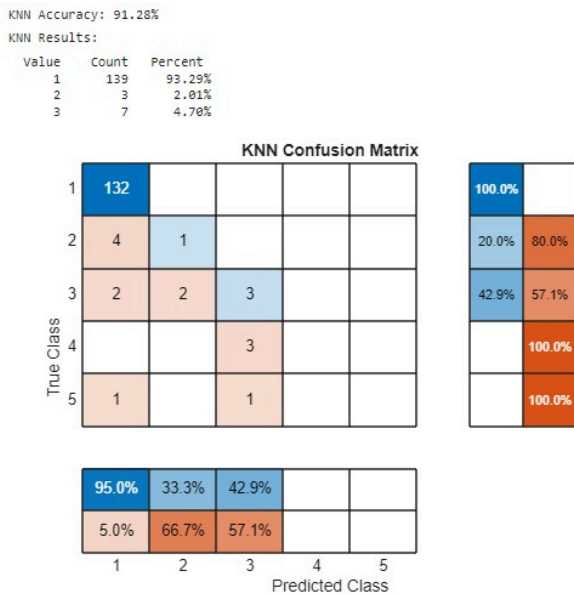

Fig. 9. (Confusion Matrix for KNN)

The KNN confusion matrix is the correct classification results of the K-Nearest Neighbors model, and indeed it achieved very good accuracy at 91.28%. Diagonal entries on the matrix represent correct predictions, while off-diagonal entries state misclassifications.

Class 1 This model generally performed well with an accuracy of 95%. Predicted were 132 correct. However, there is some misclassification. Some other class instances are predicted to be Class 1. Classes 2 and 3 also contain moderate accuracy; however, in those classes, overlap has mis-classed some instances. For example, some class 2 instances are found in the prediction belonging to Class 1.

Sometimes, some class 3 are mis-classed to the other neighboring classes. Classes 4 and 5, with few data points, correctly classified all instances 100 %. This confusion matrix indicates that the KNN model is quite well capable of handling dominant classes like Class 1 but shows a challenge in classifying less frequent or overlapping classes like Classes 2 and 3. Hence, the overall accuracy stands at 91.28%, indicating the robustness of the model, but there is still scope for further optimization that could improve its performance on minority or overlapping classes

5. SOFTWARE AND TOOLS

MATLAB (with Statistics and Machine Learning Toolbox) will be used for all computations, visualizations, and analysis

6. ACKNOWLEDGMENT

The authors would like to extend heartfelt thanks to Dr.. Neetu Srivastava for guiding and showing incessant support in the preparation of this IEEE report. It is only under the light of her enriched experience and encouragement that they could get an insight into the complex topics undertaken in this report. The feedback and suggestions improved the content and quality of this report.

7. CONCLUSION

In this paper, PCA is applied and is found to be successful in the isolation of significant dimensions in the Indian housing dataset with respect to major drivers of price fluctuation. This dimensionality reduction approach, therefore, presents a lightweight yet effective solution for handling the complexities of high-dimensional data inherent in India's diverse housing market. An optimal subset of features offered an impressive figure of as high as 95.3 percent while aggregated with SVM and KNN classifier surpassed the highest accuracies as high as 88.21 percent acquired from various models like Random Forest or XGBoost, developed in U.S.-exclusive papers. Such figures reflect a very strong capability of PCA and a sophisticated classifier in identifying very subtle patterns in Indian RE markets, and this is very important information for decision-investors, policymakers, or buyer-investors.

8. DECLARATION

I, Mallela Manish Kumar Reddy, hereby confirm that the manuscript titled *"Analyzing Housing Features with PCA and SVM for Market Insights"* authored by Mallela Manish Kumar Reddy, Yallanki Rishendra, Gorle Jayanth, B. Manjusha Reddy, and Neetu Srivastava, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to IMPeC-25 Conference.

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Md Liakat Ali, David Magrini, Michael Cangelosi, David Ribeiro (2023)"Analysis of Housing Market to Predict Home Price"

[2.] Bhaludra R Nadh Singh, Boppana Pujitha, S Vinoothna (2023), "House Price Prediction Using a Machine Learning Model: A Survey of Literature," International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), Vol. 9, Issue 3, pp. 569-574. DOI: 10.32628/IJSRCSEIT

[3.] Shubham Kulkarni, Shikhar Singh, Rahul Tapre, Amit Kukreja (2023), "House Price Prediction Using Machine Learning," International Journal of Creative Research Thoughts (IJCRT), Vol. 11, Issue 4, ISSN: 2320-2882

[4.] Ankit Mani Tripathi, Ankit Rai, Vineet Agrawal (2023), "An Approach to Predict House Price Using Machine Learning," International Journal of Research Publication and Reviews, Vol. 4, Issue 5, pp. 1032-1034. DOI: 10.55248/gengpi.234.5.39837

[5.] Siddhant Burse, Dhriti Anjaria, Hrishikesh Balaji (2021), "Housing Price Prediction Using Linear Regression," Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 8, Issue 10, ISSN: 2349-5162

[6.] https://blogs.sas.com/content/iml/2019/11/04/interpret- graphs-principal-components.html

[7.] https://www.kaggle.com/code/ryanholbrook/principal-component-analysis

[8.] Lizhong Xiao; Tigrui Yan (2019) "House prices based on RBF Neural Network Algorithms Of PCA

[9.] https://www.kaggle.com/datasets/sukhmandeepsinghbrar/house-prices-india?resource=download

Productive Efficiency in the Technology-Based Services Sector in an Emerging Market Economy: An Analysis of the Indian IT & ITeS Sector

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ABSTRACT

The aim of this research is to assess the productivity of the Indian IT and IT-enabled Services sector, determine the returns to scale (RTS), and analyze the factors that affect the productivity and response of these firms to challenges such as the global financial crisis (GFC). This study utilizes a balanced scorecard framework to identify proxy variables for the inputs and outputs of a sample of firms in India's information technology and IT-enabled services sector. It uses these variables and an additive data envelopment analysis (ADD-DEA) model to identify and analyze the inefficiency of these firms along with their returns to scale. The study reveals that many of these sample firms could have been more efficient. Moreover, those that were efficient are mostly operating under decreasing returns to scale. The research also identified the characteristics of firms that influence efficiency. This research represents the first empirical application of the ADD-DEA model (to the best of our knowledge). It is also the first application of the only theoretical model to obtain qualitative information about RTS from the primal form (and explain the factors governing RTS). The research is based on a sample of 74 firms from the Indian IT and ITeS sector throughout 2006 and 2019. It helps to identify policy implications as well as to understand how firms catering to global markets should adapt to global challenges for sustenance.

Keywords: DEA, RTS, Indian Information Technology, Financial Crisis, COVID-19.

1. INTRODUCTION

Indian IT and ITeS (IT&ITeS) firms earn high revenue due to the availability of highly skilled talents and labour cost arbitrage (Murthy, 2011), (Sabnavis & Unwalla, 2020). This industry significantly contributes to India's GDP, brings in substantial FDI inflows, earns significant foreign exchange, and generates employment for the educated workforce (Government of India, 2022) (Statista, 2022). However, the industry faces challenges due to geopolitical and technological disruptions and the availability of alternate destinations for offshoring. These firms need to be highly productive to sustain the competition.

To support these firms in global competition, we investigated their productive efficiency, analysed the returns to scale, and examined the factors influencing them. We also explored the industry's response to the global adversities.

We have adopted a non-parametric approach for computing the productive efficiency of a sample of Indian IT&ITeS firms between 2006 (financial year 2005-06 or FY 06) and 2019 (FY19). The parametric framework for estimating firms' productivity suffers from certain limitations (whether the regression approach or the stochastic frontier approach) (Behr, 2015), the most important of which is that it cannot identify productivity or efficiency at the firm level. The second disadvantage of this methodology is that it can handle only one output. Data Envelopment Analysis (DEA) is the non-parametric methodology we adopt here (Cooper,

Seiford, & Tone, 2007). DEA does not assume any probability distribution of the output and the inputs; it can incorporate multiple outputs (along with multiple inputs). This methodology essentially involves repeated solutions of linear programming problems for the decision-making unit (DMU) under evaluation compared to the usage of inputs and outputs produced by one or more DMUs in the sample (not under evaluation). The objective is to identify to what extent each firm (i.e. the DMU) in the sample is efficient in either the usage of inputs, production of outputs or both compared to all other firms in the sample.

There are several categories of DEA models. The most popular DEA models used in empirical applications are the BCC (Banker, Charnes and Cooper 1984) model and the CCR (Charnes, Cooper and Rhodes 1978) model. However, these models (BCC and CCR) are oriented – they either attempt to minimise the usage of inputs (input-oriented) for the given level of outputs or maximise outputs (output-oriented) given the level of usage of inputs. These models (BCC and CCR) are also radial – they assume that the proportion of usage of any two of the inputs (and the proportion of production of any two of the outputs) remain constant. The radial model also assumes that the relative proportions of all inputs (outputs) remain unchanged for all the sample firms. In other words, if an inefficient firm strives to become efficient, say by reducing inputs (increasing the outputs), reduction in inputs (increase of outputs) must happen without changing this proportion. A third limitation of these DEA models (BCC and CCR) is that they cannot

handle negative values in both inputs and outputs, limiting the choice of proxy variables (e.g., profitability). We chose a particular DEA model that is free from all these three limitations of BCC and CCR models – the Additive DEA (ADD-DEA) model. ADD-DEA model is non-oriented (it simultaneously maximises output and minimises inputs), non-radial (does not assume fixed proportionality among inputs or outputs), and is capable of handling negative values in one or more proxy variable(s).

Despite the overwhelming importance of the Indian IT and IT sector, very few studies have attempted to assess the efficiency of this sector using a DEA framework. However, these studies (Mathur, 2007), (Sahoo & Nauriyal, 2013), (Das & Datta, 2017), (Bhat & Kaur, 2022) have attempted to do so using oriented radial models (BCC and CCR). In this research, we use the ADD-DEA model.

Additionally, there is rarely any justification behind the selection of proxy variables for inputs and outputs in most of the empirical literature applying DEA. One notable exception is the literature applying DEA to financial institutions (e.g., banks). Based on the vast literature on the Balanced Score Card (BSC) framework (Kaplan & Norton, 1992) (wherein the performance of organisations or firms are assessed in a holistic frame) and a few on BSC-DEA integrated works (Kadarova, Durkáčová, Teplická, & Kádár, 2015) (Asosheh, Nalchigar, & Pour, 2010) (Amado, Santos, & Marques, 2012), we select proxy variables (inputs and outputs). This selection of proxy variables is one novelty of the research with respect to the technology-based services sector, not just in India but, to the best of our knowledge, beyond India as well.

We could make use of the BSC framework to choose the proxy variables because we were not restricted (in our choice of proxy variables) to avoid negative data for some of the firm-years for some of the variables, which a radial DEA model would have encountered. Using the BSC framework, we identify the following three proxy variables for inputs for the IT&ITeS firms in the sample: Cost of Goods and Services sold (CoGSS), Selling, General and Administrative Expenses (SGAE), and Total Liabilities (TL). The output parameters identified are: Earnings before Interest, Tax, Depreciation & Amortisation (EBITDA) and Sales (revenue).

These proxy variables have been mapped with three of the four perspectives of the BSC framework: financial, customer, and internal business process. We could not identify a proxy variable to capture the BSC perspective of learning and growth. Prospective proxy variables in the literature, like R&D expenses, intellectual property rights and others, have been attempted. However, the non-availability of data on (or non-existence of any expenses on) such proxy variables in our sample forced us to exclude this perspective from our analyses.

For the identified proxy variables, after mapping with the three perspectives of the BSC framework, we defined the appropriate proxy variables based on general principles of cost accounting and collated and constructed the data accordingly.

We obtained the data for these input-output parameters and explanatory variables from various sources such as Prowess, RBI databases, Bloomberg, and the websites of the sample firms.

One of the output proxy variables, EBITDA, has negative values for a few firm-years. We translate this variable by adding a fixed minimum number to this value for all firm years so as to make each value just positive. Since the ADD-DEA model is invariant in translation, this data translation does not affect efficiency (or inefficiency) scores.

However, standard methods to estimate Returns to Scale (RTS) are not invariant to data translation in the sense of computing a numerical value of RTS (e.g., value < 1 implying decreasing RTS, value = 1 implying constant RTS and value > 1 implying increasing RTS). This constraint is due to the fact that the solution of the dual (of the primal) problem is required for computing the value of RTS across all classes of DEA models, and the dual is not translation invariant. However, only one work (Khodabakhshi, Gholami, & Kheirollahi, 2010) has provided a theoretical method to draw qualitative inferences about the RTS from the primal problem only (which, in the case of the ADD-DEA model, is translation invariant). To the best of our knowledge, this research includes the first empirical application of this novel theoretical method.

Data on the input and output variables were collected from the Prowess Database of the Centre for Monitoring Indian Economy (CMIE) for the sample period from FY06 to FY19. The choice of the initial year was made to begin before the global financial crisis, while the selection of the final year was made to preclude any possible influence of the COVID-19 pandemic.

In this research, our focus is on achieving four key objectives. First, we analyse the productive efficiency of the sample firms over fourteen years from FY06 to FY19. Second, since the sample period included a significant event of global significance, i.e., the global financial crisis (GFC) originating in the US, and since the sample firms were dependent on the US market for a substantial part of their revenue (and profit as measured by EBITDA here), we attempt to analyse their response to this event. Third, given the fact that this industry has been primarily characterised by the labour-cost arbitrage between India and the rest of the English-speaking developed countries, we attempt to qualitatively analyse the Returns-to-Scale (RTS) behaviour of the sample firms during the period under study. Finally, we analyse the impact of COVID-19 on the productive efficiencies of these firms based on the data available from

2019 to 2023, using a similar approach to the one used to analyse the GFC.

2. SECTION TWO

The additive model that considers the input excess and output shortfall is given by Equation 1. Here, X is the vector of m inputs, Y is the vector of n outputs, x0 and y0 indicate the particular DMU under evaluation, e denotes a row vector in which all elements are equal to 1, s^- and s+ denotes input and output slacks respectively.

$$(ADD_o) \max_{\lambda, s^-, s^+} z = es^- + es^+ \qquad \text{Equation 1}$$

$$\text{Subject to}$$

$$X\lambda + s^- = x_o$$

$$Y\lambda - s^+ = y_o$$

$$e\lambda = 1$$

$$\lambda \geq 0, s^- \geq 0, s^- \geq 0$$

A DMU is ADD-efficient when $s^{-*} = 0$ and $s^{+*} = 0$. As such, this ADD-DEA model calculates the inefficiency of the respective inputs and outputs.

We considered firm characteristics like age, size and outward orientation (exports) as independent variables, in line with the existing empirical literature (Mathur, 2007), (Sahoo & Nauriyal, 2013), (Das & Datta, 2017). The age of a firm is years from the incorporation, and total revenue is the proxy for size. The outward orientation is the firm's exports as a proportion of its total revenue. The exchange rate (INR-USD) is considered a control variable. We considered firm-specific characteristics like industry specialisation, nature of business, and geographical focus as independent variables to study how they impact productive efficiency. Now, we have five input and output inefficiencies as the dependent variables and seven explanatory variables. We form five regression models for each of the dependent variables.

Eliminating multicollinearity (using the VIF test) and endogeneity (Durbin–Wu–Hausman test), we use a generalised least squares (GLS) random effect (RE) regression model since some explanatory variables are firm-specific and time-invariant characteristics. In case there is endogeneity, we follow Balestra and Varadharajan-Krishnakumar G2SLS (Balestra & Varadharajan-Krishnakumar, 1987). We further validate the results with the Hausman test and Hansen J test.

While the above method was followed for the first, second, as well as fourth objectives as described in section 1, for the third objective, we use the Khodabakshi et al. (Khodabakhshi, Gholami, & Kheirollahi, 2010) proposed

ADD-DEA that infers RTS using the prime, as shown in Equation2.

$$\max 1S^- + 1S^+ \qquad \text{Equation 2}$$

$$\text{Subject to} \sum_{j=1}^{n} x_j \lambda_j + S^- = \varepsilon x_o,$$

$$\sum_{j=1}^{n} y_j \lambda_j - S^+ = \varepsilon y_o,$$

$$\sum_{j=1}^{n} \lambda_j = 1,$$

$$\lambda_j, S^-, S^+ \geq 0$$

Suppose DMUo is efficient with the input-output combination (xo, yo). We try to make ξxo, ξyo inefficient for determining returns to scale of (xo, yo). In this case, if the inefficiency of ξxo, ξyo causes the increase of ξ from level one, returns to scale is increasing. If inefficiency ξxo, ξyo decreases from level one, then it will be DRS. If ξxo, ξyo never can be inefficient in the PPS, returns to scale will be constant.

RTS, which is the dependent variable in this model, will have the following values: DRS, CRS, and IRS. These values are ordinal. However, certain OLR assumptions were tested as invalid, so the Multinomial Logistic Model was used as an alternative. We used the same set of explanatory variables used to study productive efficiency.

We collected the input-output parameters data and the explanatory variables from multiple sources, viz. Prowess and RBI databases, Bloomberg and company websites. We also applied general accounting principles to define the parameters and collated the data accordingly.

3. RESULTS AND DISCUSSION

We report and analyse our findings in this work within the confines of the models and the sample (firms and period) adopted in this research.

On the first objective of this study, we report the following findings:

- For the sample firms and sample years studied by us, inefficiency on the part of the inputs is significantly

greater than that on the part of the outputs in general (Table 1).

- About 70% of the sample firms are inefficient over the period on average, and only one firm remained efficient during all fourteen years and another one for thirteen of the years (Table 2).

- The efficient firms identified in our analysis have achieved better outcomes over the years with respect to growth in earnings, revenue and profitability relative to the inefficient firms (Table 2).

- Outward orientation has a negative and statistically significant influence on COGSS inefficiency but a positive and significant influence on SGAE, TL and EBITDA inefficiency (Table 3).

- Exchange rate movement (mainly depreciation over the sample period) influenced COGSS and Revenue inefficiency reduction, but SGAE, TL and EBITDA inefficiency increased (Table 3).

- Firms catering to the domestic market alone have higher inefficiency in revenue (Table 3).

TABLE 1: Variables' Summary Statistics

Year	Excess COGSS	Excess SGAE	Excess Total Liability	Shortfall in Revenue	Shortfall in EBITDA
2006	5.8%	35.5%	33.3%	17.6%	17.2%
2007	8.2%	46.2%	40.0%	1.6%	25.9%
2008	10.3%	18.1%	35.6%	8.4%	7.0%
2009	16.4%	40.3%	37.6%	4.4%	9.7%
2010	18.0%	60.5%	40.2%	0.5%	20.6%
2011	11.5%	39.1%	25.4%	1.4%	26.8%
2012	13.2%	40.0%	29.8%	4.0%	15.6%
2013	17.8%	44.8%	33.4%	6.8%	17.5%
2014	10.6%	45.8%	33.3%	4.1%	14.6%
2015	7.9%	39.4%	36.7%	1.0%	13.4%
2016	7.9%	44.9%	30.0%	2.3%	16.7%
2017	10.1%	47.2%	30.3%	6.2%	16.0%
2018	19.3%	34.1%	35.4%	0.05%	37.5%
2019	11.9%	4.3%	35.3%	0.3%	32.4%

TABLE *2*: Efficiency, Differential Growth and Profitability

Year	No. of Firms		Average Revenue	Average EBITDA	Average ROE (%)	
Year	Eff.	In-eff.	(Eff./ In-eff.)	(Eff./ In-eff.)	Eff. Firms	In-eff. Firms
2006	20	54	3.5	3.9	28.6%	-0.3%
2007	16	58	4.2	5.9	20.2%	9.9%
2008	19	55	3.5	4.1	20.5%	10.6%
2009	18	56	3.9	4.8	24.8%	5.8%
2010	19	55	3.9	5.2	23.1%	-18.5%
2011	17	57	1.8	2.4	18.4%	-12.9%
2012	15	59	2.9	3.4	21.2%	-9.9%
2013	16	58	3.4	4.3	37.1%	12.9%
2014	18	56	2.4	2.9	25.0%	12.8%
2015	18	56	2.7	3.2	19.1%	-12.3%
2016	20	54	2.4	2.9	21.8%	9.3%
2017	13	61	3.5	4.4	22.5%	3.1%
2018	16	58	3.2	4.6	22.3%	-4.0%
2019	18	56	6.8	9.7	60.5%	8.6%

Note: "Eff." denotes efficient firms and "in-eff." denotes in-efficient firms.

TABLE *3*: Regression estimation results - G2SLS

Dependent variable	COGSS Slack	SGAE Slack	TL Slack	Revenue Slack	EBIDTA Slack
Age[c]	0.0013	0.0024	-0.00073	0.0131	-0.0265**
Size[c] (total revenue)	-1.11e-07	-3.86e-07**	-1.99e-07	-7.17e-07	-6.13e-07
Outward orientation[c]	-0.0630**	0.1680*	0.0830*	-0.4059	0.9209**
Exchange Rate[c]	-0.0023*	0.0094*	0.0039*	-0.0246**	0.0282**
Industry Specialisation[c]	-0.0180	0.0510	-0.0225	-0.3426	0.0154
Business Type[c]	-0.0024	-0.0278	0.0476	-0.2642	-0.2199
Market Focus[c]	-0.0366	-0.0475	-0.1076	1.2261*	-0.1715
Constant[c]	0.2468*	-0.3513*	0.1391**	1.6914**	-0.7932
Fit statistics					
Wald χ^2	15.91**	134.4*	26.75*	14.96**	13.61 p value 0.058
Instrumented	Outward orientation	NA	NA	Outward orientation	Outward orientation
	1 year lag			2 year lag	2 year lag
Hausman test	Prob > chi2 =0.0000	NA	NA	Prob > chi2 = 0.0390	Prob > chi2 = 0.0000
Hansen test	0.000 (equation exactly identified)	NA	NA	0.000 (equation exactly identified)	0.000 (equation exactly identified)

Note: (*) Statistically significant at 1%; (**) Statistically significant at 5%; [c] indicates coefficient

For COGSS slack, we have used one-period lagged value and for Revenue and EBIDTA slacks we have used two-period lagged value of outward orientation due to presence of endogeneity.

Hansen J Statistic: H0: Over-identification restrictions are valid (p-values are in parentheses).

Hausman Test: H0: specified endogenous variables can be treated as exogenous (p-values are in parentheses). The t – statistics are in parentheses, *** p < 0.01, ** p < 0.05, * p <0.1.

On the second objective of this study, we report the following findings:

- While total revenues and foreign (non-Indian) revenues for all Indian firms in the sample increased after the GFC, the revenue inefficiency (or shortfall as measured by the slacks ratio) also increased, implying that marginally more resources (inputs) were required than before the crisis to generate marginal revenue.

- However, due to the continuous depreciation of the INR during the post-crisis period, the EBITDA of the firms was not significantly impacted (Table 4).

- The overall cost was controlled mainly by reducing foreign travel costs (Table 6).

- Also, these firms efficiently managed their financials by curtailing investment in physical capital by shifting from ownership to lease/rent agreements during the post-crisis period (Table 5).

- However, financial investments remained unchanged across the sub-periods (Table 5).

TABLE 4: Regression estimation results pre and post GFC

Dependent Variables	Input Inefficiency[a]			Output Inefficiency[a]	
Dependent Variables	CoGSS	SGAE	TL	Revenue	EBITDA
	Coefficients				
Age	.001353	.007177 *	-.0026102	.0209293	-.0484877
Size (Revenue)	-5.06e-07	-7.39e-07	-1.18e-06**	-4.35e-06	2.49e-06

Outward orientation	.005226	.1205968**	.2459728*	-.658209	-.7548529
Exchange rate	.0174394	-.0030063	.0059488	-.7578019**	.0840954
Industry specialisation	-.0399238	.097017	-.0116726	-.4748132	-.2404285
Business orientation	-.0119635	-.0180026	-.0240381	-.6848933	-.1484576
Geography market specialisation	-.0230001	.0068852	-.0629027	2.085186*	-.3516865
Financial Crisis	-.001667	.2244218*	0.0260661	1.456815**	-.6314451
Constant	-.6892007	0.0000	0.0298342	34.75038	-1.691905
Fit statistics					
Wald χ2	17.32	170.36 *	34.94 *	21.36 *	5.37
Instrumented	Outward Orientation	Exchange Rate	NA	Outward Orientation	NA
IV lag period	1 year Lag	1 year Lag	NA	1 year Lag	NA
Hausman test	Prob > chi2 =0.0000	Prob > chi2 =0.0000	NA	Prob > chi2 =0.0000	NA
Hansen J test	0.000 (equation exactly identified)	0.000 (equation exactly identified)	0.0000	0.000 (equation exactly identified)	0.7169

Note: (*) Statistically significant at 1%; (**) Statistically significant at 5%

a: Inefficiency is expressed as percentage of respective input/output variables (before translation)

TABLE 5: Key Financial parameters of efficient and inefficient firms

Year	Net fixed assets		Capital work-in-progress		Investments in equity shares, bonds and mutual funds		Cash & Bank Balance	
	Eff	**Ineff**	**Eff**	**Ineff**	**Eff**	**Ineff**	**Eff**	**Ineff**
2006	15.98	15.81	4.58	4.25	19.98	18.79	31.33	11.31
2007	15.69	13.24	6.81	4.87	17.54	23.87	34.00	12.33
2008	14.17	13.14	6.62	5.38	19.36	19.34	30.58	13.12
2009	16.45	13.57	3.65	4.65	21.68	21.64	25.93	16.13
2010	14.77	10.97	3.50	3.06	23.58	23.97	33.92	13.56
2011	14.72	12.76	3.23	1.80	24.05	19.79	24.97	22.73

Note: Values are as % of total assets; Eff denotes efficient firms and Ineff denotes in-efficient firms

TABLE 6: Foreign Exchange spent on travel as % of Total Revenue

Year	Efficient	Inefficient
2006	1.66%	10.56%
2007	1.77%	10.66%
2008	1.66%	10.97%
2009	1.17%	13.65%
2010	1.18%	10.80%
2011	0.37%	7.63%
2012	0.39%	7.69%
2013	0.28%	8.64%
2014	0.44%	1.89%

2015	0.45%	8.78%
2016	0.10%	8.69%
2017	0.00%	0.10%
2018	0.05%	0.02%
2019	0.02%	0.02%

On the third objective of this study, we report the following findings:

- The majority of the sample firms have been operating under decreasing returns to scale (DRS).
- However, the sample firms under DRS exhibited a weak trend of moving towards the constant returns to scale (CRS) over time on average. Econometric analyses indicate that such improvements are associated with firm-level experience (Table 7).
- Econometric evidence (Table 7) also reveals the asymmetric nature of risks involved in exports of

services by the sample firms with respect to RTS behaviour over time: when firms move towards higher exports, they either worsen (move towards DRS) or improve (move towards CRS or IRS) on average. The plausible reason is that the exporting firms must conform to the contractual obligations and compete internationally. If the firm cannot comply with the contractual obligations, it may lead to delayed or no payment, resulting in reduced profitability, lost revenue, or both, and leading to DRS. If the firm can deliver according to the contract, it will gain higher revenue and profit, which will lead it towards the IRS.

TABLE 7: MLM regression for Model-1 and Model-2 (Winsorized)

Model	Efficient and projected efficient firms.	
No. of observations	1005	
No. of groups	74	
	Model-1	Model-2 (Winsorized)[#]
Wald χ^2	33.84	48.02
Prob > χ^2	0.002*	0*
Log-likelihood	-457.56	-450.6
DRS (base CRS)	Coefficient (Odds ratio)	Coefficient (Odds ratio)
Age	-0.01(0.99)	-0.04(0.97)
Size	0.0000003(1)	-0.00002(0.99)
Outward orientation	1.32(3.73)*	1.32(3.73)*
Exchange rate	0.003(1)	0.02(1.02)
Industry_Specialization	-0.1(0.91)	-0.02(0.99)
Business_Specialization	-0.2(0.82)	-0.4(0.67)
Geo_Focus	-0.54(0.58)	-0.57(0.57)
Constant	1.87*	1.92*
IRS (base CRS)	Coefficient (Odds ratio)	Coefficient (Odds ratio)
Age	0.17(1.19)**	0.18(1.2)**
Size	0(1)	0.00005(1)*
Outward orientation	3.39(29.57)*	3.2(24.53)*
Exchange rate	0.02(1.02)	0.005(1.01)
Industry_Specialization	3.17(23.88)	2.09(8.08)
Business_Specialization	-1.18(0.31)	0.53(1.7)
Geo_Focus	0.58(1.79)	0.11(1.11)
Constant	-12.24*	-11.2*

Note: (#) Winsorised fraction 0.05 for Age, Size;
(*) Statistically significant at 1%; (**) Statistically significant at 5%

We further analysed the impact of COVID-19 on the productive efficiencies of 48 of the Indian IT and ITeS firms based on the data availability from 2019 to 2023, with a similar approach to the one executed to analyse the GFC in the second objective, and report the following:

- The number of efficient firms was less than that of inefficient firms, and it decreased over the years.

- The revenue and EBITDA of efficient firms increased over these years, including a steep increase from 2021 to 2022. However, there was a dip in the ROE in 2020 for inefficient and 2021 for efficient firms. This result shows that efficient firms could absorb the crisis. Nevertheless, they could not altogether evade it. Furthermore, for inefficient firms, the EBITDA slack was much higher. It reveals that these inefficient firms could not generate higher revenue by taking advantage of labour arbitrage and were also making losses due to underutilisation of resources.

- Some critical financial parameters were analysed for COVID-19 as we did for the GFC. There is little difference between efficient and inefficient firms concerning services export (as % of total revenue), and the sharp decline continuing from 2017 may be due to business transactions with Indian subsidiaries of multinational clients rather than through exports. Over the years, foreign expenditure on travel as % of total revenue declined for all firms. For efficient firms, Physical Capital (Net Fixed Assets and Capital Work In Progress), which had reduced from about 20% of total assets in 2006 to 15% in 2019, increased to 20% in 2020 and came down to 17% in 2023. Although inefficient firms had lower physical capital than efficient firms, their investments and cash and bank balances (as a percentage of total assets) were higher and increased after 2021. It is to be noted that ROE for inefficient and efficient firms decreased in 2020-2021 due to investments, as depicted by the increase in physical capital during these years.

We document that inefficiency occurs more on the input side and less on the output side. On the input side, substantially more inefficiency has been observed on the firm-year basis for SGAE (primarily administrative costs including costs of foreign travel) and TL (primarily owners' equity including accumulated earnings, since these firms carry none or negligible debt on their balance sheet) than for CoGSS (primarily expenses incurred on employee wages and other compensations). Of these three inputs, the firms are contractually bound with respect to CoGSS (mostly employee costs) with their clients but not with respect to the other two inputs.

On the output side, far more inefficiency (on a firm-year basis) has been found with respect to EBITDA than revenue. Over and above the engagement of employees by the sample firms determined by the contractual obligations with their clients, actual revenue earned for the employees engaged also depends on successful delivery. However, such constraints do not exist on the input variables (other than employee-related costs), while the revenue (output variable) is determined not only by contractual obligations but also by successful delivery. Consequently, profitability outcomes are primarily dependent on managerial decisions regarding input and output factors/variables under managerial control and outside the scope of contractual obligations.

In response to the Global Financial Crisis, the sample firms increased allocation to specific inputs and reduced allocation to some other input/output – all under their control and free from any contractual obligations with their clients. In particular, we document that the sample firms have, on average, reduced their ownership of fixed assets (probably due to a shift from owned real estate to leased arrangements) during the post-GFC period (from 2011 in particular). In addition, these firms have also drastically reduced expenses on foreign travel over the years since the GFC. The analyses on the qualitative aspect of the RTS behaviour of the sample firms are consistent with the above results and discussions.

4. POLICY IMPLICATIONS

Indian IT & ITeS firms should focus more on the inputs (SGAE and TL) and the output (EBITDA) under their control: reduce administrative expenses (SGAE), and spend more of the accumulated earnings (TL) for future productivity growth, failing which distribute the cash to the shareholders.

These firms should frame a policy to guide the allocation of funds to the inputs under their control. Contract clauses signed by these firms with their clients may be used as a guideline.

These firms should increase their investment in R&D, failing which, they should distribute their accumulated surpluses and unutilised cash to the shareholders.

However, even if a few of these firms are able to enhance their R&D activities in order to generate future intellectual property assets that are protected in the digital world, such firms will be sustained.

REFERENCES

[1.] Amado, C., Santos, S., & Marques, P. (2012). Integrating the Data Envelopment Analysis and the Balanced Scorecard approaches for enhanced performance assessment. *Omega, 40*, 390-403. doi:10.1016/j.omega.2011.06.006

[2.] Asosheh, A., Nalchigar, S., & Pour, M. (2010). Information technology project evaluation: An integrated data envelopment

analysis and balanced scorecard approach. *Expert Systems with Applications, 37*(8), 5931-5938. doi:10.1016/j.eswa.2010.02.012

[3.] Balestra, P., & Varadharajan-Krishnakumar, J. (1987). Full information estimations of a system of simultaneous equations with error component structure. *Econometric Theory, 3*(2), 223-246.

[4.] Behr, A. (2015). *Production and efficiency analysis with R.* Berlin: Springer.

[5.] Bhat, N. A., & Kaur, S. (2022). Technical Efficiency Analysis of Indian IT Industry: A Panel Data Stochastic Frontier Approach. *Millennial Asia, [Online First].* doi:https://doi.org/10.1177/09763996221082199

[6.] Cooper, W. W., Seiford, L. M., & Tonne, K. (2007). *Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References and DEA-Solver Software.* (2/e ed.). New York: Springer.

[7.] Das, P., & Datta, A. (2017, March - April). Performance Evaluation of Indian Information Technology-enabled Services (ITeS) Industry: An Application of Two-Stage Data Envelopment Analysis. *International Journal of Advances in Management and Economics, 6*(2), 52-70. Retrieved January 13, 2021

[8.] Government of India. (2022). *Economic Survey 2021-2022.* Retrieved from www.indiabudget.gov.in: https://www.indiabudget.gov.in/economicsurvey/ebook_es202 2/files/basic-html/page353.html

[9.] Kadarova, J., Durkáčová, M., Teplická, K., & Kádár, G. (2015). The Proposal of an Innovative Integrated BSC – DEA Model. *Procedia Economics and Finance, 23*, 1503-1508. doi:10.1016/S2212-5671(15)00375-5

[10.] Kaplan, R., & Norton, D. (1992). The Balanced Scorecard: Measures that Drive Performance. *Harvard Business Review, 70*(1), 71-79.

[11.] Khodabakhshi, M., Gholami, Y., & Kheirollahi, H. (2010). An additive model approach for estimating returns to scale in imprecise data envelopment analysis. *Applied Mathematical Modelling, 34*(5), 1247-1257.

[12.] Mathur, S. (2007). Indian IT and ICT industry: A performance analysis using data envelopment analysis and Malmquist index. *Global Economy Journal, 7*(2). doi:https://doi.org/10.2202/1524-5861.1259

[13.] Murthy, N. R. (2011). The Indian Software Industry: Past, Present and Future. In M. Pai, & R. K. Shyamasundar, *Homi Bhabha and the Computer Revolution* (pp. 151–174). New Delhi: Oxford University Press.

[14.] Sabnavis, M., & Unwalla, V. M. (2020, April 14). *IT-BPM Industry Update.* Retrieved from Care Ratings: https://www.careratings.com/uploads/newsfiles/IT-BPM%20Industry%20Update.pdf

[15.] Sahoo, B. K., & Nauriyal, D. K. (2013). Technical Efficiency and Total Factor Productivity of the Software Industry in India: An Empirical Analysis. *The Indian Economic Journal, 61*(2), 227--254. doi:10.1177/0019466220130205

[16.] Statista. (2022, Aug 17). *Share of Information technology/business process management sector in the GDP of India from financial year 2009 to 2022.* Retrieved from Statista: https://www.statista.com/statistics/320776/contribution-of-indian-it-industry-to-india-s-gdp/

Sustainability Performance Measurement (SPM) in Supply Chain 5.0: A Human-Centric and Sustainable Approach

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ABSTRACT

Supply Chain 5.0 represents a significant evolution from its predecessor, Supply Chain 4.0. While the latter primarily focused on technological advancements such as robotics, IoT, AI, and blockchain to improve efficiency, productivity, and resilience, Supply Chain 5.0 introduces a more holistic approach that prioritizes human-centricity and sustainability.

As industries progress from Supply Chain 4.0, the enhanced focus of Supply Chain 5.0 emphasizes the balance between technological innovation (AI, IoT, big data analytics, Blockchain) and sustainability goals (social, environmental, and economic).

By integrating advanced digital technologies with a strong emphasis on environmental and social responsibility, Supply Chain 5.0 aims to create a more sustainable, equitable, and resilient supply chain. This paradigm shift requires a robust framework for measuring sustainability performance to track progress, identify improvement areas, and demonstrate accountability.

Supply Chain 5.0 is a digital transformation revolutionizing operations. Advanced technologies are driving efficiency, responsiveness, and customer satisfaction. Notably, sustainability has become a core focus. Organizations are increasingly adopting Sustainability Performance Measurement (SPM) to align economic goals with environmental and social responsibilities. This shift ensures that supply chains not only deliver value, but also contribute positively to a sustainable future.

This research explores a case-based methodology to evaluate the impacts of Supply Chain 5.0 on sustainability performance, specifically within complex supply chains. Using a multi-dimensional framework, the paper assesses Sustainability Performance Measurement (SPM) such as carbon footprint reduction, energy efficiency, resource optimization, resource circularity, waste minimization, ethical labor practices, and social impact. It also examines the dynamic role of real-time data analytics, machine learning, and collaborative ecosystems in driving more adaptive, responsive, and resilient supply chains.

The findings illustrate how advanced technological integration enhances sustainability while addressing stakeholder expectations and regulatory pressures. By aligning technology with sustainable objectives, Supply Chain 5.0 redefines industry standards for achieving long-term environmental and societal goals.

This research provides strategic insights into sustainability metrics, offering a roadmap for organizations to foster resilience and competitive advantage in an era of sustainability-driven economies. The goal is to create a sustainable, resilient, and transparent supply chain that aligns with global sustainability frameworks, including the United Nations Sustainable Development Goals (SDGs) and various climate action policies such as the Paris Agreement.

Keywords: Supply Chain 4.0 / 5.0; Sustainability Performance Measurement (SPM); Carbon Emissions; Industry 4.0 Technologies; Human Centricity; Environmental Impact; Circular Economy; Resource Optimization; Green Supply Chain; Sustainable Supply Chain 5.o Metrics

Key Challenges of Sustainability & Advanced Technology Adoption in Supply Chains

- **Sustainability Challenges:** High carbon emissions (Scope 1, 2, 3), resource scarcity, ethical sourcing, and balancing cost efficiency with environmental goals.

- **Technology Adoption Challenges:** Resistance to change, lack of digital skills, high investment costs, and integration of technologies like AI, IoT, and blockchain into legacy systems.

- **Complex interdependencies** between technological innovation and sustainable practices

- Misalignment between technological capabilities and organizational sustainability goals

- **Limited human capital** readiness for transformative technological integration

- **Persistent economic** barriers and investment uncertainties

- **Fragmented regulatory landscapes** across global supply chain ecosystems

Role of Digital Technologies in Supply Chain 5.0

Digital technologies are the cornerstone of Supply Chain 5.0, enabling:

- **Automation:** Intelligent automation for dynamic sustainability optimizations and enhancing operational efficiency with AI. ML and Robotics.

- **Transparency:** Blockchain for transparent and traceable sustainability performance tracking & traceability.

- **Real-Time Monitoring:** Internet of Things (IoT) enabling real-time emissions and resource utilization monitoring

- **Data Visualization:** Big Data, Advanced data visualization and simulation technologies

- **Predictive Analytics & Optimization**: AI and IoT for predictive analytics and demand forecasting.

- **Sustainability**: Reducing waste with advanced data analytics and circular economy solutions.

Research Gap

- **Insufficient holistic frameworks** integrating human-centricity with technological sustainability

- Limited studies integrating **human-centric approaches** with technology-driven sustainability.

- Limited empirical research on long-term sustainability performance measurement

- Lack of comprehensive methodological approaches for sustainable digital transformation

- Insufficient focus on the interplay of ethics, resilience, and advanced technologies in sustainable supply chains.

- Minimal understanding of human behavioral dynamics in technological sustainability adoption

- Absence of standardized sustainability performance measurement protocols

- Need for robust frameworks to measure SPM across diverse sectors and geographies.

Research Objectives

- Develop a comprehensive SPM framework incorporating human-centric and technology-driven dimensions.

- Explore how advanced technologies can enhance sustainability performance across Scope 1, 2, and 3 emissions.

- Investigate the role of human-centric strategies for technological sustainability adoption in balancing economic, environmental, and social goals.

- Investigate the impact of digital technologies on sustainability performance.

- Create a comprehensive sustainability performance measurement model.

- Analyze barriers and enablers in sustainable digital transformation.

Literature Review

- Previous Studies: Comprehensive review of sustainability performance measurement methodologies emphasize traditional sustainability metrics such as carbon footprints and energy consumption.

- Emerging Trends: Critical analysis of existing technological intervention strategies highlighting the increasing use of IoT, AI, and blockchain in supply chain sustainability. Assessment of emerging digital technologies and their sustainability potential

- Gap Identified: Lack of a cohesive strategy combining digital transformation with human-centric sustainability principles.

- Exploration of human-technology interaction in sustainability contexts

- Systematic evaluation of global supply chain sustainability practices

Methodology:

The methodology employed in this study includes a comprehensive review of the literature, empirical data analysis, and case studies to explore sustainability metrics within the context of **Supply Chain 5.0.**

The research framework incorporates qualitative and quantitative methods to assess how digital technologies are driving sustainability outcomes. Data is sourced from historical emission data, and performance reports of organizations leading in supply chain sustainability.

The study also includes an Indian case study to contextualize the findings in a developing economy. The Indian manufacturing and logistics sectors are undergoing significant digital transformation, making it a prime example of how Supply Chain 5.0 can influence sustainability practices in emerging markets.

Research Approach:

The research takes a mixed-methods approach to analyze both the technological and human dimensions of sustainability in Supply Chain 5.0. The quantitative aspect

focuses on measuring the reduction in CO_2 emissions, energy consumption, and waste generation facilitated by digital tools such as blockchain for traceability, IoT-enabled sensors for real-time energy monitoring, and machine learning models for predicting demand and optimizing resource allocation. The qualitative aspect involves interviews with industry experts, supply chain managers, and sustainability officers to understand the organizational challenges and benefits of adopting sustainability metrics within the Supply Chain 5.0 framework.

5. RESEARCH APPROACH STEPS:

- **Step 1:** Identify key metrics for measuring sustainability performance (e.g., carbon intensity, energy efficiency).

- **Step 2:** Analyze the integration of technologies in sustainability goals using case studies and surveys.

- **Step 3:** Develop a human-centric, technology-driven framework for Supply Chain 5.0.

Core Principles of Sustainable Supply Chain 5.0

Supply Chain 5.0 represents a transformative approach that integrates advanced technologies, ecological wisdom, and human-centric design to create purpose-driven global value networks. Its core principles focus on integrating regenerative practices, leveraging cutting-edge innovations, fostering resilience, and adhering to ethical standards to create intelligent, human-centered supply chains.

Let's now discuss the **Six Core Principles of Sustainable Supply Chain 5.0**
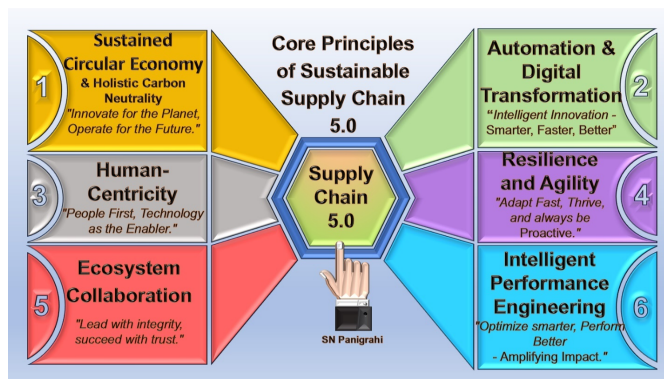
1. Sustainability: Regenerative Ecosystem Approach

Regenerate Today, Preserve Tomorrow -
"Innovate for the Planet, Operate for the Future."

It aims to restore natural ecosystems by adopting circular economy practices and minimizing environmental impact. This principle emphasizes regenerative practices that actively restore and enhance ecological systems, transforming supply chains from extractive to restorative mechanisms. It emphasizes reducing waste, optimizing resources, circular economy, and creating a positive ecological footprint.

2. Automation & Digital Transformation
"Intelligent Innovation - Smarter, Faster & Better"

Utilizes AI, IoT, and robotics to drive efficiency, accuracy, and data-driven decision-making. Advanced technologies enable end-to-end visibility and smarter supply chain operations.

3. Human-Centricity
"People First, Technology as the Enabler."

Focuses on employee well-being, stakeholder collaboration, and customer satisfaction. It promotes inclusivity, skill development, and empowering individuals across the supply chain.

4. Resilience and Agility
"Adapt Early – Respond Fast; Thrive, and always be Proactive*."*

Builds adaptive supply chains that respond swiftly to disruptions and uncertainties. Emphasizes flexibility, proactive risk management, and continuous improvement for sustained growth.

5. Ecosystem Collaboration:
"Lead with Integrity, Succeed with Trust."

Fostering interconnected, collaborative networks that transcend traditional organizational boundaries. Promoting transparent, mutually beneficial partnerships that drive collective innovation and systemic value creation. Compliance with global standards, and ethical practices fosters trust and long-term partnerships across the supply chain network.

6. Intelligent Performance Engineering
"Optimize Smarter, Perform Better & Amplify Impact*"*

Integrates advanced analytics, real-time monitoring, and predictive modeling to optimize performance. Combines precision engineering with sustainability goals for superior outcomes.

This meta-principle synthesizes technological innovation, human potential, and systemic thinking to continuously optimize supply chain performance. Creating a dynamic, self-evolving ecosystem that balances economic, social, and environmental objectives with unprecedented precision and adaptability.

Critical Analysis & Findings:

Lack of Industry Practices and Government Initiatives in Sustainability Performance Measurement (SPM) in Supply Chain 5.0

Lack of Standardized Metrics and Frameworks:

While there are numerous sustainability frameworks and standards, the absence of standardized, universally accepted

sustainability performance metrics across industries creates significant measurement inconsistencies and limits comparative analysis capabilities. This makes it difficult for companies to benchmark their performance and track progress effectively.

Global Standardization Challenges and absence of internationally recognized, adaptable sustainability performance measurement frameworks that can be implemented across diverse economic and technological contexts.

Technological Infrastructure Gap

Insufficient digital infrastructure and low technological adoption rates impede real-time sustainability tracking, preventing comprehensive emissions monitoring and performance optimization. Fragmented Technology Integration and Disconnected technological solutions and lack of interoperability between digital platforms hinder comprehensive sustainability performance measurement across supply chain ecosystems.

Data Quality and Accessibility:

Challenges of Inconsistent data collection, lack of data standardization, Incomplete, and non-verifiable emissions data, and limited data sharing compromise the integrity of sustainability reporting, undermining credible carbon accounting practices and accurate and comprehensive assessments. Improving data quality, Transparency and accessibility is crucial for effective SPM.

Regulatory Framework Limitations - Insufficient Government Support and Regulations:

Governments often lack clear and comprehensive regulations, lack of mandatory sustainability reporting standards, and incentives to promote sustainable supply chain practices creating significant compliance and accountability gaps. Weak policy implementation and enforcement mechanisms and a lack of financial support hinder the adoption of sustainable initiatives.

Complexity of Supply Chains:

Modern supply chains are increasingly complex, involving multiple tiers of suppliers and diverse geographical locations. This complexity makes it challenging to track and measure sustainability performance across the entire supply chain.

Complexity of Holistic Performance Measurement

Challenges in developing comprehensive, multi-dimensional sustainability metrics that capture environmental, social, and economic dimensions simultaneously.

Limited Industry Collaboration and Knowledge Sharing:

While some industries have started to collaborate on sustainability initiatives, there is still a lack of widespread collaboration and knowledge sharing. This limits the ability to develop best practices and innovative solutions.

Limited Financial Incentive Structures

Insufficient economic motivations and minimal government support for sustainable technology adoption are slowing down transformation efforts in supply chain performance measurement.

Cross-Sector Collaboration Barriers

Limited knowledge sharing, weak public-private partnerships, and siloed organizational approaches restrict collective sustainability performance improvement initiatives.

Lack of Awareness and Capacity Building:

Many companies, especially SMEs, lack awareness of sustainability issues and the benefits of sustainable practices. Capacity building initiatives are needed to educate and empower businesses to adopt sustainable practices.

Skills and Capability Deficiency

Inadequate workforce training programs and limited sustainability technology education restrict organizations' ability to implement advanced performance measurement strategies.

Resistance to Change and Short-Term Focus:

Some companies may resist adopting sustainable practices due to perceived costs and risks. A short-term focus on financial performance can hinder long-term sustainability goals.

Challenges in Measuring Social and Environmental Impacts:

Measuring social and environmental impacts, such as human rights, labor practices, and biodiversity conservation, can be complex and subjective. Developing robust and reliable metrics for these areas is challenging.

These findings underscore the critical need for a comprehensive, integrated approach to sustainability performance measurement, demanding collaborative efforts from industry, government, and technological innovators.

To overcome these challenges, a concerted effort is needed from governments, businesses, and other stakeholders to promote standardized metrics, improve data quality, encourage collaboration, and provide adequate support for sustainable supply chain practices.

Proposed Solutions & Recommendations:

Enhancing Sustainability Performance Measurement (SPM) in Supply Chain 5.0:

Sustainability Performance Measurement (SPM) in Supply Chain 5.0 represents a transformative approach to harmonize economic, environmental, and social goals while leveraging

advanced technologies like AI, IoT, and blockchain. It offers an integrated framework to evaluate and enhance supply chain sustainability across critical dimensions such as transparency, efficiency, and circular practices. By addressing gaps in current industry practices and aligning with global sustainability goals, SPM enables organizations to reduce their carbon footprint and create long-term value for all stakeholders.

In the complex landscape of global supply chains, transforming sustainability performance measurement requires a multifaceted, innovative approach that transcends traditional methodologies.

The following recommendations represent a comprehensive strategy to address critical challenges, leveraging advanced technologies, adaptive policy frameworks, and collaborative ecosystem development.

Let's now discuss on these of these elements:

Technological Innovation Strategies:

The digital revolution presents unprecedented opportunities to reimagine sustainability performance measurement. By integrating cutting-edge technologies like AI, blockchain, and IoT, organizations can create dynamic, transparent, and intelligent systems that provide real-time insights into environmental impact and operational efficiency.

1. Integrated Digital Ecosystem

- Develop comprehensive digital platforms integrating AI, blockchain, and IoT
- Create unified sustainability performance tracking infrastructure
- Enable real-time, transparent emissions monitoring

2. Advanced Metrics Standardization Framework

- Establish industry-agnostic sustainability performance indicators
- Develop machine-learning-powered metric calibration mechanisms
- Create adaptable, cross-sector measurement standards

3. Blockchain-Enabled Transparency

- Implement immutable carbon accounting systems

- Develop verifiable, traceable sustainability performance records
- Enable trust-based performance verification mechanisms

Policy and Regulatory Recommendations:

Effective sustainability transformation demands a robust regulatory architecture that balances innovation with accountability. These recommendations focus on creating adaptive, supportive policy frameworks that incentivize technological adoption, promote transparency, and drive systematic change across industries.

4. Comprehensive Regulatory Architecture

- Mandate comprehensive sustainability reporting
- Implement robust performance verification mechanisms
- Design progressive financial incentive structures

Strategic Skill Development Initiatives

- Create national-level sustainability technology training programs
- Develop specialized curriculum for emerging sustainability technologies
- Establish technology-industry-academia collaboration platforms

Collaborative Governance Models

- Foster public-private sustainability innovation partnerships
- Create regulatory sandboxes for sustainability technology experimentation
- Develop adaptive policy frameworks supporting technological innovation

Technological Infrastructure Enhancement:

As digital technologies become increasingly sophisticated, the infrastructure supporting sustainability performance measurement must evolve correspondingly. This section outlines strategies for developing smart, scalable, and interconnected technological ecosystems that enable comprehensive, accurate, and accessible sustainability tracking.

7. Smart Infrastructure Development

- Invest in IoT-enabled sustainability tracking infrastructure
- Develop AI-powered predictive sustainability modeling platforms
- Create scalable, cloud-based performance measurement ecosystems

8. Data Democratization and Accessibility

- Establish open-source sustainability performance databases

- Develop secure, decentralized data-sharing mechanisms

- Create transparent, accessible performance benchmarking platforms

Capacity Building and Ecosystem Development:

Sustainable transformation is fundamentally a human-centric process. These recommendations emphasize creating comprehensive skill development programs, innovation platforms, and collaborative mechanisms that empower organizations to continuously learn, adapt, and improve their sustainability performance.

9. Innovation Acceleration Programs

- Launch targeted sustainability technology innovation funds

- Support startups developing advanced sustainability measurement technologies

- Create international knowledge exchange platforms

10. Comprehensive Capability Enhancement

- Design holistic organizational transformation frameworks

- Develop adaptive sustainability performance management strategies

- Create continuous learning and improvement mechanisms

Economic and Incentive Frameworks:

Financial mechanisms play a crucial role in driving sustainability innovation. By designing intelligent economic instruments that reward performance, create market opportunities, and reduce risk, we can align economic incentives with sustainable development goals.

11. Sustainable Financial Instruments

- Design green finance products supporting sustainability initiatives

- Create carbon credit marketplace with blockchain verification

- Develop risk-adjusted sustainability performance rating systems

12. Performance-Linked Incentive Mechanisms

- Implement tax incentives for sustainable technology adoption

- Create performance-based funding models

- Develop competitive sustainability recognition programs

Ethical and Social Impact Dimension:

The human and societal fabric of sustainability transcends technological and economic metrics. This critical dimension recognizes that true sustainable transformation must integrate ethical considerations, social equity, and human-centric design principles into performance measurement frameworks. By embedding social impact assessments, human rights considerations, and inclusive development strategies, organizations can create holistic sustainability approaches that value both environmental preservation and human dignity.

Key Ethical and Social Impact Considerations:

13. Social Equity Metrics

- Develop comprehensive human rights performance indicators

- Create transparent labor practice assessment frameworks

- Integrate social impact measurements alongside environmental metrics

14. Inclusive Sustainability Design

- Ensure technology and policy innovations consider marginalized communities

- Design bottom-up participatory sustainability measurement approaches

- Develop inclusive capacity-building programs targeting diverse stakeholders

15. Human-Centric Technology Implementation

- Prioritize human well-being in technological sustainability solutions

- Create ethical guidelines for AI and blockchain implementations

- Develop responsible innovation frameworks

16. Cultural and Local Context Sensitivity

- Recognize diverse sustainability interpretations across global contexts
- Develop flexible, adaptable measurement frameworks
- Respect indigenous knowledge and local sustainability practices

17. Transparency and Accountability Mechanisms

- Create open, accessible sustainability performance reporting

- Develop multi-stakeholder verification processes

- Establish independent social impact assessment platforms

Philosophical Foundation of Sustainability is not merely a technical challenge but a profound human and societal transformation that requires empathy, understanding, and a commitment to collective well-being with Core Principles of Human Dignity; Social Equity; Inclusive Innovation; Ethical Accountability; Cultural Respect.

Implementation Roadmap:

Successful transformation requires a strategic, phased approach that allows for continuous assessment, adaptation, and refinement. The implementation roadmap provides a flexible framework for organizations to navigate the complex journey of sustainability performance enhancement.

18. Phased Transformation Strategy

- Conduct a comprehensive baseline assessment

- Develop incremental implementation framework

- Create continuous monitoring and adaptation mechanisms

The path to sustainable supply chain management is neither linear nor uniform. It requires a holistic, integrated approach that simultaneously addresses technological, policy, economic, and human dimensions of organizational transformation.

A holistic, technology-enabled, collaborative approach is essential for transforming sustainability performance measurement in Supply Chain 5.0, requiring synchronized efforts across technological, policy, and organizational domains.

Sustainability Performance Measurement (SPM) in Supply Chain 5.0 - Metrics
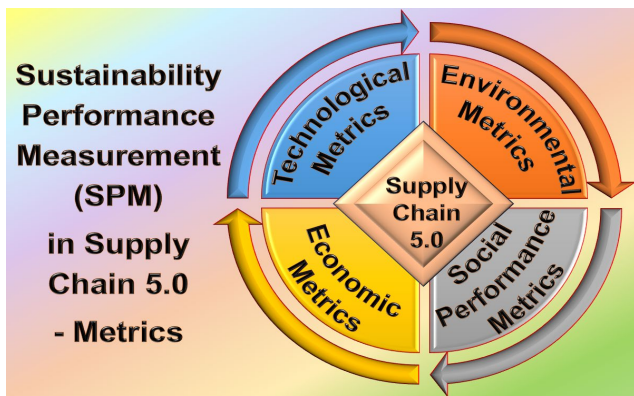
Sustainability Performance Measurement (SPM) is a sophisticated, multi-dimensional framework that comprehensively evaluates supply chain sustainability through four critical domains. By tracking and analyzing these metrics, organizations can identify areas for improvement, reduce their environmental footprint, and enhance their social and economic impact. SPM in Supply Chain 5.0 involves assessing an organization's environmental, social, and economic impacts.

Key metrics include:

Environmental metrics in Supply Chain 5.0 focus on assessing an organization's impact on the environment. This includes measuring carbon emissions, water usage, waste generation, and energy consumption. Additionally, metrics such as emissions intensity and circular material utilization help evaluate the efficiency and sustainability of resource use. By tracking these metrics, organizations can identify opportunities to reduce their environmental footprint and promote sustainable practices.

1. Environmental Performance Metrics

These focus on reducing environmental impact and enhancing resource efficiency.

Metric	Measure	Formula	Example in Supply Chain
Carbon Intensity	Carbon emissions per unit of output	Carbon Emissions (kg CO2e) / Production Output (ton)	Measuring emissions from logistics operations.
Energy Efficiency	Output per unit of energy consumed	Total Output (units) / Energy Consumed (kWh)	Monitoring energy usage in manufacturing plants.
Water Usage Intensity	Water consumption per unit of output	Water Consumed (liters) / Output (ton)	Tracking water consumption in steel production.
Circular Material Utilization	Recycling and Reuse Percentage	(Recycled/Reused Materials / Total Material Input) × 100%	Electronics component reuse rate
Recycling Rate	Proportion of waste recycled	Recycled Waste (kg) / Total Waste Generated (kg)	Waste recycling in packaging processes.
Resource Productivity	Efficiency in resource utilization	Economic Output ($) / Material Input (kg)	Tracking material waste in production.
Renewable Energy Adoption	Green Energy Integration	Renewable Energy Consumption / Total Energy Consumption × 100%	Steel manufacturing renewable energy mix
Ecosystem Restoration Index	Environmental Regeneration Impact	(Restored Ecosystem Area / Total Operational Area) × Impact Score	Mining industry land rehabilitation efforts

Sustainability Performance Metrics: Supply Chain 5.0 Environmental Measurement (Scope 1, 2, 3)

Scope	Metric	Measure	Formula	Supply Chain Example
Scope 1	Direct Emissions	CO2 Emissions from Owned Sources	Total Direct Emissions = Σ(Fuel Combustion + Company Vehicles + On-site Manufacturing)	Emissions from company-owned trucking fleet
	Energy Consumption	Direct Energy Usage	Total Direct Energy = Σ(Electricity + Fuel Consumption)	Warehouse and manufacturing facility energy use
Scope 2	Indirect Energy Emissions	Purchased Electricity	Total Purchased Energy Emissions = Electricity Consumed × Grid Emission Factor	Energy used in logistics centers
	Renewable Energy Ratio	Green Energy Percentage	(Renewable Energy Consumed / Total Energy Consumed) × 100	Solar-powered distribution centers
Scope 3	Upstream Transportation	Supplier Logistics Emissions	Total Upstream Emissions = Σ(Supplier Transportation Emissions)	Raw material transportation emissions
	Downstream Transportation	Product Distribution Emissions	Total Downstream Emissions = Σ(Product Shipping + Last-mile Delivery)	E-commerce product delivery emissions
	Waste Generation	Total Waste Lifecycle Emissions	Total Waste Emissions = Σ(Waste Generated × Emission Factor)	Packaging material waste emissions
	Embedded Carbon	Product Lifecycle Emissions	Total Product Carbon = Σ(Raw Material + Manufacturing + Transportation + Disposal)	Electronics product carbon footprint
Comprehensive	Carbon Intensity	Emissions per Unit Production	Carbon Intensity = Total Emissions / Production Volume	CO2 per unit of product manufactured
	Emission Reduction Rate	Year-on-Year Emissions Reduction	Emission Reduction % = [(Previous Year Emissions - Current Year Emissions) / Previous Year Emissions] × 100	Annual supply chain emissions reduction

Social performance metrics in Supply Chain 5.0 evaluate the social impact of an organization's operations. This includes assessing labor practices, such as fair wages, safe working conditions, and employee well-being. Additionally, metrics related to workforce diversity, community engagement, and human rights help gauge the organization's commitment to social responsibility. By tracking these metrics, organizations can identify areas for improvement and enhance their social impact.

2. Social Performance Metrics
These emphasize stakeholder well-being and ethical practices.

Metric	Measure	Formula	Example in Supply Chain
Employee Turnover Rate	Workforce retention	(Employees Left / Total Employees) × 100	High turnover in warehousing operations indicates low engagement.
Supplier Compliance Rate	Suppliers meeting ethical norms	Compliant Suppliers/Total Suppliers×100	Percentage of suppliers adhering to environmental norms.
Community Investment	Investments benefiting local communities	Community Spend ($)/Total Revenue ($)	Investments in local educational initiatives by suppliers.
Workplace Safety Rate	Safety incidents per 1,000 employees	Incidents/Employees×1,000	Reducing injuries in transportation operations.
Diversity Ratio	Gender or minority representation	Diverse Employees / Total Employees	Increasing gender diversity in procurement teams.
Fair Wage Index	Worker Compensation Equity	Average Worker Compensation / Local Living Wage × 100%	Garment industry worker wage analysis
Inclusive Employment Ratio	Workforce Diversity	(Diverse Employee Representation / Total Workforce) × 100%	Technology sector gender representation
Occupational Safety Performance	Workplace Health & Safety	(1 - (Total Workplace Incidents / Total Working Hours)) × 100%	Manufacturing sector safety compliance
Community Investment Ratio	Local Community Development	Total Community Development Investments / Total Revenue × 100%	Pharmaceutical supply chain community programs
Supplier Ethical Compliance	Human Rights and Ethics Score	(Ethical Audit Score / Maximum Possible Score) × 100%	Electronics industry supplier code adherence

Economic performance metrics in Supply Chain 5.0 focus on assessing the financial viability and long-term sustainability of an organization's operations. This includes measuring cost efficiency, revenue generation, and strategic risk management. Additionally, metrics related to green cost savings and sustainable revenue generation help evaluate the economic value of sustainable practices. By tracking these metrics, organizations can identify opportunities to reduce costs, increase revenue, and enhance their overall financial performance.

3. Economic Performance Metrics
Focused on balancing cost efficiency and value creation.

Metric	Measure	Formula	Example in Supply Chain
Cost to Serve (CTS)	Cost incurred to deliver products	Total Supply Chain Cost ($) / Delivered Orders	Costs of distribution for steel supply to construction sites.
Revenue Growth	Year-on-year revenue growth	(Current Revenue - Previous Revenue) / Previous Revenue×100	Improved margins through sustainable products.
Inventory Turnover Ratio	Inventory movement efficiency	COGS / Average Inventory Value	Tracking efficiency of raw materials usage in operations.
Supply Chain ROI	Returns generated by supply chain	(Net Profit/Supply Chain Cost)×100	Measuring financial returns on sustainable supply chain initiatives.
Logistics Cost Ratio	Logistics costs relative to revenue	Logistics Cost ($)/Total Revenue ($)	Optimizing freight and transportation costs.
Sustainable Revenue Percentage	Green Product Portfolio	(Revenue from Sustainable Products / Total Revenue) × 100%	Consumer goods sustainable product share
Green Cost Savings Ratio	Sustainability-Driven Efficiency	(Cost Savings from Sustainability Initiatives / Total Operational Cost) × 100%	Logistics sector fuel efficiency savings
Sustainability R&D Investment	Innovation in Green Technologies	(R&D Investment in Sustainable Technologies / Total R&D Budget) × 100%	Automotive electric vehicle development
Sustainability Risk Reduction Index	Strategic Risk Mitigation	(Identified Risks Mitigated / Total Identified Risks) × 100%	Agricultural climate adaptation strategies
Supply Chain Diversification Index	Resilience and Adaptability	(Number of Diverse Suppliers / Total Supplier Base) × Geographical Spread Score	Technology sector multi-regional sourcing

Technological intervention metrics in Supply Chain 5.0 assess the extent to which an organization leverages technology to drive sustainability. This includes measuring the adoption of digital technologies, such as predictive analytics, process automation, and green technologies. By tracking these metrics, organizations can identify opportunities to improve efficiency, reduce costs, and enhance their overall sustainability performance.

4. Technological Intervention Metrics
Measure the adoption and impact of advanced technologies in supply chains.

Metric	Measure	Formula	Example in Supply Chain
Automation Utilization	Extent of automation in operations	Automated Processes/Total Processes×100	Percentage of automated tasks in warehouses.
Data Integration Score	Real-time data sharing across stakeholders	(Integrated Systems/Total Systems)×100	IoT usage in logistics for real-time tracking.
Technology ROI	Financial returns on technology investment	(Savings - Costs) / Costs×100	Return on AI-driven predictive maintenance systems.
Digital Adoption Index	Employee readiness for technology use	Employee surveys to assess training effectiveness	Measuring proficiency in using blockchain for traceability.
Cybersecurity Readiness	Preparedness for data breaches	Incident response time and prevention measures	Monitoring data safety in vendor management systems.
Technology Adoption Velocity	Digital Transformation Rate	(New Technology Implementation Rate / Potential Technology Opportunities) × 100%	AI integration in supply chain management
Predictive Analytics Effectiveness	Data-Driven Decision Making	(Accurate Predictions / Total Predictive Interventions) × 100%	Inventory optimization using machine learning
Supply Chain Digital Security Score	Cybersecurity and Data Integrity	(Prevented Security Incidents / Total Potential Vulnerabilities) × 100%	Blockchain traceability in pharmaceuticals
Process Automation Rate	Operational Efficiency	(Automated Processes / Total Operational Processes) × 100%	Warehouse robotic process automation
Green Technology Integration Index	Sustainable Technology Adoption	(Sustainable Technology Implementations / Total Technology Investments) × 100%	Energy-efficient data center technologies

6. SUPPLY CHAIN & LOGISTICS CO2 EMISSIONS METRICS

Supply chain and logistics CO2 emissions metrics represent a critical framework for quantifying environmental impact across transportation, warehousing, and distribution networks. These metrics comprehensively measure carbon footprint by analyzing direct and indirect emissions through Scope 1, 2, and 3 assessments, enabling organizations to track, report, and strategically reduce their carbon emissions throughout the entire logistics ecosystem. By integrating advanced technologies like AI, blockchain, and IoT, companies can now achieve unprecedented transparency and precision in understanding and mitigating their environmental footprint.

Supply Chain & Logistics CO2 Emissions Metrics

CO2 Metric	Measure	Formula	Example	Relevance/Remarks
Transportation Emissions Intensity	Carbon Efficiency in Logistics	Total CO2 Emissions / Freight Ton-Kilometers	Diesel truck emissions per km transported	Directly measures transportation carbon footprint
Warehouse Energy Consumption	Facility Carbon Performance	Annual Facility CO2 Emissions / Total Operational Hours	Distribution center electricity and heating emissions	Evaluates infrastructure-level carbon efficiency
Modal Shift Carbon Reduction	Transportation Mode Optimization	(Initial Mode Emissions - Alternative Mode Emissions) / Initial Mode Emissions × 100%	Shifting from road to rail transportation	Assesses emission reduction through transportation strategy
Supply Chain Network Carbon Efficiency	Geographical Emission Optimization	Total CO2 Emissions / Total Network Distance Traveled	Global supply chain route carbon performance	Analyzes comprehensive network-level emissions
Last-Mile Delivery Emissions	Urban Logistics Carbon Impact	CO2 Emissions per Delivery / Total Deliveries	Electric vehicle vs. traditional delivery van emissions	Focuses on critical urban logistics carbon challenges
Reverse Logistics Carbon Footprint	Circular Economy Emission Management	CO2 Emissions from Return Processes / Total Logistics Emissions	Product return transportation and processing emissions	Measures sustainability of return and recycling processes
Inventory Turnover Carbon Efficiency	Stock Management Emission Optimization	CO2 Emissions per Inventory Cycle / Inventory Turnover Rate	Warehouse stock management carbon performance	Links inventory practices with carbon management
Packaging Material Carbon Impact	Sustainable Packaging Evaluation	CO2 Emissions from Packaging Materials / Total Shipment Weight	Comparative analysis of packaging material emissions	Assesses packaging-related carbon contributions
Multimodal Transport Emission Optimization	Integrated Transportation Carbon Strategy	Weighted Average CO2 Emissions Across Different Transportation Modes	Combining sea, air, road, and rail transportation emissions	Provides holistic multi-modal emission assessment
Supplier Carbon Performance	Supply Chain Partner Emission Accountability	Aggregated Supplier CO2 Emissions / Total Supply Chain Emissions	Tier 1 and Tier 2 supplier emission calculations	Evaluates upstream and downstream emission sources

7. CONCLUSION

In the rapidly evolving global landscape, Supply Chain 5.0 emerges as a critical paradigm for sustainable transformation, integrating advanced technologies with environmental consciousness. The intersection of artificial intelligence, blockchain, and IoT presents unprecedented opportunities to revolutionize sustainability performance measurement across industries. This holistic approach demands comprehensive strategies that transcend traditional measurement frameworks, enabling organizations to effectively track, analyze, and optimize their environmental impact with unprecedented precision and transparency.

Implementing Sustainability Performance Measurement in Supply Chain 5.0 fosters a paradigm shift toward resilience, transparency, and resource efficiency. By adopting advanced technologies and focusing on stakeholder collaboration, organizations can not only meet regulatory and environmental standards but also drive innovation and social equity.

Implementing comprehensive, technology-driven measurement frameworks ensuring accuracy, transparency, and continuous improvement in supply chain sustainability performance. A commitment to such practices ensures a competitive edge and reinforces the role of supply chains in achieving a sustainable future.

REFERENCES

Academic Journals:

[1.] Govindan, K. (2022). "Sustainable Supply Chain Management: A Comprehensive Review." International Journal of Production Economics.

[2.] Choi, T. Y., & Linton, J. D. (2021). "Digital Transformation in Sustainable Supply Chains." Journal of Cleaner Production.

[3.] Bag, S., et al. (2023). "AI and Blockchain in Sustainable Supply Chain Management." IEEE Transactions on Engineering Management.

[4.] CEEW-Council on Energy, Environment and Water - What are CO2 Emissions from India's Transport Sector?

[5.] Megha Kumar, Zhenying Shao, Caleb Braun, and Anup Bandivadekar (2022): Decarbonizing India's Road Transport: A Meta-Analysis Of Road Transport Emissions Models

Organizational Reports:

[6.] United Nations Environment Programme (UNEP). "Global Supply Chain Sustainability Report 2023."

[7.] World Economic Forum. "Supply Chain 4.0 and Sustainability Transformation."

[8.] International Energy Agency (IEA). "Global Emissions Tracking and Supply Chain Insights."

[9.] CT2022-Climate Trnsparancy India – Report NITI Aayog - India Climate & Energy Dashboard

[10.] IEA 2023: Transitioning India's Road Transport Sector

[11.] Council on Energy, Environment and WaterTechnology & Innovation:

[12.] McKinsey Global Institute. "Digital Supply Chain: Sustainability and Technology Integration."

[13.] Gartner Research. "Emerging Technologies in Supply Chain Performance Measurement."

[14.] Deloitte Insights. "Sustainability 5.0: Technology-Driven Transformation."

Policy & Regulatory:

[15.] IPCC - Intergovernmental Panel on Climate Change "Supply Chain Emissions Mitigation Strategies."

[16.] World Trade Organization. "Sustainable Trade and Supply Chain Practices."

Behavioral Biases and Socially Responsible Investment Decision: Through the Lens of Prospect Theory

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ABSTRACT

With an upsurge in global interest concerning adherence to sustainability aspects in the financial ecosystem, investors are increasingly considering aligning financial goals with their values through socially responsible investments (SRI). SRI is an investment strategy that intends to derive positive non-economic values while making economic gains through sustainable equity investments. The study uniquely attempts to investigate the impact of cognitive biases associated with ESG consciousness and the risk assessment of SRI on the SRI decision-making behavior of retail investors. Based on the theoretical foundation of Prospect theory, a survey of 337 BSE-registered retail investors was conducted using the structured equation modeling technique through PLS-SEM 4. The findings provide critical insight into the nexus of ESG consciousness and cognitive biases on the SRI decision-making process of retail investors. While loss aversion and risk perception positively shaped the SRI decision through ESG consciousness, the risk propensity showed no effect on making actual SRI behavior. The study significantly contributes to the existing research in behavioral finance by extending the prospect theory and integrating behavioral insights into sustainable investment strategy. Finally, the study offers practical implications for a wide range of stakeholders in expanding SRI in the emerging financial market.

Keywords: Socially responsible investment (SRI), investment behavior, behavioral bias, prospect theory, loss aversion, risk perception,

1. INTRODUCTION

The financial market is experiencing a transformative shift with a strong emphasis on sustainability (Eccles and Klimenko, 2019). This shift is largely driven by the Paris Agreement (Paris Agreement, 2015), which positions financial institutions at the forefront of efforts to combat climate change. Investors serve as important intermediaries in the potential progress of sustainable development goals by guaranteeing proper capital allocation (PRI, 2017). Integrating sustainability criteria, like ESG (environmental, social, and governance) scores, into the investment decision analysis has made socially responsible investment (SRI) a popular investment strategy. This emergence of SRI as a growing niche in the financial investment world, over the past few decades underscores the expanding interest among investors in matching their financial objectives with their moral principles to generate profits while having a beneficial social impact (Chatzitheodorou et al., 2019; Mishra et al., 2023). A wider dedication to sustainability and ethical governance is reflected in SRI, which considers both the social impact of investment allocations and financial returns (Riedl and Smeets, 2017). These investments emphasize long-term financial gains and avoid companies participating in immoral behavior or actions that negatively impact society and the environment, resulting in external costs not covered by the parties concerned (Scholtens, 2006; Sovacool and Linnér 2016).

The number of investors who link their investment choices to sustainability outcomes increased from 66% to 79% between 2021 and 2023, according to the GRI (2024) report. Aiming to reach these goals by 2050, hundreds of PRI signatories have committed to shifting their investment portfolios to net-zero greenhouse gas (GHG) emissions in recognition of the urgency of combating climate change. Essentially, there are two main causes for this amazing increase. First, people became more conscious of the negative impact of ineffective risk management and governance procedures on financial markets and the world economy during the 2007–2008 financial crisis. Second, the dire external environmental conditions including resource depletion, climate crisis, and biodiversity loss have increased the demand for more responsible conduct and better global cooperation between corporations and government entities (Hidalgo-Oñate et al., 2023; Erragragui et al., 2023).

Traditional financial theories, such as the modern portfolio theory by Markowitz (1951), identify investors as Homo Economicus, assuming them to be perfectly rational while evaluating their investment options purely based on expected returns and risks. However, insights from the behavioral finance theories, introduced by Kahneman and Tversky (1979), reveal that cognitive biases and emotional factors play a crucial role in individuals' decision-making process. Specific perceptual errors among investors correlate with psychological biases and investment behaviors (Ady, 2018; Sahi, 2017; Dervishaj, 2021). Biases, particularly associated with investors' perception of potential losses and risk have been significant in determining the investment choice among investors (Mitroi & Stancu, 2014; Fernandes et al., 2017; Waheed et al, 2020). The "risk versus reward" dichotomy has been a distinctive and crucial parameter in determining investment decisions. However, in the context of the current investment scenario, "sustainability versus reward" is a more

appropriate consideration. For instance, which would you prefer, an asset with greater sustainability or one with a larger yield at the same degree of risk? The importance of long-term sustainability for investments has recently come to the attention of several institutional investors.

With the upsurge in the global trend of incorporating sustainability factors in the financial ecosystem, there has been a huge shift in the perception of investors toward considering ESG factors while making investment decisions (Dmuchowski et al., 2022; Kłobukowska, 2017; Sweta, 2023). Although most research classifies investors who choose SRI as value-driven, Banerjee and David (2024) postulated that the majority of investors prioritize traditional indicators over ESG factors.

However, a higher level of ESG awareness posits a significant influence among both retail and institutional investors to prioritize companies with strong ESG compliance and positively correlate to the increased inclination toward sustainable investment decisions (Tiwari et al., 2024; Banerjee & David, Sinha et al., 2020). Therefore, the EESG (economic, environmental, social, and governance) aspect of investments emerged as a crucial factor in assessing investment considering its impact on the expected risk and return of the portfolio (Revelli, 2017).

Simultaneously, behavioral biases have been identified as crucial determinants in shaping investment choices among investors. Extant literature in behavioral finance has demonstrated that different cognitive biases such as loss aversion, overconfidence, and herding are significantly responsible for formulating investors' judgments and risk assessment (Aigbovo & Ilaboya, 2019; Mittal, 2022; Gautam et al., 2021). Furthermore, the varying degree of ESG awareness among investors directly influences their perception of risk, long-term values, and ethical alignment with their investment decisions (Pong, 2024; Park & Shin, 2024). However, the presence of cognitive biases may either enhance or undermine the influence of ESG awareness on the SRI decision-making process of investors.

Therefore, the study aims to present a nuanced perspective on the psychological and ethical drivers behind SRI decision-making behavior, by uniquely integrating ESG awareness and psychological biases based on the Prospect theory by Kahneman and Tversky (1979). The study's insights can be utilized in designing investment strategies that align with both profit and sustainability goals, and in shaping effective investment policies to advance sustainable finance.

2. REVIEW OF LITERATURE
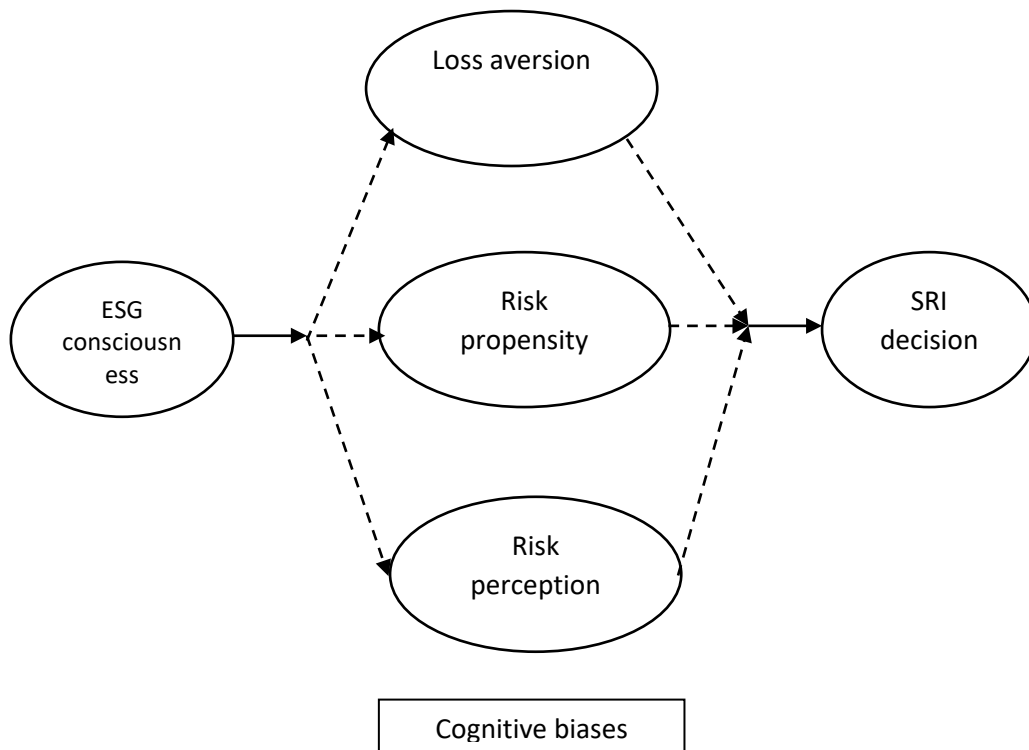
2.1 Theoretical background and conceptual framework

Figure I. Conceptual model.

Source: Authors.
Note: Dotted lines represent mediation.

In contrast to the expected utility theory, the prospect theory, which was first presented by Kahneman and Tversky in 1979, offers a framework for evaluating how risk affects investors' decision-making. It highlights that when faced with possible rewards and losses, investors frequently make irrational decisions and are swayed by cognitive biases. According to Tom et al. (2007), it is thought to be the best behavioral model for comprehending how people make decisions in the face of risks and uncertainty. Prospect theory has primarily been used to study how people make decisions about equity investments (Jaroslava et al., 2017; Prietzel, 2020; Gou et al., 2021; Zhenmin et al., 2023). Existing research has found that investors' willingness to compromise returns for SRI to be contradictory (Dorfleitner and Utz 2014; Glac 2009; Berry and Yeung 2013). While some investors refrain to forgo returns (Peylo, 2014; Von Wallis and Klein, 2014), other are willing to accept a lower percentage of return for sustainable investments (Dorfleitner and Utz 2014; Lewis & Mackenzie 2000). This difference in perspective on SRI enables us to completely utilize the Prospect theory in order to comprehend how retail investors' SRI judgments are influenced by cognitive biases in presence of ESG information. Therefore, we propose the following conceptual model in Figure I:

ESG consciousness and SRI decisions

With the emergence of SRI as an alternative investment option advocating ESG standards, the investors are increasingly inclining toward incorporating ethical considerations while making investment decisions (Richardson, 2009; ECHEAN, 2024). This shift is a consequence of the upsurge in ESG and sustainability awareness rising from the ESG initiatives by government and financial institutions owing to global economic and environmental crisis. ESG discretion on investment decision making is getting prevalence among investors as with increase in ESG awareness they are more likely to evaluate companies based on their long-term risk adjusted returns, sustainability practices, social impact and ethical standards (Aich et al., 2021; Sultana et al., 2018; Khalil & Khalil, 2022). Furthermore, ESG investing is considered as a strategic and effective move by the investors aiming to reduce risk and improve efficiency (Chung et al., 2024; Cagli et al., 2023; Briand et al., 2011). The ESG aspect of a company such as environmental responsibility and corporate integrity makes up crucial information reflected through the ESG ratings of the companies that investors use in building their perception and better assess the risk associated with their investment choices (Sinha et al., 2020; Puente De La Vega Caceres, 2024). Therefore, we propose the hypothesis:

H1: ESG consciousness significantly affects SRI decisions among retail investors.

H2: ESG consciousness significantly affects LA.

H3: ESG consciousness significantly affects Rpro.

H4: ESG consciousness significantly affects Rper.

Loss aversion as a mediator

Loss aversion bias (LA) is the tendency of individuals to exhibit a higher sensitivity to possible loss than to comparable gains in decision-making, causing them to depart from predicted utility. This psychological bias was introduced by Kahneman and Tversky (1979) as a central idea in the Prospect theory. A wide variety of complex decision-making behavior has been explained through loss aversion bias (Abdellaoui et al., 2008; Polman, 2012; Erev et al., 2008; Hadlaczky et al., 2018; Jervis, 1992; Anderssson et al., 2016). Many studies, including those by Kumar and Babu (2018), Bouteska and Regaieg (2020), and Sarwar et al. (2020), have demonstrated that when making traditional investment decisions, investors are more likely to take on greater risks when holding onto losing assets in the hopes that they will recover than when they are in a gain position. Investment decisions are subsequently influenced by whether loss aversion is overestimated or underestimated. Furthermore, Arora and Kumari (2015) propounded that the intensity of loss aversion reduces the effect of demographic characteristics on risk tolerance level of investors. Additionally, Ouzan (2020), validated that loss aversion could be one of the resaons for market crash owing to the stimulation from information asymmetry. This opens up the need to explore the impact of ESG information on investors; sensitivity to potential losses associated with their choice of investment practices. Therefore, we propose the following hypotheses:

H5: The intensity of loss aversion bias significantly affects SRI decisions among retail investors.

H6: LA mediates the relationship between ESG consciousness and SRI decisions among retail investors.

Risk perception as a mediator

Perception is created in the mind through neural activation and stimulation (Hamlyn, 2017). Receiving information aids in creating a picture of the outcome, which affects perception (Rogers, 2017). Risk perception (Rper) significantly impacts decision-making when faced with ambiguity, and cognitive biases can influence how people perceive risk (Lanciano et al., 2020; Eitzinger et al., 2018). Investment decisions are affected by risk perception as individuals who perceive higher risk tend to allocate more funds to less risky assets whereas individuals with lower risk perception tend to make riskier investments (Kartini & Nahda, 2021; Salamanca et al., 2020). Furthermore, many studies have confirmed risk perception to be a significant mediator in various decision-making processes (Lim et al., 2018; Zambrano-Cruz et al., 2018). Therefore, we propose the following hypotheses to

determine the effect of risk perception on SRI in the presence of ESG information as follows:

H7: Rper significantly affects SRI decisions among retail investors.

H8: Rper perception mediates the relationship between ESG consciousness and SRI decisions among retail investors.

Risk propensity as a mediator

Risk propensity (Rpro) refers to an individual's predilection toward risk. It is a dynamic attribute in an individual that evolves with experience (Hung & Tangpong, 2010). Simply put, risk propensity is a person's willingness to take risks, whereas risk perception is how they view uncertainty in a particular situation. Decision-making in various crucial settings is strongly influenced by individual's willingness to avoid or accept the risk, that is their risk propensity (Das & Teng, 2001; Combrink & Lew, 2020; Schäfer et al., 2023). While some studies support risk propensity as a dispositional trait that is consistent and stable (MacCrimmon and Whrung, 1986; Kimball, 1990), many studies have alternatively confirmed that an individual's risk propensity shifts and changes with the different decision-making contexts (Keil et al., 2000; Das & Teng, 2001; Schildberg-Hörisch , 2018; Zivi et al., 2023). Additionally, the mediating effect of risk propensity has been assessed and validated by existing research in distinct paradigms (Zhang et al., 2020; Rauch et al., 2017; Hussain et al., 2021). Thus, we put forth the following hypotheses:

H9: Rpro significantly affects SRI decisions among retail investors.

H10: Rpro mediates the relationship between ESG consciousness and SRI decisions among retail investors.

3. RESEARCH GAP IDENTIFICATION

Most of the studies conducted in the extant ESG literature have been focused mainly on assessing the impact of sustainable investments on portfolio performance. However, the link between ESG awareness and the development of risk perception related to investment choices has received limited attention in past studies (Deka et al., 2023;

While prior research has essentially taken into consideration the ethical, religious, and social factors in justifying the adoption of SRI, very few studies have assessed the combined effect of ESG awareness (a value-centric, non-financial aspect) and biases related to financial risk (a mental process) together to robustly comprehend the factors that drive SRI decisions among retail investors. Additionally, to our knowledge, no studies have explored the mediation-moderation mechanism analysis of risk propensity in the context of SRI decision-making behavior among retail investors.

To address this gap, the study examines the intertwined influence of ESG awareness and select cognitive bias (loss aversion) and processes (risk perception and risk propensity) as mediators to present a comprehensive analysis of SRI behavior.

4. METHODOLOGY

Data collection

G*Power v3.1.9.4 software was used to establish the study's minimum sample size (Faul et al., 2009). At a minimal effect size of 0.15, with four predictor variables, a minimum sample size of 146 retail investors was found sufficient to achieve a power of 0.95. Our study's participants were Indian equity traders who are registered with the BSE. A combined sampling technique using convenience, proportionate, and snowballing approaches was used to collect response data for the study. The data was collected between February, 2024 and June, 2024. We began by selecting the top 5 states with the highest number of registered investor base listed in BSE database. Next, we collected responses proportionately corresponding to the percentage of investors in each selected state. A standardized Likert scale-based questionnaire was structured and created using Google Forms. A total of 400 questionnaires were distributed online via email and social media platforms. Out of which, we received 346 full responses. Additionally, screening questions were integrated to identify suitable responders within the study's collected data, leaving us with 337 properly acceptable respondent data.

Measures

The study is based on primary data and all the latent (endogenous and exogenous) constructs are measured by adapting items from existing literature to suit the context of the study. The questionnaire consists of three sections; the first is dedicated to collecting the demographic details, the second comprises screening questions to filter appropriate responders for the study, and the third contains items for measuring each construct in the study. 5 items each for the constructs 'ESG consciousness', 'loss aversion', 'risk perception', and 'risk propensity' were adapted from Deka et al., 2023, Kisaka, 2015, Hoffmann et al., 2015, and Zhang et al., 2019, respectively. The 'SRI decision' construct was measured by adapting 4 items from Nilsson (2007).

Data analysis

Each construct in the structural model and its interactions were measured and assessed using the PLS-SEM analysis in SmartPLS 4. Since our study is exploratory, the PLS-SEM approach was considered suitable as it does not require normally distributed data and exhibits stronger statistical power with small samples (Hair et al., 2011; Fornell & Bookstein, 1982). Furthermore, it emphasizes predictive analysis and employs the bootstrap process to estimate model

parameters from the initial sample of observations, producing reliable findings (Hair et al., 2017; Hair et al., 2011).

5. FINDINGS AND DISCUSSIONS

Demographic details

Although the majority of the responders were men (195) as opposed to women (142), the difference is marginal, with a respective ratio of 57.8% and 42.13%. Therefore, it can be stated that the survey predominantly represents both genders' opinions. Additionally, most of the responders were within the age bracket of (31-40 years; 59.64%) Therefore, it can be inferred that the responses collected were mostly from a mature group of individuals with a better understanding of SRI. With regard to investment experience, most of the respondents had a personal investment experience of 1-5 years (60.83%) which implies their familiarity with and efficacy in investment decision-making. The demographic representation of the sample is presented in Table 1.

TABLE 1: Demographic details.

Attributes	Categorization	Incidence rate	Incidence rate percentage (%)
Gender	Male	195	57.80
	Female	142	42.13
Age	18-30	48	14.24
	31-40	201	59.64
	41-50	67	19.88
	51 and above	21	6.23
Educational Qualification	Graduate	285	84.56
	Postgraduate	43	12.75
	Others	9	2.67
Occupation	Student	89	17.50
	Self-employed	102	30.26
	Service	136	40.35
	Others	10	2.96
Experience in investment	Less than 1 year	43	12.75
	1-5 years	205	60.83
	6-10 years	69	20.47
	More than 10 years	20	5.93
Monthly income (in Rupees)	Less than 20,000	30	8.90
	20,000-50,000	195	57.86
	51,00-100,000	76	22.55
	More than 100,000	36	10.68

CMB analysis

Prior to delving into the main analysis, we conducted Herman's single-factor test using SPSS 21 to check for the possibility of common method bias (CMB) arising from using a single instrument to measure all the variables leading to spurious relationships between the variables, affecting the validity of the findings. With 41.57% of the maximum variation explained by the items, which is below the threshold of 50%, the analysis confirmed the absence of CMB in our study (Podsakoff et al., 2003). Subsequently, the two-staged SEM analysis consisting of the assessment of the measurement model followed by the assessment of the structural model was performed.

Measurement model analysis

The collinearity between all constructs was evaluated before the hypotheses were tested. Each item's VIF (variance inflation factor) values, ranging from 1.339 to 2.558, were below the 3.0 criterion. With factor loadings ranging from 0.715 to 0.863, each latent construct demonstrated sufficient construct reliability, surpassing the 0.7 threshold (Hair et al., 2011, Hair et al., 2018, Sarstedt et al., 2017). The internal consistency of the constructs was confirmed through the composite reliability, whose values ranged from 0.779 to 0.855 and the Cronbach's alpha values for each construct ranged from 0.770 to 0.842, further indicating scale reliability. Additionally, all of the constructs' acceptable convergent validity was confirmed by the average variance extracted (AVE) value exceeding 0.50 (Fornell & Larcker, 1981).

Furthermore, two methods were used to evaluate the discriminant validity: the Heterotrait-Monotrait (HTMT) ratio of correlation criteria, which ranged from 0.599 to 0.736 while staying below the 0.90 threshold, and the Fornell and Larcker criterion, which required that each construct's square root of AVE be greater than the corresponding inter-construct relationship to validate the discriminant validity among the latent constructs (Sarstedt et al., 2017, Fornell & Larcker, 1981). The measurement model is depicted in Figure II.
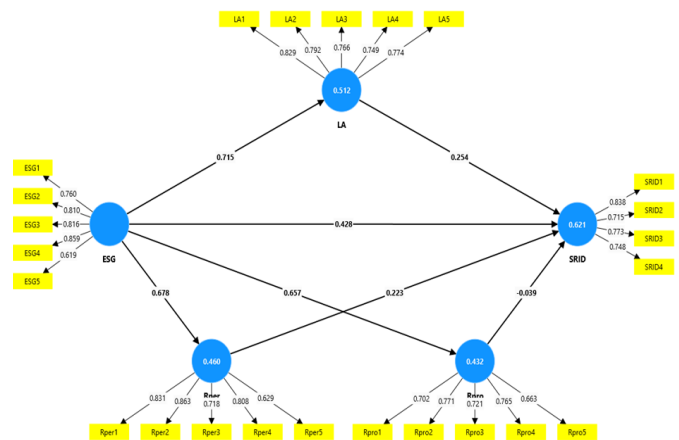

Figure II: Measurement model.

Structural model analysis

We began the structural model analysis by assessing the standardized root mean square residual (SRMR) value of the structural equation model to evaluate the model fit. The SRMR value of 0.046 falls within the threshold recommended by Henseler et al (2016), indicating a good model fit. Then, following Ozili's (2022) advice, we evaluated the R2 value to determine each exogenous latent variable's contribution to the model. All four constructs: 'loss aversion', 'risk perception', 'risk propensity', and 'SRID' had significant R2 values of 0.512, 0.460., 0.432, and 0.621, respectively, suggesting they account for 62.1% variability in investors' decision to invest in socially responsible funds (Hair et al., 2018). Next, we assessed the Q2 value, which was above 0 for all the exogenous constructs establishing the predictive reliability of the model (Shmueli et al., 2019).

Following model fit confirmation and establishment, all direct hypotheses were initially tested in SmartPLS 4 using bootstrapping with 5,000 subsamples. The results are presented in Table 2. The suitability of the sample size was confirmed by the strong statistical power of 0.999 or higher for each of the hypotheses. H_1, H_2, H_3, and H_4 were substantiated because the results showed that 'ESG consciousness' had a strong impact on 'SRID', 'loss aversion', and 'risk perception' (β =0.233, p = 0.000; β = 0.195, p = 0.000; β = 0.288, p = 0.000) and weaker positive impact on 'risk propensity (β =0.061, p = 0.001). Also, H_5, H_7, and H_7 were accepted demonstrating LA (β =0.204, p = 0.001), Rper (β =0.287, p = 0.001), and Rpro (β =0.198, p = 0.039) had a significant impact on SRID. The structural model is depicted the in Figure 3.
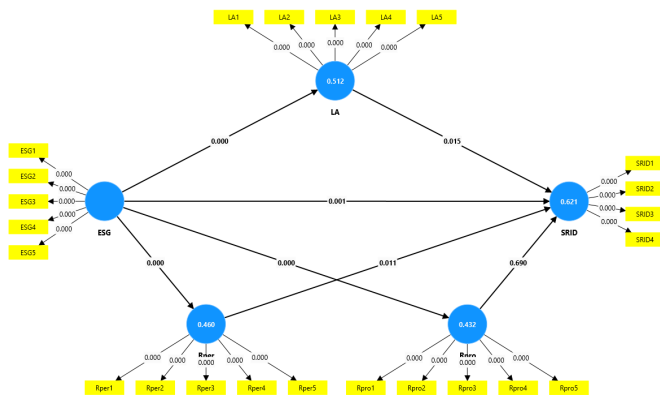

Figure III: Structural model.

Mediation analysis

In our study, we hypothesized 'Loss aversion', 'Risk perception', and 'Risk propensity' to mediate the relationship between 'ESG consciousness' and 'SRI decision'. The indirect effect of mediation was assessed using 5,000 subsamples and the bootstrapping method. At a 95% confidence level, the results showed that adding 'loss aversion', and 'risk perception' to the model had a significant

partial mediation effect (β = 0.176, p = 0.017; β = 0.162, p = 0.015) leading to the acceptance of H6 and H8. However, 'risk propensity' had no significant mediating effect between the 'ESG consciousness' and 'SRI decisions' of retail investors (β = 0.064, p = 0.688). Therefore, H10 was rejected. This underscores the greater sensitivity of ESG-conscious investors to preventing possible long-term losses, which is strengthened by ESG data and their loss-aversion inclinations, which encourages them to make real SRI decisions. This is also consistent with our findings on the mediating influence of risk perception, which shows that people are more likely to choose SRI options over traditional ones as they become more aware of ESG issues. However, people's decisions on SRI are unaffected by their overall risk tolerance. This highlights that risk perception is a context-driven behavior that can change based on the risk assessment of the particular investment, independent of an individual's overall risk tolerance, whereas risk propensity, is a stable personality trait indicating their risk appetite, which is less likely to convert into willingness to invest in SRI options even in the presence of ESG information. The direct and specific indirect effects from the structural model analysis are presented in Table II and Table III.

TABLE II: Direct effect hypotheses analysis results.

Hypotheses	Relation	β	p-value
H_1	ESG → SRID	0.233	0.000
H_2	ESG →LA	0.195	0.000
H_3	ESG → Rper	0.288	0.000
H_4	ESG → Rpro	0.061	0.001
H_5	LA → SRID	0.204	0.001
H_7	Rper → SRID	0.287	0.001
H_9	Rpro → SRID	0.198	0.039

TABLE II: Specific indirect effect hypotheses analysis results.

Hypotheses	Relation	β	p-value
H_6	ESG →LA→ SRID	0.176	0.017
H_8	ESG →Rper → SRID	0.162	0.015
H_{10}	ESG → Rpro → SRID	0.064	0.688

6. IMPLICATIONS

Theoretical implications

By applying prospect theory beyond conventional financial behavior, the study adds to the body of knowledge on behavioral and sustainable finance and advances our understanding of how specific cognitive biases function within the SRI framework. The finding challenges the assumption of risk tolerance as a driving factor of investment

decision-making behavior within the context of SRI. Moreover, the study emphasizes on the subjective evaluation of the 'risk perception' construct as not only limited to volatility and financial losses but also other associated factors such as environmental risk, reputational risk, and regulatory risk. Additionally, the findings support the loss aversion affect introduced in the Prospect theory in with regard to the emotional weight of avoiding potential loss from investing in funds not adhering to ESG standards. Consequently, the theoretical comprehension of risk attitude in sustainable finance is expanded.

Practical implications

The study offers various practical implications for stakeholders including, financial advisors, educators, and policy makers. The emergence of 'risk perception' as a significant driving factor implies the need for financial advisors to emphasize on reframing the risk narratives associated around SRI, focusing on their long-term stability. Policy makers should support strengthening the transparency through standardized ESG reporting by companies, demonstrating the data on performance of ESG funds over time. This not only will help in attaining better corporate governance standards but also inject more information and awareness related to sustainable investments, which in turn can potentially encourage more SRI, thereby also advancing toward achieving the nation's SDG goals. Additionally, government and educators may introduce ESG education through webinars and workshops on advanced financial literacy courses.

7. LIMITATIONS AND FUTURE RESEARCH AGENDA

Despite the study's contribution to the literature on sustainable behavior, certain limitations highlight the opportunity for further investigation to comprehend the complexities associated with SRI behavior. Since 'risk perception' is subjective, it is difficult to generalize the findings based on data from a particular geographical area. Therefore, future studies could explore these relations in the context of different geographical settings to validate the findings of the study. Furthermore, the study encourages development of a multidimensional 'risk perception' construct to fully capture the factors influencing risk perceptions related to SRI. Additionally, the study exclusively focused on selective cognitive bias focusing primarily on loss aversion. Other potentially influential biases such as overconfidence bias, anchoring bias, and status quo bias may be explored in future studies to gain a more refined perspective of what could potentially drive SRI among retail investors.

8. DECLARATION

We, Debopriya Kar & Binoti Patro, hereby confirm that the manuscript titled " Behavioral Biases and Socially Responsible Investment Decision: Through the Lens of Prospect Theory" authored by Debopriya Kar and Binoti Patro, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

We affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to International Management Perspective Conference (IMPeC) 2025.

We declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Abdellaoui, M., Bleichrodt, H. & Kammoun, H. (2013). Do financial professionals behave according to prospect theory? An experimental study. *Theory and Decision*, 74, 411–429. https://doi.org/10.1007/s11238-011-9282-3

[2.] Ady, S. U. (2018). The cognitive and psychological bias in investment decision-making behavior:(Evidence from Indonesian investor's behavior). *Journal of Economics and Behavioral Studies,* 10(1), 86-100.

[3.] Aich, S., Thakur, A., Nanda, D., Tripathy, S., & Kim, H. (2021). Factors Affecting ESG towards Impact on Investment: A Structural Approach. *Sustainability*, 13(19), 10868. https://doi.org/10.3390/su131910868

[4.] Aigbovo, O., & Ilaboya, O. J. (2019). Does behavioural biases influences individual investment decisions. *Management Science Review*, 10(1), 68-89.

[5.] Andersson, O., Holm, H. J., Tyran, J. R., & Wengström, E. (2016). Deciding for others reduces loss aversion. *Management Science*, 62(1), 29-36.

[6.] Arora, M., & Kumari, S. (2015). Risk taking in financial decisions as a function of age, gender: mediating role of loss aversion and regret. *International Journal of Applied Psychology*, 5(4), 83-89.

[7.] Banerjee, S., & David, R. (2024). Does ESG really matter? Accessing the relevance of ESG in Indian investors' decision-making dynamics. *Qualitative Research in Financial Markets*. https://doi.org/10.1108/qrfm-10-2023-0241

[8.] Berry, R. H., & F. Yeung. (2013). Are Investors Willing to Sacrifice Cash for Morality?. *Journal of Business Ethics*, 117 (3): 477–492. doi:10.1007/s10551-012-1529-6.

[9.] Bouteska, A., & Regaieg, B. (2020). Loss aversion, overconfidence of investors and their impact on market performance evidence from the US stock markets. J*ournal of Economics, Finance and Administrative Science*, 25(50), 451-478.

[10.] Briand, R., Urwin, R., & Chia, C. P. (2011). Integrating ESG into the investment process. MSCI ESG Research, New York, NY, available at: www. msci. com/resources/research_papers/integrating_esg_into_the_investment_process_2. html (accessed 20 April 2013).

[11.] Cagli, E. C. C., Mandaci, P. E., & Taşkın, D. (2023). Environmental, social, and governance (ESG) investing and commodities: Dynamic connectedness and risk management strategies. *Sustainability Accounting, Management and Policy Journal*, 14(5), 1052-1074.

[12.] Chung, K., Nguyen, L. T. M., & Nguyen, D. T. T. (2024).

Improving hotels' operational efficiency through ESG investment: A risk management perspective. *Service Science*, 16(3), 172-183.

[13.] Combrink, S., & Lew, C. (2020). Potential underdog bias, overconfidence and risk propensity in investor decision-making behavior. *Journal of Behavioral Finance*, 21(4), 337-351.

[14.] Das, T. K., & Teng, B. S. (2001). Strategic risk behaviour and its temporalities: between risk propensity and decision context. *Journal of Management Studies*, 38(4), 515-534.

[15.] Deka, J., Sharma, M., Agarwal, N., & Tiwari, K. (2023). Linking ESG-Investing Consciousness, Behavioral Biases, and Risk-Perception: Scale Validation with Specifics of Indian Retail Investors. *European Journal of Business Science and Technology*, 70.

[16.] Dervishaj, B. (2021). Psychological biases, main factors of financial behaviour-A literature review. *European Journal of Medicine and Natural Sciences*, 4(1), 27-44.

[17.] Dmuchowski, P., Dmuchowski, W., Baczewska-Dąbrowska, A. H., & Gworek, B. (2022). Environmental, social, and governance (ESG) model; impacts and sustainable investment – Global trends and Poland's perspective. *Journal of Environmental Management*, 329, 117023. https://doi.org/10.1016/j.jenvman.2022.117023

[18.] Dorfleitner, G., & S. Utz. (2014). Profiling German-speaking Socially Responsible Investors. *Qualitative Research in Financial Markets*, 6 (2): 118–156. doi:10.1108/QRFM-07-2012-0024.

[19.] Eccles, R.G., Klimenko, S., 2019. The investor revolution. *Harvard Business Review*, 97 (3), 106–116.

[20.] ECHEAN, V. (2024). ALIGNING VALUES WITH RETURNS: ETHICAL INVESTING IN PERSONAL FINANCE. Available at SSRN 4845450.

[21.] Eitzinger, A., Binder, C. R., & Meyer, M. A. (2018). Risk perception and decision-making: do farmers consider risks from climate change?. *Climatic change*, 151(3), 507-524.

[22.] Erev, I., Ert, E., & Yechiam, E. (2008). Loss aversion, diminishing sensitivity, and the effect of experience on repeated decisions. *Journal of Behavioral Decision Making*, 21(5), 575–597. https://doi.org/10.1002/bdm.602

[23.] Erragragui, E., Peillex, J., Benlemlih, M., & Bitar, M. (2023). Stock market reactions to corporate misconduct: The moderating role of legal origin. *Economic Modelling*, 121, 106197. https://doi.org/10.1016/j.econmod.2023.106197

[24.] Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

[25.] Fernandes, J. L., Santoro, H., & Oliveira, A. (2017). Behavioral Finance: Perception of Profits or Losses and Investment Decisions. Available at SSRN 3004534.

[26.] Fornell, C., & Larcker, D.F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39-50

[27.] Fornell, C. and Bookstein, F.L. (1982), Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research*, 19(4), 440-452.

[28.] Gautam, C., Raman, T. V., & Kumar, V. (2021). LOSS AVERSION, OVERCONFIDENCE AND SELFATTRIBUTION: IMPACT ON INDIVIDUAL INVESTMENT DECISION. *Journal of General Management Research*, 8(1).

[29.] Glac, K. (2009). Understanding Socially Responsible Investing: The Effect of Decision Frames and Trade-off Options. *Journal of Business Ethics*, 87 (1): 41–55.

[30.] Gou, X., Xu, Z., Zhou, W., & Herrera-Viedma, E. (2021). The risk assessment of construction project investment based on prospect theory with linguistic preference orderings. *Economic Research-Ekonomska Istraživanja*, 34(1), 709–731. https://doi.org/10.1080/1331677X.2020.1868324

[31.] Hadlaczky, G., Hökby, S., Mkrtchian, A., Wasserman, D., Balazs, J., Machín, N., Sarchiapone, M., Sisask, M., & Carli, V. (2018). Decision-Making in Suicidal Behavior: The Protective Role of Loss Aversion. *Frontiers in Psychiatry*, 9. https://doi.org/10.3389/fpsyt.2018.00116.

[32.] Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2011b). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6

[33.] Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks. Sage, p. 165.

[34.] Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2018). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. https://doi.org/10.1108/ebr-11-2018-0203

[35.] Hamlyn, D. W. (2017). The Psychology of Perception. In Routledge eBooks. https://doi.org/10.4324/9781315473291

[36.] Henseler, J., G. Hubona, & P. Ray. (2016). Using PLS Path Modeling in New Technology Research: Updated Guidelines. *Industrial Management & Data Systems*, 116, 2–20.

[37.] Hidalgo-Oñate, D., Fuertes-Fuertes, I., & Cabedo, J. D. (2023). Climate-related prudential regulation tools in the context of sustainable and responsible investment: a systematic review. *Climate Policy*, 23(6), 704–721. https://doi.org/10.1080/14693062.2023.2179587

[38.] Hoffmann, A. O., et al. (2015). How investor perceptions drive actual trading and risk-taking behavior. *Journal of Behavioral Finance*, 16(1), 94-103. https://doi.org/10.1080/15427560.2015.1000332

[39.] Hung, K.-T., & Tangpong, C. (2010). General risk propensity in multifaceted business decisions: Scale development. *Journal of Managerial Issues*, 88-106.

[40.] Hussain, I., Nazir, M., Hashmi, S. B., Shaheen, I., Akram, S., Waseem, M. A., & Arshad, A. (2021). Linking green and sustainable entrepreneurial intentions and social networking sites; the mediating role of self-efficacy and risk propensity. *Sustainability*, 13(13), 7050.

[41.] Jaroslava, H., Ines, F. &, Panagiotis, T. (2017). The consumption–investment decision of a prospect theory household: A two-period model. *Journal of Mathematical Economics*, 70, 74-89.

[42.] Jervis, R. (1992). Political implications of loss aversion. *Political Psychology*, 13(2), 187. https://doi.org/10.2307/3791678

[43.] Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263. https://doi.org/10.2307/1914185

[44.] Kartini, K., & NAHDA, K. (2021). Behavioral biases on investment decision: A case study in Indonesia. *The Journal of Asian Finance, Economics and Business*, 8(3), 1231-1240.

[45.] Keil, M., Wallace, L., Turk, D., Dixon-Randall, G., & Nulden, U. (2000). An investigation of risk perception and risk

propensity on the decision to continue a software development project. *Journal of Systems and Software*, 53(2), 145-157.

[46.] Khalil, M. K., & Khalil, R. (2022). Leveraging Buyers' Interest in ESG Investments through Sustainability Awareness. *Sustainability*, 14(21), 14278. https://doi.org/10.3390/su142114278

[47.] Kisaka, E. K. (2015). The effect of behavioral finance factors on stock investment decisions in Kenya. https://www.semanticscholar.org/paper/The-effect-of-behavioral-finance-factors-on-stock-Kisaka/7d8d44f376024785c2ebb680c5d3fba9b481aa5dKimball, M. S. (1990). Precautionary saving and the marginal propensity to consume.

[48.] Kłobukowska, J. (2017). SOCIALLY RESPONSIBLE INVESTMENT IN ASIA. *Copernican Journal of Finance & Accounting*, 6(1), 55. https://doi.org/10.12775/cjfa.2017.003

[49.] Kumar, A. A., & Babu, M. (2018). Effect of loss aversion bias on investment decision: A study. *Journal of Emerging Technologies and Innovative Research*, 5(11), 71-76.

[50.] Lanciano, T., Graziano, G., Curci, A., Costadura, S., & Monaco, A. (2020). Risk perceptions and psychological effects during the Italian COVID-19 emergency. *Frontiers in psychology*, 11, 580053.

[51.] Lewis, A., & C. Mackenzie. (2000). Morals, Money, Ethical Investing and Economic Psychology. *Human Relations*, 53 (2), 179–191.

[52.] Lim, T. S., Mail, R., Karim, M. R. A., Ulum, Z. K. a. B., Jaidi, J., & Noordin, R. (2018). A serial mediation model of financial knowledge on the intention to invest: The central role of risk perception and attitude. *Journal of Behavioral and Experimental Finance*, 20, 74–79. https://doi.org/10.1016/j.jbef.2018.08.001

[53.] MacCrimmon, K. R., & Wehrung, D. A. (1986). Assessing risk propensity. In Recent developments in the foundations of utility and risk theory (pp. 291-309). Dordrecht: Springer Netherlands.

[54.] Markowitz, H. M. (1991). Foundations of Portfolio Theory. *The Journal of Finance*, 46(2), 469. https://doi.org/10.2307/2328831

[55.] Mitroi, A., & Stancu, I. (2014). Biases, Anomalies, Psychology of a Loss and Individual Investment Decision Making. *Economic Computation & Economic Cybernetics Studies & Research*, 48(1).

[56.] Mittal, S. K. (2022). Behavior biases and investment decision: theoretical and research framework. *Qualitative Research in Financial Markets*, 14(2), 213-228.

[57.] Nilsson, J. (2007). Investment with a Conscience: Examining the Impact of Pro-Social Attitudes and Perceived Financial Performance on Socially Responsible Investment Behavior. *Journal of Business Ethics*, 83(2), 307–325. https://doi.org/10.1007/s10551-007-9621-z

[58.] Ouzan, S. (2020). Loss aversion and market crashes. *Economic Modelling*, 92, 70–86. https://doi.org/10.1016/j.econmod.2020.06.015

[59.] Ozili, P. K. (2022). The Acceptable R-Square in Empirical Modelling for Social Science Research. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4128165

[60.] Paris Agreement 2015 United Nations.

[61.] Park, Y. N., & Shin, M. (2024). Effect of customers' subjective knowledge on accepting ESG (environmental, social, governance) activities in the hospitality industry. *Journal of Travel & Tourism Marketing*, 41(1), 51-67.

[62.] Peylo, B. T. (2014). Rational socially responsible investment.

Corporate Governance, 14(5), 699–713. https://doi.org/10.1108/cg-08-2014-0089

[63.] Podsakoff, P. M., MacKenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

[64.] Pong, J. (2024). Environmental, Social and Governance Awareness and Organisational Risk Perception Amongst Accountants. *Journal of Risk and Financial Management*, 17(480).

[65.] Prietzel, T.T. (2020). The effect of emotion on risky decision making in the context of prospect theory: a comprehensive literature review. *Management Review Quarterly*, 70, 313–353. https://doi.org/10.1007/s11301-019-00169-2.

[66.] Puente De La Vega Caceres, A. (2024). Drivers of value creation and the effect of ESG risk rating on investor perceptions through financial metrics. *Sustainability*, 16(13), 5347.

[67.] Rauch, M., Wenzel, M., & Wagner, H. T. (2017, December). The Impact of Digital Innovation on Path-Dependent Decision-Making: The Mediating Role of Risk Propensity and Opportunity-Threat Perception. In ICIS.

[68.] Revelli, C. (2017). Socially responsible investing (SRI): From mainstream to margin?. *Research in International Business and Finance*, 39, 711-717.

[69.] Richardson, B. J. (2009). Keeping ethical investment ethical: Regulatory issues for investing for sustainability. *Journal of business ethics*, 87, 555-572.

[70.] Rogers, B. (2017). Perception: A Very Short Introduction. In Oxford University Press eBooks. https://doi.org/10.1093/actrade/9780198791003.001.0001

[71.] Sahi, S. K. (2017). Psychological biases of individual investors and financial satisfaction. *Journal of Consumer Behaviour*, 16(6), 511-535.

[72.] Salamanca, N., de Grip, A., Fouarge, D., & Montizaan, R. (2020). Locus of control and investment in risky assets. *Journal of Economic Behavior & Organization*, 177, 548-568.

[73.] Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial Least Squares Structural Equation Modeling. In Springer eBooks (pp. 1–40). https://doi.org/10.1007/978-3-319-05542-8_15-1

[74.] Sarwar, D., Sarwar, B., Raz, M. A., Khan, H. H., Muhammad, N., Azhar, U., & KASI, M. K. (2020). Relationship of the big five personality traits and risk aversion with investment intention of individual investors. *The Journal of Asian Finance, Economics and Business*, 7(12), 819-829.

[75.] Schäfer, F. S., Hirsch, B., & Nitzl, C. (2023). The effects of public service motivation, risk propensity and risk perception on defensive decision-making in public administrations. Journal of Public Budgeting, *Accounting & Financial Management*, 35(2), 244-263.

[76.] Schildberg-Hörisch, H. (2018). Are risk preferences stable?. *Journal of Economic Perspectives*, 32(2), 135-154.

[77.] Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: guidelines for using PLSpredict. European Journal of Marketing, 53(11), 2322–2347. https://doi.org/10.1108/ejm-02-2019-0189

[78.] Sinha, R., Datta, M., & Zioło, M. (2020). ESG awareness and perception in sustainable business decisions: perspectives of Indian investment bankers vis-a-vis selected European financial counterparts. In Finance and Sustainability: Proceedings from the 2nd Finance and Sustainability

Conference, Wroclaw 2018 (pp. 261-276). Springer International Publishing.

[79.]Sultana, S., Zulkifli, N., & Zainal, D. (2018). Environmental, Social and Governance (ESG) and Investment Decision in Bangladesh. *Sustainability*, 10(6), 1831.

[80.]https://doi.org/10.3390/su10061831

[81.]Sweta, D. A. P. Y. (2023). Changing Dynamics of Sustainable Investing: Emerging Trends. *Journal of Informatics Education and Research*, 3(2).

[82.]Tiwari, K., Sharma, M., & Deka, J. (2024). ESG Consciousness in Mutual Fund Advisory: Examining Attitudes, Intentions, and Moderating role of Fund Fundamentals and Herding Bias. *Research Square (Research Square)*. https://doi.org/10.21203/rs.3.rs-3886374/v1

[83.]Tom, S. M., Fox, C. R., Trepel, C., & Poldrack, R. A. (2007). The Neural Basis of Loss Aversion in Decision-Making Under Risk. *Science*, 315(5811), 515–518. https://doi.org/10.1126/science.1134239

[84.]Von Wallis, M., & Klein, C. (2014). Ethical requirement and financial interest: a literature review on socially responsible investing. *BuR - Business Research*, 8(1), 61–98. https://doi.org/10.1007/s40685-014-0015-7

[85.]Waheed, H., Ahmed, Z., Saleem, Q., Din, S. M. U., & Ahmed, B. (2020). The mediating role of risk perception in the relationship between financial literacy and investment decision. International Journal of Innovation, *Creativity and Change*, 14(4), 112-131.

[86.]Zambrano-Cruz, R., Cuartas-Montoya, G., Meda-Lara, R., Palomera-Chávez, A., & Tamayo-Agudelo, W. (2018). Perception of risk as a mediator between personality and perception of health: test of a model. *Psychology Research and Behavior Management*, 11, 417–423. https://doi.org/10.2147/prbm.s165816

[87.]Zhang, D. C., Highhouse, S., & Nye, C. D. (2019). Development and validation of the general risk propensity scale (GRiPS). *Journal of Behavioral Decision Making*, 32(2), 152-167.

[88.]Zhang, J., Xiang, P., Zhang, R., Chen, D., & Ren, Y. (2020). Mediating effect of risk propensity between personality traits and unsafe behavioral intention of construction workers. *Journal of construction engineering and management*, 146(4), 04020023.

[89.]Zivi, P., Sdoia, S., Alfonsi, V., Gorgoni, M., Mari, E., Quaglieri, A., ... & Ferlazzo, F. (2023). Decision-Making and Risk-Propensity Changes during and after the COVID-19 Pandemic Lockdown. *Brain Sciences*, 13(5), 793.

Sustainable Investing in ESG Funds for Attaining the Carbon Neutrality Goals

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ABSTRACT

Progressing towards carbon neutrality in India is closely tied to the principles of Environmental, Social, and Governance (ESG). However, the mechanisms driving this integration have not been fully investigated. In a time when the fight against climate change is urgent, understanding these mechanisms is essential for establishing a sustainable economic model that harmonizes developmental objectives with environmental responsibilities. This research uses data from eight thematic ESG equity mutual funds (MFs) based on the Nifty 100 ESG benchmark to encourage investors to support ESG-related funds, thus aiding the industry in reaching its ESG goals for carbon neutrality. In response to the growing need for environmentally responsible investing, this study examines the relationship between sustainable investment and climate-neutral goals. By analyzing the ESG performance of eight thematic ESG equity mutual funds, research aims to provide investors with a clearer understanding of how these funds align with a low-carbon economy. This research compares key metrics such as net asset value, returns, risk, and portfolio composition over the past three years, revealing significant differences in financial performance. Ultimately, the research demonstrates the relevance of thematic ESG investing and contributing to a more sustainable future. It sheds light on the complex interplay between investor intentions, ESG performance, and carbon neutrality, presenting strategic implications for researchers, businesses, and policymakers.

Keywords: ESG, Sustainable Investment, Green Finance, Carbon Neutrality, Thematic ESG Equity MFs.

1. INTRODUCTION

The urgent need to address climate change has prompted a global call to action for achieving net-zero carbon by the Intergovernmental Panel on Climate Change (IPCC) and backed by more than 100 countries that have submitted plans to reach carbon neutrality. Amidst varying stages across the globe, India is undergoing a significant transformation of its economy, focusing on industrial modernization to meet its pledged carbon neutrality targets (Gu et al., 2023).

In environmental leadership as an emerging economy, spearheading global initiatives to protect the planet. On the world stage, India chaired the G20 Summit. It hosted the G20 Environment, Climate, and Sustainability Working Group, culminating in the launch of the "Mission Life" initiative, which promotes eco-friendly living (Ministry of Information & Broadcasting, 2023). The country also introduced the Green Development Pact, providing a roadmap for nations to achieve their energy, climate, and environmental goals. Domestically, India's progress in environmental initiatives has been bolstered by the proactive efforts of the Securities and Exchange Board of India (SEBI), which has played a pivotal role in driving India's corporate sector towards sustainability. SEBI's innovative measures, including the mandatory Business Responsibility and Sustainability Report (BRSR), have transformed sustainability reporting from a voluntary practice to a comprehensive requirement, solidifying India (Sinha, 2023).

In the 2022-23 fiscal year, India's top 1000 companies adopted the SEBI mandate the way for in-depth analyses of their ESG performance over time, across peer groups, and within sectors BRSR format enables investors to assess a company's ESG performance not just year-over-year, but also in comparison to its peers. Initially viewed as a compliance requirement, the BRSR is expected to evolve into a benchmark for excellence and competitiveness as awareness and adoption grow. Many companies have already demonstrated leadership in their BRSR disclosures, which are likely to translate into improved performance. The B transform India's ESG investment landscape, shifting from a focus on ESG performance, leading to more balanced portfolios and a greater emphasis on overall portfolio ESG scores. This, in turn, will enable investors to engage with underperforming companies to drive improvement, the BRSR continues to evolve, companies will be able to refine their reporting and disclosure practices, ultimately leading to more comprehensive and assured sustainability reporting.

To foster a deeper understanding of the sustainability information disclosed by companies in their BRSR and other initiatives, an impartial assessment by external experts is necessary. This critical function is fulfilled by ERPs (*SEBI | Master Circular for ESG Rating Providers (ERPs)*, n.d.), who conduct a comprehensive evaluation of a company's ESG performance using their evaluation models. The ERP framework established by SEBI has created a standardized

pathway for ESG ratings, striking a balance between flexibility and uniformity to ensure comparability across different ERPs. Furthermore, the framework assesses companies based on the momentum of their investments in transitioning to a more sustainable and environmentally responsible future. A distinctive feature of the framework is the "Parivartan Score", which evaluates a company's environmental commitments and progress alongside its absolute ESG score. This dynamic metric measures the pace of a company's progress toward its ESG goals, providing a more nuanced assessment of its sustainability performance.

An approach to sustainable financing, known as Transition Finance, has emerged in response to growing concerns about ESG issues. This innovative financing model supports individuals, businesses, and communities in their shift towards sustainability by offering financial resources to, and economic conditions. Effective collaboration among stakeholders is essential for driving meaningful change and achieving Sustainable development goals (SDG). The concept of Transition Finance is closely linked to Green Financing, and its development would greatly benefit from this connection. In India, the SEBI ESG framework is expected to play a significant role, particularly with the introduction of Green Debt Securities (GDS). Furthermore, SEBI has implemented measures to prevent the misuse of GDS proceeds and ensure that they are used for their intended environmental purpose, thereby preventing "greenwashing" (*SEBI | Dos and Don'ts Relating to Green Debt Securities to Avoid Occurrences of Greenwashing*, n.d.).

India has become the leading issuer of Green Bonds in Asian Emerging Markets (excluding China), with a total of $21 billion worth of Green Bonds issued by February 2023. Local Governments and Municipal Corporations, such as Ghaziabad Nagar Nigam and Indore Municipal Corporations, have also started using Green Bonds to raise funds for environmental projects. According to the World Bank, companies are increasingly turning to Green Bonds as a preferred means of financing projects focused on environmental sustainability. Corporations and industries are the main entities Green Bonds (Hussain & Dill, 2024).

Sustainable financial practices are vital for advancing environmental goals, mitigating the effects of climate change, and optimizing resource use. By fostering a low-carbon economy, green finance provides a critical framework for achieving carbon neutrality for advancing

environmental goals of ESG. The objectives of carbon neutrality and green finance are closely linked, with the former relying on the latter to transform high-carbon industries and promote a more sustainable economic model. Conversely, green finance plays a direct role in achieving carbon neutrality by prioritizing environmental protection and carbon reduction. Studies have shown that green finance has significantly curbed emissions in affluent countries, and

research by (Liang & Renneboog, 2020) and (Chen et al., 2023) in reducing carbon emissions and intensity through more efficient resource allocation, particularly in high-carbon regions. Ultimately, green finance is a key driver of the transition to cleaner energy sources and lower carbon emissions.

This research uses data from eight thematic equity mutual funds to encourage investors to support Thematic ESG equity mutual funds (MFs) based on the NIFTY 100 ESG benchmark, thus aiding the industry in reaching its ESG goals for carbon neutrality. In response to the growing need for environmentally responsible investing (Soler-Domínguez et al., 2020), this study examines the relationship between sustainable investment and climate-neutral goals. By analyzing the ESG performance of eight thematic equity MFs, we aim to provide investors with a clearer understanding of how these funds align with a low-carbon economy. This research compares key metrics such as net asset value, returns, risk, and portfolio composition over the past three years, revealing significant differences in financial performance.

The United States boasts a more established track record of ESG investing, with a market that has developed significantly over time. The country's experience with ESG-themed investments dates back to the early 2000s, marking the beginning of a notable growth trend in this space.

The S&P 500 ESG Index was created in 2005 by Standard & Poor's, focusing on the top 500 US Listed companies with strong ESG performance. This index mirrors the composition of the S&P 500 but includes companies that excel in environmental, social, and governance criteria. Over time, the S&P 500 ESG Index has shown a track record of outperforming the S&P 500 Index in terms of returns.

This reasoning is supported by examining the Dow Jones Industrial Average (DJIA) the Dow Jones Sustainability Index (North America Composite) (DJSI). The DJIA consists of 30 US blue-chip companies, while the DJS the top 20% of North American companies based on market value. The DJSI has consistently performed better than the DJIA yielding higher returns (SP Global Sustainability, n.d.). This demonstrates that lower returns in ESG-focused funds may result in temporary setbacks but lead to greater gains in the long term.

2. LITERATURE REVIEW

2.1 *Integration of ESG Factors*

The integration of ESG factors into financial practices is increasingly recognized as essential for sustainable investment and corporate governance. This integration not only enhances financial performance but also aligns with stakeholder expectations and regulatory demands. The following sections outline key aspects of ESG integration.

Importance of ESG in Financial Education

- The absence of ESG criteria in financial education poses risks to economic and ethical outcomes, emphasizing the need for their inclusion in profitability evaluations (Pénnanen-Arias et al., 2024).

- Incorporating ESG factors into cash flow assessments is crucial for a comprehensive financial analysis, particularly in adjusting discount rates to reflect sustainability impacts (Pénnanen-Arias et al., 2024).

Benefits of ESG Integration in Financial Sectors

- Financial institutions that adopt ESG standards improve their brand value and manage risks effectively, leading to enhanced long-term viability (Shetty & Suraj, 2024).

- Successful ESG integration requires uniform reporting standards and robust compliance procedures, which can foster innovation and stakeholder trust (Shetty & Suraj, 2024).

Strategic Framework for ESG Adoption

- A structured approach to ESG integration involves assessing material issues, aligning with business strategies, and committing to continuous improvement (Olanrewaju et al., 2024).

- This framework helps organizations navigate the complexities of ESG factors, ultimately driving financial performance and stakeholder engagement (Olanrewaju et al., 2024).

While the integration of ESG factors presents numerous advantages, challenges such as data quality and the need for standardized practices remain significant hurdles. Addressing these issues is vital for realizing the full potential of ESG in finance (Shetty & Suraj, 2024) (Huang & Huang, 2023).

2.2 Performance and Risk Considerations

Sustainable investing, particularly through ESG funds, plays a crucial role in achieving carbon neutrality while balancing performance and risk considerations. The integration of ESG factors into investment strategies not only addresses environmental concerns but also enhances long- term financial performance by mitigating risks associated with poor governance and environmental practices. This multifaceted approach can be broken down into several key aspects.

ESG Integration and Risk Management

- Institutional investors are increasingly incorporating ESG issues into their investment decisions to manage material financial risks associated with poor ESG performance (O'Sullivan, 2024).

- Companies with strong ESG practices tend to exhibit resilience during economic downturns, potentially leading to better long-term returns (Lo, 2024).

Impact on Carbon Neutrality

- Research indicates a significant negative correlation between ESG performance and carbon emission intensity, suggesting that improved ESG practices can facilitate progress toward carbon neutrality (Xie, 2024).

- Green finance acts as a moderating factor, enhancing the effectiveness of ESG initiatives in reducing carbon emissions, particularly in less industrialized regions (Xie, 2024).

2.3 Performance Considerations

- Sustainable investing has gained traction, with over $34 trillion in assets committed to responsible investment principles, reflecting a growing belief that lower ESG risks correlate with superior long-term performance (Kidd, 2012).

- However, there are concerns regarding the potential for greenwashing and the actual effectiveness of ESG practices in delivering tangible benefits to investors (Lo, 2024).

While the integration of ESG factors into investment strategies is increasingly recognized for its potential to enhance performance and mitigate risks, scepticism remains regarding the authenticity and effectiveness of these practices. This dual perspective highlights the need for ongoing scrutiny and improvement in ESG frameworks to ensure they deliver on their promises.

2.4 Challenges and future directions

The study of sustainable investing in ESG funds faces several challenges that hinder the attainment of carbon neutrality. Key issues include the prevalence of greenwashing, the need for standardized ESG metrics, and the integration of ESG factors into investment strategies. Addressing these challenges is crucial for the future of sustainable finance.

Key Challenges in ESG Investing

- Greenwashing Concerns: Many firms may misrepresent their ESG efforts, leading to scepticism among investors about the authenticity of sustainability claims (Lo, 2024) (Kapil & Rawal, 2023).

- Lack of Standardization: The absence of uniform ESG metrics complicates the assessment of fund performance and investor decision-making, creating barriers to effective investment strategies (Shah, 2024) (Abhayawansa & Mooneeapen, 2022).

- Short-term Focus: Investors often prioritize immediate financial returns over long-term sustainability goals, undermining the potential benefits of ESG investing (Lo, 2024).

Future Directions

- Enhanced Regulatory Frameworks: Developing comprehensive regulations for ESG disclosures can improve transparency and accountability (Shah, 2024) (Xiao et al., 2023).

- Research Expansion: Future studies should explore diverse aspects of ESG investing, including investor behaviour and the effectiveness of various ESG strategies (Abhayawansa & Mooneeapen, 2022) (Kapil & Rawal, 2023).

- Integration of ESG in Financial Models: Incorporating ESG factors into traditional financial models can help align investment practices with sustainability goals (Xiao et al., 2023).

While the challenges are significant, the potential for ESG investing to contribute to carbon neutrality remains promising, provided that stakeholders commit to overcoming these obstacles.

3.   METHODOLOGY

3.1   Prospect Theory

This theory written by Daniel Kahneman and Amos Tversky (1979). This theory explains that how people make decision under uncertainly. This theory has two main components.

1. Value function

2. Probability weighting function

Loss aversion is a critical aspect of Prospect Theory, and its components revolve around how individuals evaluate potential gains and losses.

Key component of Loss aversion

a) **Reference Dependence-** People evaluate outcomes relative to a reference point, typically their current status or expectations. Gains and losses are defined based on this point rather than absolute wealth or value.

b) **Asymmetry Between Gains and Losses-** Losses have a greater psychological impact than equivalent gains.

c) **Diminishing Sensitivity-** As the magnitude of gains or losses increases, the emotional impact grows at a diminishing rate.

d) **Risk Preferences**

- In Losses: People are often risk-seeking to avoid a sure loss (e.g., gambling to recover a debt).

- In Gains: People are typically risk-averse and prefer guaranteed gains (e.g., taking a smaller but certain reward over a larger gamble).

e) **Endowment Effect-** People assign more value to items they own compared to items they don't, partly because giving them up feels like a loss.

f) **Negativity Bias-** Negative events or outcomes are weighted more heavily than positive ones. This bias contributes to loss aversion by making potential losses stand out more than gains.

g) **Framing Effects-** How a situation is framed—either as a gain or a loss—affects decision-making.

Significance of Loss Aversion

- Investors often weigh potential losses more heavily than gains. Prospect theory can explain why some may hesitate to invest in ESG funds despite their long-term benefits, perceiving them as riskier or less profitable.

- Investors often weigh potential gains and losses differently. For ESG funds, this model helps understand how individuals perceive risks associated with sustainable investing (e.g., lower returns or higher volatility) versus its long-term societal benefits (e.g., carbon neutrality).

Applications of Prospect Theory

- Analyse how investors perceive the risks and returns of ESG funds compared to traditional funds.

- Study whether framing ESG investments as contributing to "carbon neutrality" positively influences decision-making.

- Study how ESG fund investors evaluate the trade-offs between short-term financial returns and long-term sustainability goals.

- Assess risk preferences and loss aversion tendencies in ESG fund adoption

Relevance of Prospect Theory

Investors often weigh potential gains and losses differently. For ESG funds, this model helps understand how individuals perceive risks associated with sustainable investing (e.g., lower returns or higher volatility) versus its long-term societal benefits (e.g., carbon neutrality).

3.2 Some important points for investors as per the loss aversion theory for the selection of equity funds for investment.

- NAV: Should be low to have more units.

- Funs Age: At least 3-5 yrs old.

- Fund size (AUM): Avoid too big or too low.

- Return: see the return over 3 yrs/ long time

Risk measures

- Standard deviation (SD): It represents the riskiness of the MF as an annualized percentage. The higher the SD, the higher the volatility of the asset hence the higher risk. So larger the possibility of both loss and gain. SD should be low.

- Sharpe: Sharpe is the measure of the risk adjusted returns to evaluate the fund's performance the ratio denotes the unit of return earned (over & risk-free return) for every unit of risk undertaken.

- The higher the Sharpe ratio, the better is the Fund. Risk free return is the maximum return you can generate without taking any risk.

- Beta: MF beta is the measure of relative risk as its benchmark. It tells investors how risky a fund is as compared to its benchmark.

- If a fund's beta<1, then the fund is perceived as less risky.

- If beta > 1, it is considered riskier compared to its benchmark.

- Sortino: Sortino ratio measures the return per unit of risk, considering only the downside risk (or negative return). Like Sharpe, Higher a fund's Sortino's ratio, the better it is.

- Alpha: Alpha is the risk adjusted; excess fund returns over the benchmark returns. A positive alpha denotes the fund is rewarded (higher alpha) if the returns are generated at lower risk(beta<1) and penalized for being volatile (beta > 1).

Portfolio: Investment in which sector

- Turnover ratio: The portfolio turnover ratio is used to measure the percentage of a mutual fund's holding that has changed within a given year.

- It should not change abruptly fund details.

- Express ratio: Should be below 1%

- Benchmark index

- Check the diversification of your MF and avoid the overlapping of MF sector investment.

3.3 Sustainable Investing with Nifty ESG Indices

The Nifty100 ESG Index is designed to cater to the growing socially conscious investment options. By focusing on companies with strong ESG track records, these indices aim to deliver enhanced risk-adjusted returns while promoting sustainable business practices. The Nifty indices offer a sector-neutral portfolio with a tilt towards companies that excel in ESG performance, resulting in a higher allocation to firms with better ESG credentials.

Eligibility criteria

To be included in the Nifty100 ESG Index stocks must meet specific eligibility requirements. Stakeholders Empowerment Services (SES) provides ESG and controversy research.

The eligible stocks are those that are part of the Nifty 100 at the time of review, and only ordinary equity shares are considered for performance in terms of ESG factors, is categorized into eight grades ranging as below (Nifty Indices Methodology, n.d.) in Table 1.

TABLE 1: Eight grades of ESG

Grades	Score
A+	90 - 100
A	80 - 89.99
B+	70 - 79.99
B	60 - 69.99
B-	50 - 59.99
C+	40 - 49.99
C	20 - 39.99
D	0 - 19.99

Companies are assessed annually by SES based on their sustainability reports and other key disclosures and are also monitored for any ESG-related controversies. To be included in the index, the following points should be considered (SES Governance, n.d.):

- Companies must have an ESG score at the time of review.

- For the Nifty100 ESG Index, companies with an ESG score below 60 are excluded. companies with a controversy rating below 70 will not be considered.

- Enterprises involved in the commerce of tobacco, alcohol, disputed weaponry, and gambling activities are not considered. Disputed weaponry encompasses chemical weapons, biological weapons, anti-personnel mines, and cluster bombs.

- The index will undergo a semi-annual review in June and December, using data from the preceding six months (May and November).

- Stocks not currently part of the Nifty 100 will be excluded from consideration.

4. RESULTS & DISCUSSION

The Nifty100 ESG Index aims to mirror the performance of companies in the Nifty 100 by considering their ESG risk scores. The index adjusts the weight of each company based on its ESG risk score, and is calculated using the company's free-float market capitalization and adjusted ESG risk score (Nifty Indices Factsheet, n.d.).
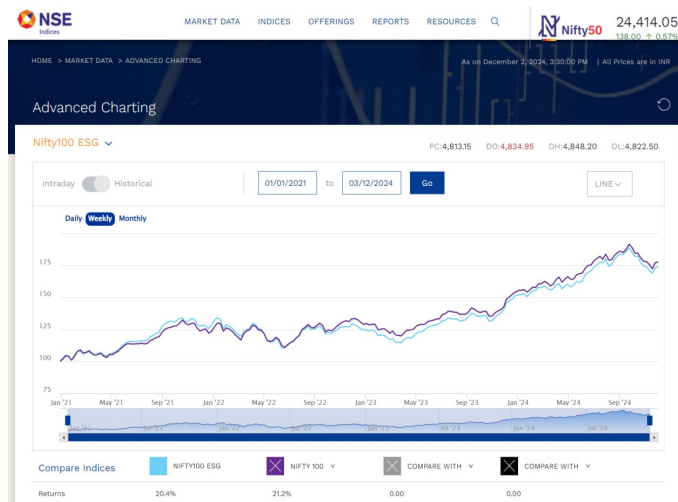

Figure 1: Nifty Indices of Nifty 100 ESG Vs Nifty 100 (Nifty Indices advanced charting, n.d.)

The introduction of the Nifty100 ESG Index has enabled benchmarking and comparison of these schemes. However, in terms of returns, these schemes currently nearly meet the expectations compared to traditional investment strategies. Notably, the ESG Benchmark (Nifty 100 ESG Index) follows the standard index return (Nifty 100 Index) as shown in figure 1, with only a few select ESG schemes outperforming the index while few struggle to meet benchmark returns.

ESG Investments: Righteousness versus Returns

ESG Investments: Balancing Ethics and Prof core principles. When ESG investments are evaluated based on immediate returns and short-term perspectives, they may seem less effective compared to traditional investment strategies. However, it is important to recognize that sustainable investing is actually in line with financial interests when considered over the long term.

It would not be accurate to suggest that the performance of ESG funds is indicative of the ability of mutual funds to engage in non-ESG and achieve higher returns, then the lower seen in ESG funds cannot be solely attributed to inefficiency. In reality, ESG is because companies with higher ESG ratings prioritize environmental and social concerns more than others, leading to higher expenses in enhancing these aspects. These expenses can be viewed as investments for long-term sustainable operations. As regulations become more stringent and are rigorously enforced, the risk associated with low-scoring ESG companies may eventually shift, paving the way for higher returns on ESG-focused funds. It is important to consider recent developments, such as the closure order issued for a copper smelter, when analyzing this trend.

The reserved attitude towards ESG investments is reflected in the lackluster performance of mutual funds that integrate ESG principles. Despite the Indian Mutual Fund Industry surpassing ₹50 lakh crores in Assets Under Management (AUM) as of December 2023, only a small fraction, around ₹11,000 crores (less than 0.25%), is allocated to ESG-based mutual fund schemes. There are only 8 dedicated ESG schemes within the ESG Mutual Funds Space having Nifty 100 ESG as benchmark, focusing on evaluating investments based on ESG criteria. Details and risk measures are shown in table 2.

TABLE 2: Thematic ESG Equity Mutual Fund Details & Risk Measures (ET Money, n.d.-a) (ET Money, n.d.-b)

Parameters	SBI ESG Exclusionary Strategy Fund Direct Growth (1)	Aditya Birla Sun Life ESG Integration Strategy Fund Direct Growth (2)	Axis ESG Integration Strategy Fund Direct Growth (3)	ICICI Prudential ESG Exclusionary Strategy Fund Direct Growth (4)	Invesco India ESG Integration Stategy Fund Direct Growth (5)	Kotak ESG Exclusionary Strategy Fund Direct Growth (6)	Quant ESG Equity Fund Direct Growth (7)	Quantum ESG Best In Class Strategy Fund Direct Growth (8)
NAV ₹	263.45	19.49	23.57	23.47	19.81	18.45	36.8	25.71
Fund Age	11 yrs 11 m	3 yrs 11 m	4 yrs 10 m	4 yrs 2 m	3 yrs 9 m	4 yrs	4 yrs 1 m	5 yrs 5 m
Fund Size (AUM)	₹5,750 Crs	₹679 Crs	₹1,333 Crs	₹1,557 Crs	₹519 Crs	₹943 Crs	₹309 Crs	₹88 Crs
1 year Return	22.15%	29.80%	24.68%	31.10%	30.44%	22.23%	33.39%	24.85%
3 year Return	13.19%	11.64%	10.48%	17.97%	13.49%	13.67%	24.56%	13.76%

Parameters	SBI ESG Exclusionary Strategy Fund Direct Growth (1)	Aditya Birla Sun Life ESG Integration Strategy Fund Direct Growth (2)	Axis ESG Integration Strategy Fund Direct Growth (3)	ICICI Prudential ESG Exclusionary Strategy Fund Direct Growth (4)	Invesco India ESG Integration Strategy Fund Direct Growth (5)	Kotak ESG Exclusionary Strategy Fund Direct Growth (6)	Quant ESG Equity Fund Direct Growth (7)	Quantum ESG Best In Class Strategy Fund Direct Growth (8)
Expense Ratio	1.31%	1.40%	1.27%	1.01%	1.00%	0.81%	0.79%	0.85%
Standard Deviation	12.75	14.86	14.49	12.66	13.29	13.7	18.33	12.89
Sharpe	0.59	0.43	0.35	0.89	0.58	0.59	1.04	0.62
Beta	0.94	1.03	0.97	0.85	0.94	1.01	1.13	0.94
Sortino	1.16	0.74	0.6	1.69	1.02	0.98	1.86	1.04

Historical NAV & Returns of all the Thematic ESG equity MFs are shown from Figures 2-9 below.

Figure 2: SBI ESG Historical NAV & Returns (ET Money, n.d.-c)

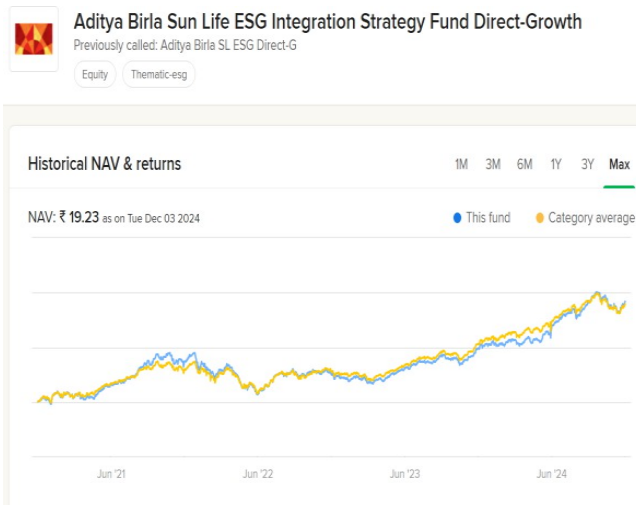**Figure 4: Axis ESG Historical NAV & Returns (ET Money, n.d.-e)**

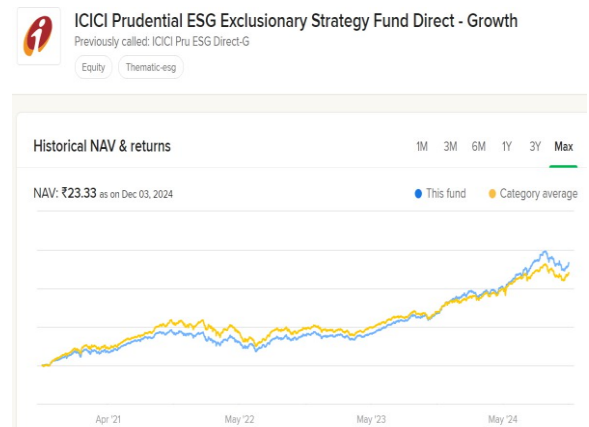**Figure 3: Aditya Birla Sun Life ESG Historical NAV & Returns (ET Money, n.d.-d)**

Figure 5: ICICI Prudential ESG Historical NAV & Returns (ET Money, n.d.-f)
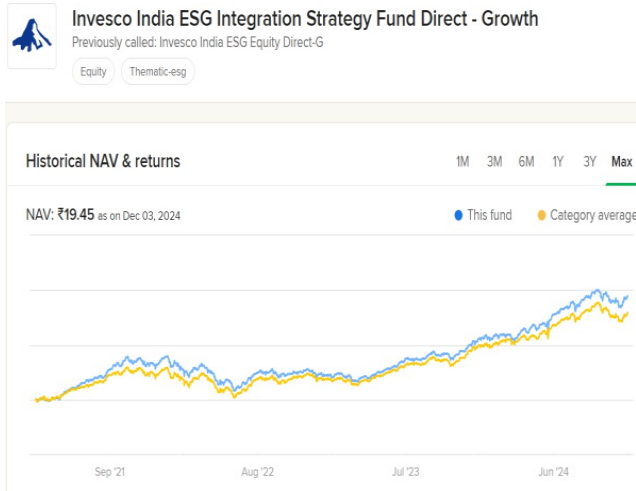
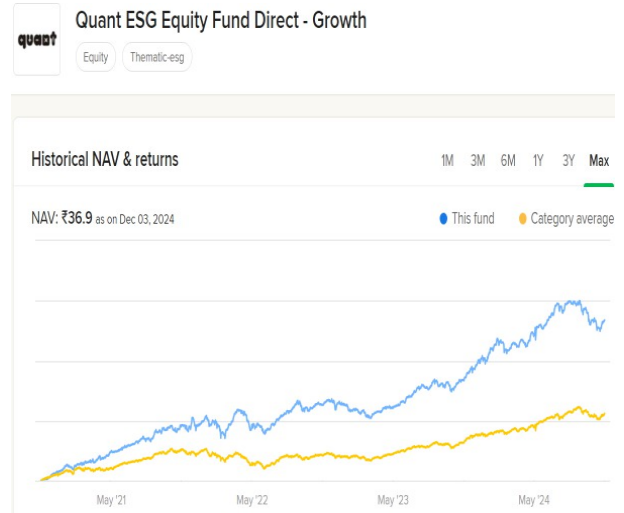**Figure 6: Invesco India ESG Historical NAV & Returns (ET Money, n.d.-g)**

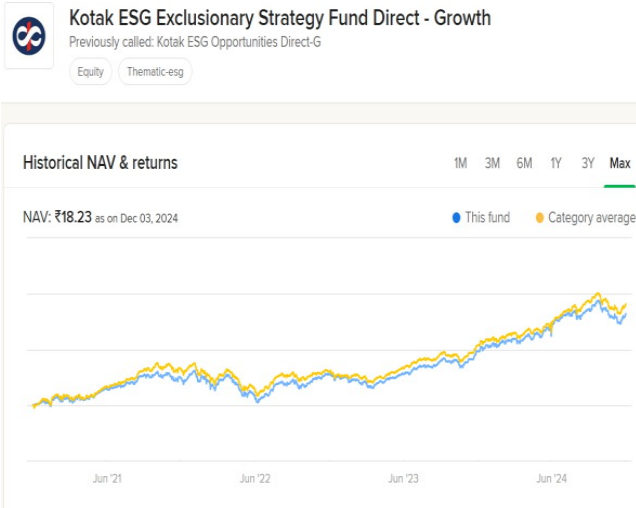**Figure 8: Quant ESG Historical NAV & Returns (ET Money, n.d.-i)**

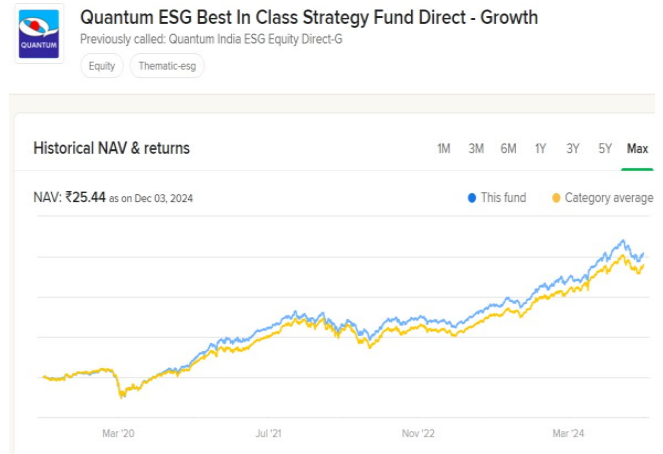**Figure 7: Kotak ESG Historical NAV & Returns (ET Money, n.d.-h)**

Figure 9: Quantum ESG Historical NAV & Returns (ET Money, n.d.-j)

The portfolio of the Thematic ESG Equity MFs are shown in table 3.

TABLE 3: Thematic ESG Equity MF Portfolio (ET Money, n.d.-a) (ET Money, n.d.-b)

Parameters	SBI ESG Exclusionary Strategy Fund Direct Growth (1)	Aditya Birla Sun Life ESG Integration Strategy Fund Direct Growth (2)	Axis ESG Integration Strategy Fund Direct Growth (3)	ICICI Prudential ESG Exclusionary Strategy Fund Direct Growth (4)	Invesco India ESG Integration Stategy Fund Direct Growth (5)	Kotak ESG Exclusionary Strategy Fund Direct Growth (6)	Quant ESG Equity Fund Direct Growth (7)	Quantum ESG Best In Class Strategy Fund Direct Growth (8)
Top 3 sectors	Financial (31.63%) Technology (19.16%) Automobile (9.18%)	Financial (27.76%) Technology (22.41%) Automobile (9.33%)	Technology (17.71%) Financial (16.67%) Services (12.56%)	Financial (20.35%) Technology (15.36%) Capital Goods (11.42%)	Financial (28.02%) Technology (18.14%) Healthcare (11.59%)	Financial (24.53%) Technology (14.87%) Automobile (12.79%)	Consumer Staples (25.56%) Insurance (16.97%) Financial (11.6%)	Automobile (16.15%) Technology (15.64%) Financial (15.16%)
	HDFC Bank Ltd.	ICICI Bank Ltd.	Infosys Ltd. (6.13%)	Sun Pharmaceutical Industries	HDFC Bank Ltd.	HDFC	HDFC Life	TVS Motor

Top 5 holdings	(8.81%) Infosys Ltd. (8.25%) ICICI Bank Ltd. (7.83%) Axis Bank Ltd. (4.62%) Larsen & Toubro Ltd. (4.61%)	(8.69%) Infosys Ltd. (8.58%) HDFC Bank Ltd. (4.31%) LTIMindtree Ltd. (3.89%) Kotak Mahindra Bank Ltd. (3.61%)	ICICI Bank Ltd. (5.81%) Bharti Airtel Ltd. (4.56%) HDFC Bank Ltd. (4.53%) Torrent Power Ltd. (4.09%)	Ltd. (8.09%) HDFC Bank Ltd. (7.3%) Bharti Airtel Ltd. (7.29%) ICICI Bank Ltd. (7.24%) Inox Wind Ltd. (4.91%)	(7.85%) ICICI Bank Ltd. (6.81%) Infosys Ltd. (5.26%) Tata Consultancy Services Ltd. (5.15%) Axis Bank Ltd. (3.74%)	Bank Ltd. (7.57%) Infosys Ltd. (7.44%) ICICI Bank Ltd. (5.47%) Larsen & Toubro Ltd. (4.88%) Bharti Airtel Ltd. (4.62%)	Insurance Co Ltd. (9.51%) Reliance Industries Ltd. (9.42%) JIO Financial Services Ltd. (8.58%) Britannia Industries Ltd. (7.5%) Aditya Birla Fashion and Retail Ltd. (7.46%)	Company Ltd. (5.16%) The Indian Hotels Company Ltd. (4.45%) HDFC Bank Ltd. (3.84%) Persistent Systems Ltd. (2.84%) Tata Consumer Products Ltd. (2.69%)
P/E Ratio	26.21	27.79	26.78	32.4	29.67	26.29	39.3	36.02
P/B Ratio	4.29	4.77	4.96	4.43	5.18	4.11	4	5.71
Equity%	98.10%	99.03%	96.18%	93.71%	99.11%	99.53%	98.38%	94.46%
Debt%	0%	0%	0.99%	0.03%	0%	0.43%	0.00%	0.00%
Turnover Ratio	31	NA	55	29	56	17	NA	18.17

ESG risk score of the portfolio of top holdings of the thematic ESG equity MF are shown in the table 4.

TABLE 4: ESG Risk ratings of the Top holdings of the thematic ESG equity mutual funds (*Do You Know Your ESG Rating*, n.d.)

Top Holdings of Thematic ESG Equity Mutual funds	ESG Risk Rating	Exposure	Management
HDFC Bank Ltd.	30.0 Medium	Medium	Average
Infosys Ltd.	14.0 Low	Low	Strong
ICICI Bank Ltd.	22.5 Medium	Medium	Strong
Axis Bank Ltd.	19.9 Low	Medium	Strong
Larsen & Toubro Ltd.	32.7 High	High	Strong
LTI Mindtree Ltd.	21.5 Medium	Medium	Average
Kotak Mahindra Bank Ltd.	13.7 Low	Medium	Strong
Bharti Airtel Ltd.	20.0 Medium	Medium	Strong
Torrent Power Ltd.	36.4 High	High	Average
Sun Pharmaceutical Industries Ltd.	31.5 High	Medium	Average
Inox Wind Ltd.	28.3 Medium	Medium	Average
Tata Consultancy Services Ltd.	14.4 Low	Low	Strong
Reliance Industries Ltd.	38.5 High	High	Average
HDFC Life Insurance Co Ltd.	21.2 Medium	Medium	Strong
Britannia Industries Ltd.	26.0 Medium	Medium	Strong
Aditya Birla Fashion and Retail Ltd.	13.1 Low	Low	Strong
TVS Motor Company Ltd.	15.4 Low	Low	Average
Persistent Systems Ltd.	19.3 Low	Low	Average
Tata Consumer Products Ltd.	26.0 Medium	Medium	Strong
Zomato Ltd.	16.9 Low	Medium	Strong

Table 5: Selection of the Thematic ESG equity fund for sustainable investment as per loss aversion and overall analysis of various parameters, risk measures, portfolio, and ESG risk score.

Parameters	Ordering of Thematic ESG Equity MF
3 year Return	7, 4, 8, 6, 5, 1, 2, 3
Standard Deviation	4, 1, 8, 5, 6, 3, 2, 7
Sharpe	7, 4, 8, 6, 1, 5, 2, 3
Beta	4, 8, 1, 5, 3, 6, 2, 7
Sortino	7, 4, 1, 8, 5, 6, 2, 3
Alpha	7, 4, 8, 5, 1, 6, 2, 3
Turnover Ratio	5, 8, 4, 1, 3, 5, 7, 2
Expense Ratio	7, 6, 8, 5, 4, 3, 1, 2

The final Selection of the Thematic ESG equity fund for sustainable investment as per loss aversion and overall analysis as per Table 5 of various parameters, risk measures, portfolio, and ESG risk score is mentioned below:

1. ICICI Prudential ESG Exclusionary Strategy Fund Direct Growth (4)

2. Quantum ESG Best In Class Strategy Fund Direct Growth (8)

3. Quant ESG Equity Fund Direct Growth (7)

Funds to ignore for the investment as per loss aversion and overall analysis of various parameters, risk measures, portfolio, and ESG risk scores is mentioned below:

1. Axis ESG Integration Strategy Fund Direct Growth (3)

2. Aditya Birla Sun Life ESG Integration Strategy Fund Direct Growth (2)

The underwhelming performance of these schemes can be attributed to the teething issues associated with implementing ESG investment strategies in India. However, the introduction of the BRSR framework is expected to facilitate more informed investment decisions by providing greater access to information, potentially drawing in more capital as awareness grows. From a long-term standpoint, incorporating sustainability principles into investment approaches and the current returns disparity will likely reverse as the ESG investment market in India trend is already evident in international markets, where ESG indices are outperforming their traditional counterparts.

5. CONCLUSION

This research compares key metrics such as net asset value, returns, risk, portfolio, and ESG Risk Score composition over the past three years, revealing significant differences in financial performance. Notably, the findings highlight the importance of ESG considerations in investment decisions. Suppose investors are educated about carbon neutrality, ESG scores' role for the companies, and the returns they are getting while maintaining their social responsibilities. In that case, more companies will be serious about ESG scores and carbon neutrality. This study sheds light on the considerations of the ESG scores in identifying climate-aware investment opportunities and underscores the need for green finance strategies to support carbon neutrality in India. Ultimately, the research demonstrates the relevance of thematic ESG investing and contributing to a more sustainable future. It sheds light on the complex interplay between investor intentions, ESG performance, and carbon neutrality, presenting strategic implications for businesses, policymakers, and sectors. ESG investments are evaluated based on immediate returns and short-term perspectives, they may seem less effective compared to traditional investment

strategies. However, it is important to recognize that sustainable investing is actually in line with financial interests when considered over the long term.

REFERENCES

[1.] Abhayawansa, S., & Mooneeapen, O. (2022). Directions for future research to steer environmental, social and governance (ESG) investing to support sustainability: a systematic literature review. In *Edward Elgar Publishing eBooks* (pp. 318– 341). https://doi.org/10.4337/9781800373518.00027

[2.] Chen, H., Guo, R., Hung, C., Lin, Z., & Wu, M. (2023). Behavioral intentions of bank employees to implement green finance. *Sustainability*, *15*(15), 11717. https://doi.org/10.3390/su151511717

[3.] ET Money. (n.d.-a). *Compare Mutual Funds: Compare performance, returns, risk & portfolio*. https://www.etmoney.com/mutual-funds/compare?schemeIds=15786%2C41689%2C41003%2C41595

[4.] ET Money. (n.d.-b). *Compare Mutual Funds: Compare performance, returns, risk & portfolio*. https://www.etmoney.com/mutual-funds/compare?schemeIds=41807%2C41670%2C41633%2C40488

[5.] ET Money. (n.d.-c). *SBI ESG Exclusionary Strategy Fund Direct Plan-Growth: NAV, Review, Holding & Performance*. https://www.etmoney.com/mutual-funds/sbi-esg- exclusionary-strategy-fund-direct-plan-growth/15786

[6.] ET Money. (n.d.-d). *Aditya Birla Sun Life ESG Integration Strategy Fund Direct-Growth: NAV, Review, Holding & Performance*. https://www.etmoney.com/mutual- funds/aditya-birla-sun-life-esg-integration-strategy-fund-direct-growth/41689

[7.] ET Money. (n.d.-e). *Axis ESG Integration Strategy Fund Direct-Growth: NAV, Review, Holding & Performance*. https://www.etmoney.com/mutual-funds/axis-esg- integration-strategy-fund-direct-growth/41003

[8.] ET Money. (n.d.-f). ICICI Prudential ESG Exclusionary Strategy Fund Direct - Growth: NAV, Review, Holding & Performance. https://www.etmoney.com/mutual-funds/icici-prudential-esg-exclusionary-strategy-fund-direct-growth/41595

[9.] ET Money. (n.d.-g). *InVesco India ESG Integration Strategy Fund Direct - Growth: NAV, Review, Holding & Performance*. https://www.etmoney.com/mutual-funds/invesco- india-esg-integration-strategy-fund-direct-growth/41807

[10.] ET Money. (n.d.-h). *Kotak ESG Exclusionary Strategy Fund Direct - Growth: NAV, Review, Holding & Performance*. https://www.etmoney.com/mutual-funds/kotak-esg-exclusionary-strategy-fund-direct-growth/41670

[11.] ET Money. (n.d.-i). *Quant ESG Equity Fund Direct - Growth: NAV, Review, holding & Performance*. https://www.etmoney.com/mutual-funds/quant-esg-equity-fund-direct- growth/41633

[12.] ET Money. (n.d.-j). *Quantum ESG Best in Class Strategy Fund Direct - Growth: NAV, Review, Holding & Performance*. https://www.etmoney.com/mutual-funds/quantum-esg-best- in-class-strategy-fund-direct-growth/40488

[13.] *Do you know your ESG Rating*. (n.d.). sustainalytics.com. https://www.sustainalytics.com/corporate-solutions/know-your- esg-score

[14.] Gu, X., Firdousi, S. F., Obrenovic, B., Afzal, A., Amir, B., & Wu, T. (2023). The influence of green finance availability to

retailers on purchase intention: a consumer perspective with the moderating role of consciousness. *Environmental Science and Pollution Research*, *30*(27), 71209–71225. https://doi.org/10.1007/s11356-023-2735

[15.] Huang, S., & Huang, X. (2023). How Green Bankers Promote Behavioral Integration of Green Investment and Financing Teams—Evidence from Chinese Commercial Banks. *Sustainability*, *15*(9), 7350. https://doi.org/10.3390/su15097350

[16.] Hussain, F. I., & Dill, H. (2024, March 16). India incorporates green bonds into its climate finance strategy. *World Bank Blogs*. https://blogs.worldbank.org/en/climatechange/india-incorporates-green-bonds- its-climate-finance-strategy

[17.] Kapil, S., & Rawal, V. (2023). Sustainable investment and environmental, social, and governance investing: A bibliometric and systematic literature review. *Business Ethics the Environment & Responsibility*, *32*(4), 1429–

[18.] 1451. https://doi.org/10.1111/beer.12588 Kidd, D. (2012). Investment risk and performance.

[19.] Liang, H., & Renneboog, L. (2020). Corporate Social Responsibility and Sustainable Finance: A Review of the literature. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3698631

[20.] Lo, S. O. (2024). Sustainability Management: A review of ESG principles and policies in investment. *Advances in Economics Management and Political Sciences*, *71*(1), 62–68. https://doi.org/10.54254/2754-1169/71/20241422

[21.] Ministry of Information & Broadcasting. (2023). India's G20 Presidency Environment and Climate Sustainability Ministers' meeting. In *G20 Series*. https://static.pib.gov.in/WriteReadData/specificdocs/document s/2023/aug/doc2 023822242301.pdf

[22.] Nifty Indices advanced charting, (n.d.). https://www.niftyindices.com/market-data/advancedcharting?Iname=%20NIFTY100%20ESG

[23.] Nifty Indices Factsheet, (n.d.). https://www.niftyindices.com/Factsheet/Factsheet_NIFTY100 _ESG_Index.pdf

[24.] Nifty Indices Methodology, (n.d.). https://www.niftyindices.com/Methodology/Method_NIFTY_ Equity_Indices.pdf

[25.] O'Sullivan, N. (2024). Sustainable investment. In *Edward Elgar Publishing eBooks* (pp. 207– 214). https://doi.org/10.4337/9781800880344.ch39

[26.] Pénnanen-Arias, C., Barrientos-Oradini, N., Álvarez-Maldonado, D., Puentes, C. A., & Jara, V. M. Y. (2024). Integration of ESG criteria in financial education. In *IntechOpen eBooks*. https://doi.org/10.5772/intechopen.1005833

[27.] SECTORS: a CASE OF SUSTAINABILITY INVESTMENT STRATEGIES. *EPRA*

[28.] *International Journal of Economics Business and Management Studies*, 23–29. https://doi.org/10.36713/epra17662

[29.] *SEBI | Master Circular for ESG Rating Providers (ERPs)*. (n.d.). https://www.sebi.gov.in/legal/master-circulars/jul-2023/master-circular-for-esg- rating-providers-erps-_73856.html

[30.] *SEBI | Dos and don'ts relating to green debt securities to avoid occurrences of greenwashing*. (n.d.). https://www.sebi.gov.in/legal/circulars/feb-2023/dos-and-don-ts-relating-to- green-debt-securities-to-avoid-occurrences-of-greenwashing_67828.html

[31.] SES Governance, (n.d.). https://www.sesgovernance.com/esg-pdf/photo_1725020756_ESG- Analysis-on-200-Listed-Companies-%E2%80%93-Impact-of-Regulatory-Push.pdf

[32.] Shah, D. (2024). Sustainable Finance and ESG investing. *International Journal for Research in Applied Science and Engineering Technology*, *12*(2), 412–416. https://doi.org/10.22214/ijraset.2024.58346

[33.] Shetty, N. a. R., & Suraj, N. D. N. (2024). ESG INTEGRATION IN FINANCIAL Olanrewaju,

[34.] N. O. I. K., Daramola, N. G. O., & Babayeju, N. O. A. (2024). Transforming business models with ESG integration: A strategic framework for financial professionals. *World Journal of Advanced Research and Reviews*, *22*(3), 554–563. https://doi.org/10.30574/wjarr.2024.22.3.1757

[35.] Sinha, V. (2023, December 2). What is Green Credit Initiative, launched by PM Modi at COP28 summit? *Hindustan*

[36.] *Times*. https://www.hindustantimes.com/environment/what-is-green-credit-initiative- launched-by-pm-modi-at-cop28-climate-summit-in-dubai-101701487482709.html

[37.] Soler-Domínguez, A., Matallín-Sáez, J. C., De Mingo-López, D. V., & Tortosa-Ausina, E. (2020). Looking for sustainable development: Socially responsible mutual funds and the low-carbon economy. *Business Strategy and the Environment*, *30*(4), 1751– 1766. https://doi.org/10.1002/bse.2713

[38.] SP Global sustainability, (n.d.). https://www.spglobal.com/spdji/en/indices/esg/dow-jones-sustainability-north-america-composite-index/#overview

[39.] Xiao, R., Deng, J., Zhou, Y., & Chen, M. (2023). Analyzing contemporary trends in sustainable finance and ESG investment. *Law And Economy*, *2*(11), 44–52. https://doi.org/10.56397/le.2023.11.06

[40.] Xie, Y. (2024). The interactive impact of green finance, ESG performance, and carbon neutrality. *Journal of Cleaner Production*, *456*, 142269. https://doi.org/10.1016/j.jclepro.2024.142269

Lessons from Indian Study for Sustainable Economic Growth through Insurance

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ABSTRACT

Insurance penetration and density are 2 important metrics used to measure the level of expansion and can be used as sustainability Quotient for the Life Insurance sector worldwide. This paper examines the movement of penetration and density of life insurance in India during the year 2013 to 2023 to evaluate the growth pattern of life insurance sector in the Indian economy. The multivariate corelation is employed to analyse growth pattern of GDP and Per Capita Income with penetration in insurance and density of insurance for the identified duration. The finding of this study indicate that insurance density has sizable effect on GDP per capita growth. Also, a bit different perspective has emerged that Life Insurance Penetration, Density and GDP growth do not go always hand in hand. This gap can be mitigated by bridging Protection Gap. This paper contributes to the literature on the sustainability of the growth story of Indian life insurance sector and Sustainability Quotient which can be used in Life Insurance Industry.

Key words: Insurance sector, insurance penetration, insurance density, sustainable growth, Sustainability Quotient, Protection Gap.

Objective of the study:

To evaluate the sustainability in growth of life insurance sector in the Indian economy based on the trends in life insurance penetration and life insurance density over last 10 years.

1. INTRODUCTION

Insurance Regulatory and Development Authority (IRDA) Annual Report 2022 -23 emphatically mentions that "Sustainability" in Insurance in India is necessarily driven by the "orderly and speedy growth" with the goal of providing long-term funds for accelerating growth of the Indian economy." Also, it states that "Insurance Penetration and Insurance Density are two important metrics used to assess the level of development of Insurance Industry".

Insurance penetration gives us the understanding about to what extent the population is insured. It is denoted as a ratio of insurance premiums to gross domestic product (GDP). Any population or Market segment showing higher penetration ratio necessarily means that there is better acceptance, access and utilization of life insurance. Since, life insurance is becoming important financial need of a person and also a good affordable strategy to mitigate the losses arising out of untimely death and loss of continued income for survival. This metric also gives a fair idea about the progress and development of insurance sector of the country. It also shows the possibilities of encashing the untapped potential. The countries with low penetration have good potential and in turn offers good opportunities to take insurance market to new levels. The y- o-y shifts of penetration in India for last 10 years seen as under:

Insurance Penetration:
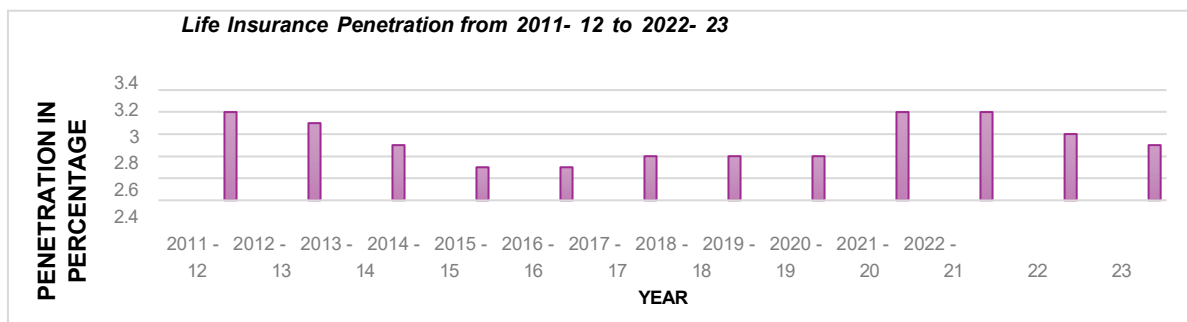
Fig 1: Life Insurance Penetration in India

(Source: IRDA Annual Report 2022-23)
The spikes in penetration in 2019- 20 and 2020- 21 are attributable to the unfortunate pandemic.

Insurance Density:

Per capita insurance premium is Insurance density. It is measured in terms of total life insurance premium income divided by the population insured. It gives an idea about quality-of-life insurance and telling us about adequacy of life insurance for an

individual. Higher Insurance density is contributing to the economy in terms of increased GDP. Higher density is normally found in developed countries. All economies strive hard to improve density to have better and qualitative contribution from insurance sector. Insurance density from the year 2011- 12 to 2022- 23 is as follows:
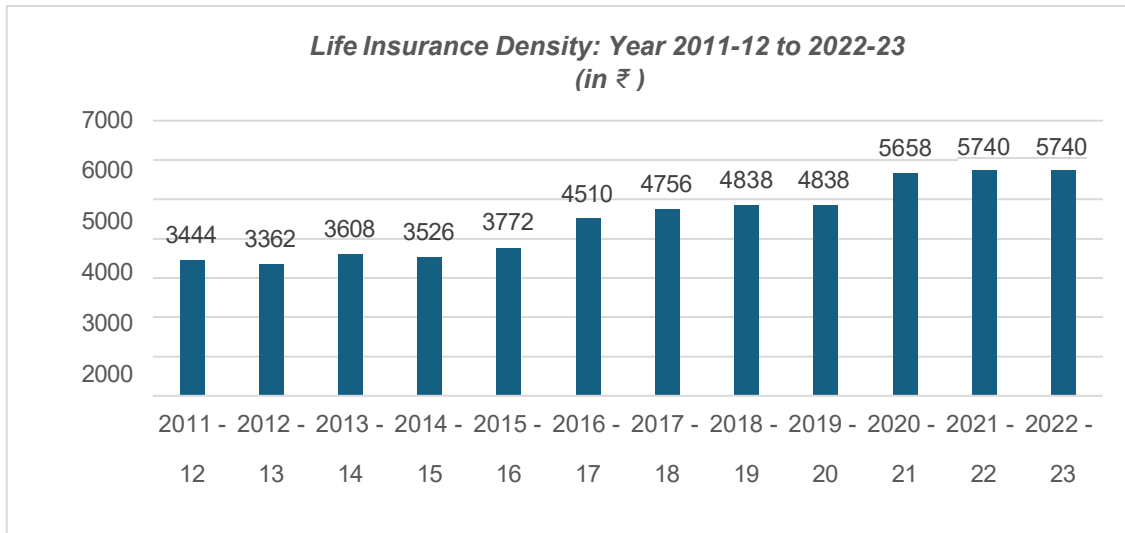
Fig 2: Life Insurance Density in India

(Source: IRDA Annual Report 2022-23)

There is gradual but steady increase in density, which has increase from Rs 3444 in the year 2011-12 to Rs 5740 in the year 2022-23. Except the marginal decline in the year 2014-15 over the year 2013-14, it has been improving in all the years. Its is noteworthy that there is substantial increase post pandemic i.e. of 16.94 % in the year 2020-21 over the year 2019-20. As such this study makes an attempt to find out the corelation between life insurance penetration, population of India, life insurance premium collection and GDP whole and per capita. Also, the study tries to understand the global view in life Insurance penetration, and density so as to get important insights into the factors influencing Insurance Sector sustainability in India. While making this study, we have taken an approach that "Insurance Penetration and Insurance Density can be strong "Sustainability Quotients" with respect to Insurance Industry.

Fig 3. Interconnectivity of the variables of this study

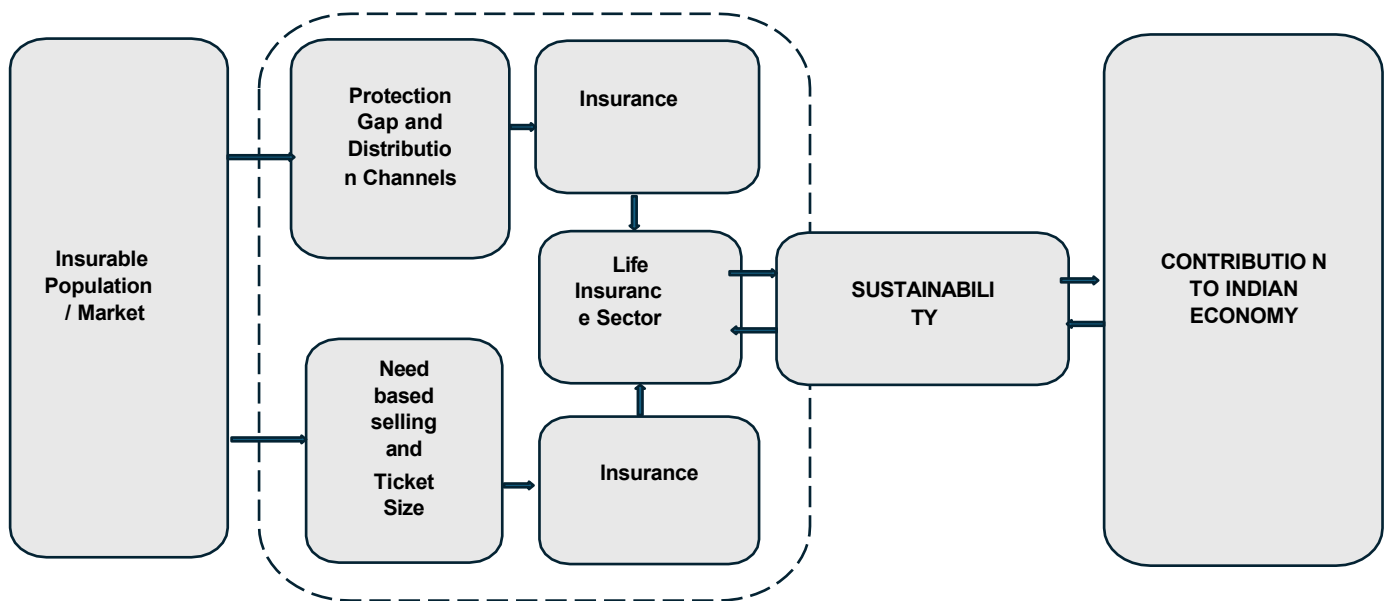The Indian insurance sector has been experiencing steady growth in recent years, driven by factors such as increasing awareness, rising disposable incomes, constructive interventions by the Regulator and favourable government policies. This growth is in terms of total premium earned by the life insurance sector.

Literature Review:

[1] The study conducted in Kenya concluded that growth in health insurance has positive impact on economic growth. Application of ARDL analysed the data of Kenyan GDP and growth of private and social insurance. It also recommends that there is need to enhance domestic financing insurance sector.

[2] The empirical study of Middle East and North Africa (MENA) Region has analysed the relationship between life insurance market development and economic growth. The present study revealed that there is demand of life insurance s well as supply which is leading all the MENA economies towards growth. The study also suggests that financial inclusion will play major role for the development of insurance in this sector. Public private partnership with advanced technology implications will foster the growth of economy.

[3] In the comprehensive descriptive study, the author has presented CSR initiatives of insurance companies. The study analysed CSR activities of few measure insurance companies namely LIC, HDFC Life, SBI life, ICICI, Bajaj alliance, Tata AIA and Aditya Birla sun life. Present study gives suggestions to the policy makers for insurance sector about variety of potential risks and business development and opportunities in insurance sector.

[4] The paper on distribution of insurance focused more on sale point of view and ultimately designing of the products. Insurance distribution is very crucial in today's world so proper management of distribution risk is dependent on proper functioning of the sector.

[5] The present research paper of Born, posit that insurance density and penetration has variations in economic transitions in post-communist European countries. 10 years analysis of 18 post- communist European countries deliver many suggestions to policy makers regarding availability and affordability of insurance in these specified countries.

[1] Chepchirchir D, Siele R, Kemboi I (2024)
[2] Zerriaa M (2024)
[3] Panchal s, Rao P (2024)
[4] Marano P (2021)
[5] Born P, Bujakowski D (2022)

2. REVIEW OF GENERAL ECONOMIC ENVIRONMENT OF INDIA:

As per interim estimates of National Income released by National Statistical Office (NSO), India's Gross Domestic Product (GDP) at current prices in the year 2022-23 is estimated at

272.41 lakh crore, as against 234.71 lakh crore in 2021-22, showing a growth rate of 16.1 percent. The Gross National Disposable Income (GNDI) at current prices is estimated at 273.36 lakh crore during 2022-23, as compared to 236.06 lakh crore during 2021-22, showing a rise of 15.8 per cent. The per capita at current prices is 1,96,983 GDP during 2022-23 as compared to 1,71,498 in 2021-22 showing a growth of 14.9 per cent. Per Capita Private Final Consumption Expenditure increased to 1,19,277 in 2022-23 from1,04,811 in 2021-22 registering a 13.8 per cent increase. Aggregate supply, measured by Gross Value Added (GVA) at basic prices, expanded by 15.4 percent in 2022-23 after registering an expansion of 17.9 per cent in 2021-22.

"To bring about speedy and orderly growth of the insurance industry (including annuity and superannuation payments), for the benefit of the common man and to provide long term funds for accelerating growth of the economy." Is one of the objectives as envisaged in the Mission Statement of IRDA, the Authority set up to regulate and develop Insurance corporation in India.

3. PROGRESSION OF THE INDIAN INSURANCE SECTOR:

- ***Increasing penetration*:** The insurance penetration in India has been steadily increasing, reflecting a rising awareness and acceptance of insurance among the Indian population. This indicates significant potential for growth in the future.

- ***Growing market size*:** The Indian insurance market is also as big as US and China, and it is expected to continue growing at a healthy pace. Life insurance has consistently outperformed than non-life insurance in terms of both density and penetration, indicating a strong preference for life protection among Indian consumers.

  This growth is being directed by influences such as rising urbanization, growing incomes, and budding awareness of the benefits of insurance.

- ***Rising premiums*:** The total premium income of the Indian insurance sector has been steadily increasing, reflecting the growing demand for insurance products. This growth is being driven by both life and non-life insurance segments.

- *Increased competition*: The Indian insurance market has become increasingly competitive, with a growing number of both domestic and foreign players. This competition is driving innovation and product development, which is benefiting consumers.

Bestowing PWC report, the Indian insurance industry continues to grow year-on-year on the back of varied factors, the life insurance market penetration remains at 3.2% as of 2021 due to increasing protection deficit and limited allocation reach.

4. CHALLENGES FACED BY INSURANCE INDUSTRY:

- *Technological Advancements*: The rapid pace of technological change, such as the rise of insurtech, presents new challenges for regulators in terms of oversight and consumer protection.

- *Global Risks*: Events like natural disasters, pandemics, and cyberattacks can have significant impacts on the insurance industry, requiring regulators to adapt their policies and practices.

- *Complexity of Insurance Products*: The increasing complexity of insurance products can make it difficult for regulators to ensure that consumers fully understand the terms and conditions.

5. FUTURE TRENDS IN INSURANCE INDUSTRY:

- *Data Analytics*: Regulators are increasingly using data analytics to identify risks, detect fraud, and improve market surveillance.

- *Climate Change*: The growing threat of climate change is prompting regulators to consider the implications for the insurance industry and develop appropriate regulatory frameworks.

- *International Cooperation*: As the insurance market becomes more globalized, there is a need for increased international cooperation among regulators to address cross- border challenges

6. METHODOLOGY

The quantitative methodological approach is developed to study the relationship between GDP, PCI, Penetration of insurance & density of insurance in India for identifiable period. Insurance for country typically measured by Insurance penetration.

*Insurance penetration= (Total premium income/GDP) *100*

Insurance density is also one of the measuring criteria for economy which depicts information of the average insurance premium per capita. Data of ten years have been selected for this study. Pearson correlation values are depicting positive correlation of GDP and Density of Population over the years. But penetration of insurance and GDP growth is not showing strong dependence on each other. Rise in PCI also has positive correlation with density of insurance.

Penetration of Life Insurance:

Table of Pearson Correlation: GDP, Penetration Insured population & Density of Insurance							
		Year	Total Population in Billion	GDP growth annual %	Per capita Income (at Current Prices in $)	Penetration Population	Density in Rs.
Year	Pearson Correlation	1	.997**	.090	.985**	-.096	.970**
	P-value		.000	.804	.000	.778	.000
	N	12	12	10	12	11	11
Total Population in Billion	Pearson Correlation	.997**	1	.066	.976**	-.123	.964**
	P-value	.000		.857	.000	.718	.000
	N	12	12	10	12	11	11
GDP growth annual %	Pearson Correlation	.090	.066	1	.061	-.482	.129
	P-value	.804	.857		.866	.188	.741
	N	10	10	10	10	9	9
Per capita Income (at Current Prices in $)	Pearson Correlation	.985**	.976**	.061	1	.012	.981**
	P-value	.000	.000	.866		.972	.000
	N	12	12	10	12	11	11
Penetration	Pearson	-.096	-.123	-.482	.012	1	-.009

Population	Correlation						
	P-value	.778	.718	.188	.972		.980
	N	11	11	9	11	11	11
Density in Rs.	Pearson Correlation	.970**	.964**	.129	.981**	-.009	1
	P-value	.000	.000	.741	.000	.980	
	N	11	11	9	11	11	11
**. Correlation is significant at the 0.01 level (2-tailed).							

Correlation of GDP growth and Penetration Population

Correlations				
		GDP growth annual %	Penetration Population	Density in Rs.
GDP growth annual %	Pearson Correlation	1	-.482	.129
	P-value		.188	.741
	N	10	9	9
Penetration Population	Pearson Correlation	-.482	1	-.009
	P-value	.188		.980
	N	9	11	11
Density in Rs.	Pearson Correlation	.129	-.009	1
	P-value	.741	.980	
	N	9	11	11

7. RESULT & DISCUSSIONS

The above 2 tables are based on the data of insurance penetration and insurance density in India for the specific time duration of 10 years. In the specified time which is 2014 -15 to 2022 -23 it has been observed that GDP of India has increased consistently in better manner whereas penetration and density could not cope up the pace rate of GDP.

As a result of investigations, it is quite apparent there observed that "Per capita income" is showing strong relationship with "Insurance Density". (Pearson Correlation being 0.981) However, the same is surprisingly weak with "Insurance Penetration". This essentially means that Life Insurance Premium is growing with the increase in the population, but not as fast as GDP is growing. As such, Insurance Penetration as Sustainability Quotient needs to be improved. Growth in Total Life Insurance premium has to be compatible with the growth in GDP.

It can also be observed that the ticket size, i.e. premium per policy is very low in India. Average further comes down when life insurance premiums of Social Security Schemes, run by the Governments are added, since the insurance provided is at cheaper rate. Efforts need to be taken to improve average premium per policy. Here, another noteworthy point is that the "Protection Gap" is wide in India. If this gap is bridged by some concrete efforts, the average premium per policy will improve. It has been observed that there is a wide scope of growth in penetration

and density of insurance in Indian economy considering the identifiable steps taken by policy makers.

8. CONCLUSIONS

In this paper researchers have investigated the relationship between GDP and density of insurance as well as penetration of insurance. The results show that there exists no specific interdependence between the GDP growth and growth in penetration of insurance. But, density of insurance and GDP has positive correlation.

Study also finds with the available literature that; India has made significant strides in improving insurance density and penetration and there is still ample scope for growth. By referring the challenges and available opportunities, the insurance sector can participate a fundamental role in protecting the financial interests of its citizens and contributing to the country's overall economic growth.

The Indian government has been taking steps to promote the growth of the insurance sector, such as simplifying regulations and increasing awareness about insurance products. Favourable government policies are expected to continue to support the growth of the sector. Overall, the Indian insurance sector is poised for continued growth in the coming years. The increasing penetration, growing market size, rising premiums and favourable government policies are all factors that are expected to drive the sector's growth.

1. Digging deep into above analysis it is apparent that there is definite growth in the density of life insurance in India, which means per capita life insurance premium is increasing in India. However, the growth in density does not commensurate with that of the growth in GDP.
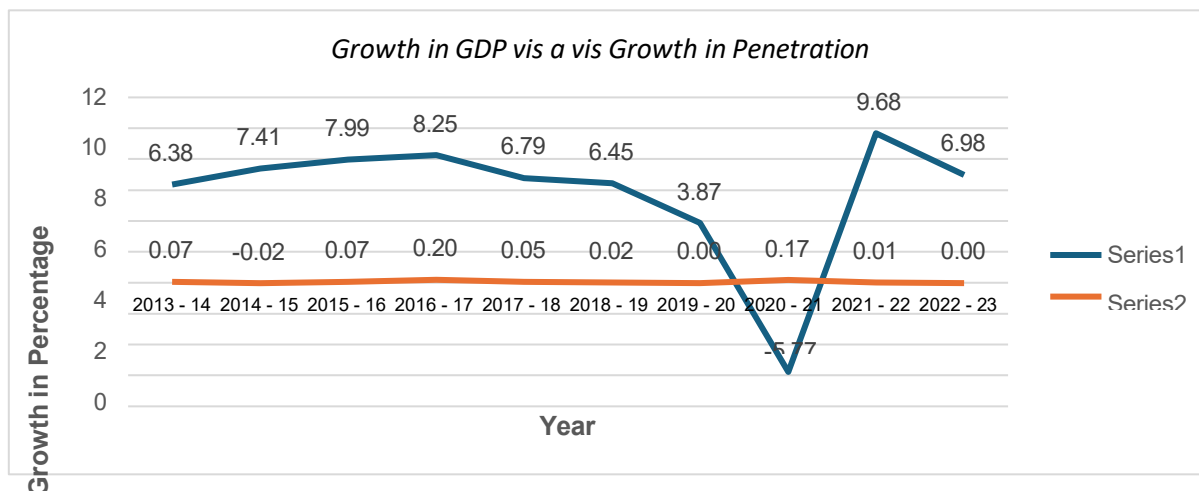

Figure 4: Growth in GDP vis a vis Growth in Insurance Penetration

2. As seen in Fig 4, series 1 depicts GDP growth and series 2 depicts penetration growth, GDP growth is much higher in the growth of Life Insurance Penetration year over year for last 10 years. In the year 2020- 21, GDP growth was in negative due to effect of COVID -19. Ironically, due to the same reason, Insurance Penetration maintained its pace. Very important conclusion which may be drawn from the forgoing analysis is that, unfortunately, Life Insurance has not been a part of India's growth story. Contribution of other sectors to the GDP growth is more than that of the Life Insurance.

3. As can be seen from the study and the analysis above, the Life Insurance Penetration is very low in India, which needs immediate improvement to contribute to the overall growth story of the Indian Economy. The industry needs to take immediate steps to improve the Penetration, i.e. Premium per policy, which is also called as Ticket Size. To achieve this, two-fold strategic interventions are required. The first being "Bridging the Protection Gap" and other one is "Providing Need based qualitatively superior Life Insurance".

4. Protection Gap is the difference between the required life insurance and the actual life insurance a person is covered with. In India, this protection gap is wide. It can be bridged by undertaking various activities to increase insurance awareness, especially in rural area. These awareness activities may be undertaken by the Governments, Insurance Companies, Regulatory Authority and the groups working for financial awareness in the society.

5. Identifying the insurance needs of the various segments of the society correctly is another task which can be undertaken to assess the potential in the life insurance market. This will help in designing and providing right insurance product to a person as per his/ her profile. This, in turn will increase the premium per insurance policy and improve the insurance density.

9. RECOMMENDATIONS FOR GROWTH IN INSURANCE:

1. The present paper would like to recommend, to increase penetration in India with specific efforts at school level and college level with incorporation of insurance subject in the curriculum itself.

2. Large scale mass level awareness campaigns need to be floated by the Insurers to create awareness of insurance amongst the public at large.

3. Community based awareness campaigns like village level, school level, ward level, society level activities are suggested to be undertaken by the insurers.

4. Popularising various lines of insurance, based on the specific insurance needs addressed by these lines can be another customer specific activity. For example, Making people understand the need and importance of health insurance to beat the health services inflation.

5. Creating awareness and education with respect to mortgage insurance to be used as collateral security for bank loans, in case of unfortunate death of the loanee takes place. Burder of paying subsequent EMIs and risk of the loan getting converted into NPA can be mitigated with this approach.

6. It is recommended that insurance companies to take responsibility to make insurance distribution channels robust, sustainable and trust worthy

10. DECLARATION

We, Dr Deepali Mohan Garge and Mr Sandeep Bhalchandra Moghe, hereby confirm that the manuscript titled "Lessons from Indian Study for Sustainable Economic Growth through Insurance" authored by Dr Deepali Mohan Garge and Mr Sandeep Bhalchandra Moghe, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

We affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to [Name of the Journal/Conference].

We declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Born P, Bujakowski D (2022) economic transition and insurance market development-evidence from post-communist European countries, the Geneva risk and insurance review, https://doi.org/10.1057/s10713-021-00066-3, pp201-237

[2.] Chepchirchir D, Siele R, Kemboi I (2024) Influence of health insurance financing on economic growth in Kenya, Journal of Economics Finance and Management studies, ISSN (print): 2644- 0490, ISSN (online): 2644-0504, Volume 07 Issue 10 DOI: 10.47191/jefms/v7-i10-03, pp6118-6122

[3.] Marano P (2021), Management of Distribution Risks and Digital Transformation of Insurance Distribution—A Regulatory Gap in the IDD, Risks 9:143. https://doi.org/10.3390/ risks9080143, pp1-11

[4.] Panchal s Rao P, Corporate Social Responsibility in insurance sector and role of insurance sector in economic Development of India Journal of Economics Innovative Management and Entrepreneurship JEIME ISSN 3029-7091Vol 2 Issue 1 pp52-58

[5.] Reddy A, Dondapati P (2019) "A study on life insurance penetration in India", The International journal of analytical & experimental modal analysis, ISSN 0886-9367 Vol XI. Issue XII, pp601-604

[6.] Sajid Mohy ul din, Angappan Regupathi, Arpah Abu-Bakar, (2017) "Insurance effect on economic growth – among economies in various phases of development", Review of International Business and Strategy, Vol. 27 Issue: 4, pp501-519

[7.] Zerriaa M (2024) Life insurance and economic growth Nexus: Evidence from the MENA region, International Journal of Economics & Finance, ISSN 1916-971X, E ISSN 1916-9728, Vol 16, No 9, pp23-30

[8.] IRDAI Hand Books (https://irdai.gov.in/document-detail?documentId=1623336) IRDA Annual Reports (https://irdai.gov.in/document-detail?documentId=1346564) https://law.asia/irdai-reforms-insurance-market-growth/

[9.] https://openknowledge.worldbank.org/entities/publication/3f80 9424-918c-5a3e-a54d- 9a4f60cc2699

Mergers and Acquisitions deals in India

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ABSTRACT

Black swan events like pandemics, economic upheavals, and product life cycles all increase the likelihood that businesses may fail. The purpose of Mergers and Acquisitions (M&A) is to save businesses from imminent problems and closures. M&A successfully combines the complementary requirements of two distinct business units, resulting in a synergy that ensures survival and sustainability. Through M&A, businesses can expand more quickly than they could through organic expansion, improve their competitiveness, and solidify their place in the global market. Globalisation, liberalisation, privatisation, and technical advancements have all contributed to the current surge in popularity of M&A. The quantity and volume of M&A transactions have significantly increased throughout the last 5 Years. Due to improved market reputation and power, synergy power, and other qualitative and quantitative aspects, it is assumed that mergers help to develop the company financial performance. M&A are now a common way for Indian businesses looking to quickly enter new markets to grow outside of their country. In recent years, Indian businesses have greatly increased their merger and acquisition activity, particularly when it comes to cross-border operations. Industries including Banking and Financial services, IT and Energy and Natural Resources between 2019 and 2024. Since the volume and value of M&A transactions are crucial to this investigation, correlation and regression analysis will be used to examine their relationship across the chosen industries.

Keywords: Mergers, Acquisitions, Financial Performance, Technological Growth, Liberalization.

1. INTRODUCTION

A merger refers to the consolidation of two or more corporate entities to establish a newly formed organization with an augmented capacity. In the event of a merger, both entities will dissolve as they function collectively under the auspices of a newly constituted organization. A merger transpires when an organization perceives a strategic benefit in amalgamating its operations with another enterprise, such as the enhancement of shareholder wealth. The process of acquisition entails the transfer of ownership of one corporation to another, which encompasses the complete purchase and sale of the business between the involved parties. In an acquisition scenario, one corporation may assume control over another, which can occur through either amicable or adversarial means.

Globally, mergers and acquisitions have emerged as a predominant mechanism for corporate restructuring, concurrently, the financial services sector has also undergone waves of mergers, culminating in the formation of significantly large banking institutions and financial entities. The principal catalyst propelling merger activities is the intense competition prevalent among firms within the same industry, which emphasizes the importance of achieving economies of scale, enhancing cost efficiency, and maximizing profitability. Another contributing factor to bank mergers is the "too big to fail" doctrine that is adhered to by regulatory authorities. In certain nations, such as Germany, financially vulnerable banks have been compelled to merge in order to mitigate the risks associated with financial instability stemming from non- performing loans and the depletion of capital reserves. Noteworthy examples of

substantial transactions include the merger of HDFC with HDFC Bank valued at USD 60 billion, the acquisition of Ambuja Cements and ACC Cements by Adani Enterprises for USD 10.5 billion, and L&T Infotech's acquisition of Mindtree for USD 2.2 billion.

The initial semester of 2024 has ushered in significant transformations within the Mergers and Acquisitions (M&A) domain of the Indian technology sector. In spite of a reduction in the frequency of transactions, a marked transition towards high-value deals has been observed. These strategic initiatives are directed towards the augmentation of technological and operational proficiencies, mirroring both a prudent response to prevailing market conditions and an ambitious pursuit of growth, both on domestic and international fronts. M&A have been regarded as one of the most effective instruments for a company's inorganic expansion and represent prevalent forms of restructuring that facilitate an efficient mechanism for the synergy of business operations and the realization of economies of scale. The motivations underpinning

M&A activities by firms may encompass a range of objectives, including the attainment of competitive advantages, the realization of synergies, the enhancement of operational capacities, the acquisition of tax advantages, and the consolidation of organizational operations.

M&A are employed as mechanisms of significant expansion and are increasingly being recognized by Indian enterprises as an essential component of corporate strategy. They are extensively utilized across various sectors, including information technology, telecommunications, and business

process outsourcing, as well as traditional industries, to bolster operational strength, enhance customer outreach, diminish competitive pressures, or penetrate new markets or product categories. Mergers and acquisitions may be pursued to gain access to the market via an established brand, to secure a share of the market, to eradicate competition, to mitigate tax obligations, or to acquire expertise, or to offset the accumulated losses of one entity against the profits of another entity.

In the year 2021, India experienced an unprecedented surge in the rates of mergers and acquisitions, predominantly driven by novice investors. The advent of disruptors or insurgents has significantly impacted this expansion across various sectors of the economy. As indicated in the report released in 2021 by a management consulting firm, 85 transactions were completed, amounting to USD 75 million. First-time purchasers represent 80% of the total volume of mergers and acquisitions. In India, major corporations such as Reliance and Tata Group have demonstrated consistent growth, successfully concluding over 25 transactions in the preceding two years. The resultant innovation and advancement have catalyzed these merger and acquisition endeavours within the retail, digital, and durable consumer markets. The Indian government's dedication to fulfilling its renewable energy objectives, which includes the ambitious strategy revealed at COP26 to attain 500GW of renewable energy capacity by the year 2030, has drawn substantial investments from international energy conglomerates.

In the recent convening of the Indo-Pacific Economic Framework for Prosperity (IPEF) Clean Economy Investor Forum, India committed to a substantial investment of USD 500 billion in opportunities within the clean energy value chain by the year 2030, encompassing sectors such as renewable energy, green hydrogen, and electric vehicle markets. Within the Indian power sector, a total of 40 M&A transactions were reported in the first quarter of 2024, with an aggregate value amounting to $1.7 billion, as documented by Global Data's Deals Database. The acquisition of the KSK Mahanadi Power Project, valued at $602.5 million, represents the most significant disclosed transaction within the industry, executed by NTPC from an undisclosed seller. The Power Industry Mergers and Acquisitions Deals report by Global Data for the first quarter of 2024 elucidates critical trends influencing the power market's M&A activity and facilitates a nuanced understanding of the disruptive themes propelling the most prominent transactions. Between 2021 and 2023, the proportion of energy deals relative to the total M&A deal value in India experienced a rapid escalation from 7% to 15%, paralleling the increased inbound private equity investment in solar and wind energy assets in India, thereby reflecting a pronounced emphasis on private equity's allocations towards "green assets".

A few afterward M&A in India's Money related organizations industry in 2024 include:

- Mitsubishi UFJ Budgetary Group's obtainment of DMI Finance: In the third quarter of 2024, Mitsubishi UFJ Financial Bunch successfully secured a minority interested in DMI Back for a entire of $330 million, talking to the most significant revealed trade interior the division.

- Life Assurances Venture of India's securing of HDFC Bank: In January 2024, the Life Assurances Organization of India executed the securing of a 9.99% esteem stake in HDFC Bank.

- HDFC Bank's securing of IndusInd Bank: In February 2024, HDFC Bank endeavored the securing of a 9.5% ownership stake in IndusInd Bank.

- Zurich Assurances Group's securing of Kotak Mahindra Bank: In February 2024, Zurich Assurances Accumulate openly detailed the securing of a 70% stake in the common assurances division of Kotak Mahindra Bank for a include up to thought of $670 million.

- Invesco Asset Organization India and IndusInd All-inclusive Holdings' joint meander: This collaborative meander is intentionally laid out to amplify exhibit closeness and grow operational capabilities.

The taking after depicts a few famous M&A happening interior India's Information Development division in the year 2024:

- Accenture and NaviSite Accenture executed the obtainment of NaviSite, a provider of progressed alter organizations, to energize its clientele in the integration of generative fake experiences.

- Data Establishment Accept and ATC India Data System Accept secured the assets of ATC India for a noteworthy entire of $2.5 billion, stamping one of the most basic trades in the system space for the year 2024.

- Adani Bunch and NDTV The Adani Assemble gotten an additional 27.26% proprietorship stake in NDTV, as of now held by the creators of NDTV.

- Zomato and Blinkit Zomato and Blinkit, both substances bolted in in online food and essentially require transport organizations, come to a understanding to solidify in a trade organized as an all-stock agreement.

The taking after clarifies a few afterward M&A interior the Imperativeness and Typical Resources portions in India:

- In the to start with quarter of 2024, NTPC executed the securing of the KSK Mahanadi Control Wander for a entirety of $602.5 million, talking to the most impressive openly revealed trade interior the Indian control space.

- In the to start with quarter of 2024, Reliance Businesses and Disney built up a collaborative joint meander pointed at the amalgamation of Viacom 18 and Star India. This imperative machination is adjusted to cause a media combination that encompasses tv broadcasting, spouting organizations, cinematography, and athletic events.

- Adani Control Compelled grasped the merger of its assistant, Mahan Energen Obliged (MEL), with Stratatech Mineral Resources to back its fuel security initiatives.

Recent solidifications and acquisitions interior the Essentialness and Ordinary Resources fragments in India wrap the taking after instances:

- Brookfield has secured a controlling charmed in Hop Green Imperativeness.

- Aerem has successfully gotten Spinkraft.

- IndiGrid has executed an assention to get 300 MW (AC) of sun situated assets from Revive

2. REVIEW OF LITERATURE

The research by Chen (2023) indicates that the integration of new ideas with existing knowledge significantly bolsters innovation core competitiveness post-M&A. As per Enerdata (Citation2022), Brazil holds the third position globally in renewable energy production at 78.4%, while China closely follows with 28.8%; Russia, South Africa, and India fall below average with 19.3%, 9.2%, and 20.4%, respectively. In 2019, the global renewable energy

production share was recorded at 26.3%. The findings of Yang and Zhou (2019) illustrate that the effects of technical innovation from technology M&As are more pronounced when the acquired entity experiences substantial growth. Sharma and Jain (2018) demonstrate the multifaceted nature of M&A activities across various sectors in the Indian economy, attracting both domestic and international investments. This indicates the strategic opportunities available in a complex economic landscape. Gupta and Kumar (2017) assert that acquisitions yield beneficial results, particularly in technology transfer and knowledge exchange, enhancing target companies' performance, in line with technology-driven globalization trends in IT. Zhang et al. (2017) assert that technology M&A mitigates the knowledge cocoon trap and fosters innovation by rapidly updating knowledge stocks, leveraging complementary technological resources for enhanced corporate performance.

Reddy and Singh (2016) note that while M&A can enhance production capacity, they face risks from global oil price volatility, potentially affecting target company performance. Prof. Ritesh Patel & Dr. Dharmesh Shah (2016) employed an economic value-added approach to analyze pre and post-merger financial performance in the Indian banking sector, concluding that mergers may enhance financial performance, contingent on prior financial data analysis. Gurubaksh Singh & Sunil Gupta (2015) assessed the impact of M&A on Indian banking sector profitability, revealing positive effects on merged banks through various financial metrics over a five-year span. Parveen Kumari (2014) posits that bank M&A serves as a strategic approach aimed at enhancing credit generation, with data indicating growth in branches, ATMs, net profit, deposits, and net worth post-merger. David C. Cheng's (2009) study on financial determinants of bank takeovers found that purchase price is a negative function of the target's capital to asset ratio. Srivassan et al. (2009) discussed the financial implications of mergers and acquisitions, highlighting consolidation and synergy-based mergers. Zhao's (2009) analysis of US M&A cases revealed that technology M&As often lead to increased patents for companies with weak innovation capacity. Cassiman et al. (2005) argued that merger parties intentionally select firms with missing technological knowledge.

3. RESEARCH GAP

The study lacks exploration of M&A impacts on innovation. Limited focus on specific industry sectors i.e., Banking and Financial services sector, IT Sector, and Energy and Natural resources sector for M&A deals in India. There is no examination of long-term M&A performance post-acquisition.

Need for the Study

Companies that choose to go for M&A deals must contend with increased market pressure, which could lead them to prioritise long-term expansion by merging their companies with other or by just acquiring in the market. This research aids investors in selecting the best sector for merging and acquiring in India. The current study finds M&A deals in India for 3 sectors i.e., Banking and Financial services sector, IT sector and Energy and Natural resources sector. It also analyses the volume and value of M&A sector wise trends to identify possibilities for investors to make M&A deals in the market.

Objectives of the Study

- To investigate the trends of Mergers and Acquisitions within specific industry sectors.

- To measure sector-wise trend of M&A investments in India.

- To analyse relationship between M&A deal volume and value.

Scope of the Study

The study focuses on M&A deals in India. It targets particularly 3 sectors i.e., Banking and Financial services sector, IT sector and Energy and Natural resources sector. It

considers the data through secondary sources like Journals, publications, books, newspapers from 2019 to 2024.

Research Methodology

This study used descriptive analysis to provide a comprehensive overview of the data collected, allowing for a nuanced understanding of the underlying patterns. Tests of normality were conducted to assess the data's distribution, ensuring the validity of statistical analyses. Multicollinearity and heteroscedasticity were evaluated to ensure the assumptions of regression analysis were met, examining potential correlations among independent variables and the constancy of variance in residuals. Correlation and regression analyses were used to examine relationships between variables, providing insights into the strength and directionality of associations and allowing for prediction of variables based on each other's values. T-tests and ANOVA were conducted to facilitate meaningful comparisons across different groups within the dataset, determining if statistically significant differences could be attributed to the independent variables being investigated.

Statistical Methods

To investigate the hypotheses related to trends and relationship of volume and value of the M&A sectoral deals in India, a range of statistical analyses were utilized, such as descriptive analysis, tests of normality, assessments of multicollinearity and heteroscedasticity, correlation, regression, as well as t-tests and ANOVA.

Normality Tests

Normality of residuals is a crucial assumption in regression analysis, as it enhances the reliability of the results if they are normally distributed. The Shapiro-Wilk test, in particular, is well-regarded for its sensitivity in detecting departures from normality, making ita robust choice for evaluating the normal distribution assumption in statistical analysis (Razaliand Wah, 2011). In the present study (the number of sectors) the sample size is less than 50 asthe Shapiro-Wilk (SW) Test is particularly advantageous when dealing with smaller sample sizes, specifically when the sample comprises fewer than 50 observations. (Al-Hroot et al.2020). The Shapiro-Wilk Test is employed alongside the Kolmogorov-Smirnov Test to rigorously examine the distribution of the data. By utilizing both tests, it is ensured that a comprehensive and thorough exploration of the normality of the data, with a specific emphasison leveraging the strengths of the SW test to enhance the accuracy of the assessment.

Heteroscedasticity Test (White test)

The White test (Lyon, J.D. and Tsai, C.L.1996) is conducted to check for heteroscedasticity inthe residuals. Heteroscedasticity can impact the precision of coefficient estimates. A non- significant White test suggests homoscedasticity, indicating that the variance of the residuals is constant across all levels of the independent variables.

R-Squared (R²)

R-squared (R²) is a statistical method used to assess the proportion of variance in investments that can be explained by. A higher R-squared indicates a strongerfit of the model to the data (Morck R. et al. 2013).

Coefficients of Multiple Correlation

The coefficients of multiple correlation is calculated to measure the strength and direction of the overall relationship among the variables. This provides insights into how well the combined independent variables explain the variation in the dependent variable.

Dependent and Independent Variables

The total value of deals is inherently dependent on the total number of deals conducted within a specific sector or industry. This dependency arises from the cumulative impact of individual transactions on the overall financial system. As the total number of deals increases, there is a corresponding escalation in the cumulative financial value, representing the aggregated worth of these transactions. This relationship is grounded in several key factors, including market dynamics, economies of scale, and the fundamental principle that increased deal activity fosters a more competitive and vibrant marketplace. A higher total number of deals not only signals adynamic and active industry but also often reflects positive market sentiment and confidence. Moreover, as companies engage in multiple transactions to diversify portfolios and explore new opportunities, the synergistic effect of a greater deal volume contributes significantly to an elevated total value of deals. In essence, the total number of deals serves as a catalyst, shaping the overall financial magnitude of transactions and influencing the comprehensive value derived from the collective economic activity within a given sector. (Bieshaar H. et al., 2001)

Hypotheses

Considering Deal Value as dependent variable and Deal Volume as independent variable in M&A transactions following hypotheses have been formulated which is relevant to thesecond aim of the study (To measure the sector wise trend of M&A Investments in India over the last 5 years).

Main Hypothesis: Hypothesis 1

H01: There exists no noteworthy connection between the Value and Volume of M&A deals in India over the past 5 years.

Sub-Hypotheses

H02.1: There is no significant association between the Volume of Deals and the Value of Deals (USD mn) in Banking and Financial Services

H02.2: There is no significant association between the Volume of Deals and the Value of Deals (USD mn) in IT

H02.3: There is no significant association between the Volume of Deals and the Value of Deals (USD mn) in Energy and Natural Resources

Outliers

Outliers are observations or data points that significantly deviate from the majority of other data points in a dataset, often being unusual or atypical. They can lead to model misrepresentation, biased parameter estimation, and inaccurate outcomes when left unaccounted for. Identifying outliers is crucial for achieving a cohesive analysis and reducing inference errors. Outliers can significantly influence regression analysis results, leading to inflated coefficient of determination (R^2), erroneous sloM&A and intercept values, and potentially misleading model conclusions. To address this issue, graphical methods, such as residual plots, are commonly employed to detect outliers. These techniques help visualize discrepancies between observed data points and the regression model's predicted values, allowing researchers to identify influential observations that deviate significantly from the overall pattern. By identifying and dealing with outliers, researchers can obtain more accurate and reliable regression models and draw more meaningful conclusions from their analyses. To ensure the accuracy and reliability of statistical analyses and models based on a dataset, outlier detection was conducted using Tukey's Fences method before finalizing the dataset. This process ensured the robustness of subsequent analyses and mitigated the potential for model misrepresentation, biased parameter estimation, and inaccurate outcomes.

Homoscedasticity

The White test is a diagnostic tool used to evaluate the consistency of variance in regression models, indicating homoskedasticity. It was proposed by H. White and uses reliable standard errors to examine the assumption of homoscedasticity in M&A deal volume and value data. Homoscedasticity is a statistical model where the variance of errors or residuals remains uniform across all independent variables. A model is considered homoscedastic if the variance of errors exhibits uniformity, indicating its robustness.

Shapiro-Wilk Test

The Shapiro-Wilk test is a statistical method used to assess the normality of residual errors in a linear regression model. It assumes that the errors follow a normal distribution, which is necessary for valid statistical inference using the model. The test is considered one of the most powerful tests among the tests, and it is applied to the residual errors of the linear regression model to determine if they follow a normal distribution. If the p-value of the Shapiro-Wilk test is greater than the significance level (usually 0.05), the null hypothesis that the data follows a

normal distribution cannot be rejected, and the normality assumption is considered reasonable.

If the p-value falls below the chosen significance level, the null hypothesis positing that the data adheres to a normal distribution is rejected, resulting in the assumption of normality being deemed implausible or unsupported by the statistical evidence. Alternative methods may be used to account for the non-normality of the data, such as transforming the data or using non- parametric methods. The intercept term (b) represents the anticipated outcome value when all predictor variables assume a zero value. The coefficient associated with a predictor variable delineates the anticipated alteration in the outcome variable for a unitary increment in the said predictor variable, under the condition of maintaining all other predictor variables at a constant level.

The standard error of the regression coefficient gauges the degree of variability inherent in the estimate of the coefficient, and a diminished standard error conveys a higher degree of precision in the estimation process. The confidence interval provides an interval of conceivable values within which the true coefficient in the population is likely to fall, serving as an evaluative measure of the precision inherent in the coefficient estimate. The standardized coefficient facilitates the comparative assessment of the relative significance of distinct predictor variables within the model. The p-value in a t-test represents the probability of observing a t-value as extreme as or more extreme than the observed value, assuming the null hypothesis's validity.

Sample of the Study

M&A Deal Volume and Values in India for 3 sectors were considered in the study. The study only took into account sectors for which data was consistently and uniformly available throughout the entire study period (2019-2024).

The Study has chosen various sectors for its analysis.

Following three (3) sectors M&A deal volume and deal values in India have been included in the study:
* Banking and Financial Services (BFS)
* IT
* Energy and Natural Resources

Period of the Study

M&A volume and values of 3 sectors i.e. sectoral trend data was available for the only for the five-year period (2019-2024) and hence 5 years sectoral M&A volume and values considered.

Limitations

* This study is confined to Mergers and Acquisitions deals in India
* This study is restricted only to Value and Volume of M&A.

- This study is limited to only 3 sectors i.e., Banking & Financial services sector, IT sector, and Energy and Natural resources sector.

- This study is bounded to secondary data for 5 years i.e., from 2019 to 2024.

TABLE 1: M&A Deals in Banking and Financial Services, IT, Energy and Natural Resources Sector

Year	Banking and Financial Services Sector		IT Sector		Energy & Natural Resources Sector	
	Volume	Value (Billion US$)	Volume	Value (Billion US$)	Volume	Value (Billion US$)
2019	1904	263.63	5121	485.4	4876	771.09
2020	1523	253.23	4692	569.87	4239	603.07
2021	1527	403.31	5979	767.19	4793	817.96
2022	1294	366.65	5259	448.7	3963	783.59
2023	875	144.98	4203	281.92	3129	631.38
2024	814	167.93	3607	406.43	2860	577.78

Source: imaa-institute.org

Interpretation:

From the Year 2019 to 2024, Banking and Financial sector, IT Sector and Energy and Natural resources sector volume and value is fluctuating. The banking and financial services sector's volume and value have increased significantly in recent years, reaching a total of $167.93 billion in 2024. The IT sector experienced significant growth in volume and value from 2019 to 2024, reaching a total of 767.19 billion US dollars. The Energy and Natural Resources sector has undergone substantial growth in volume value between 2019 and 2024 with 577.78 billion US dollars of volume. For Banking and Financial Services Sector, volume is high in 2019 i.e., 1904 and value is high in 2021 i.e., 403.31 (Billion US$) where as volume is low in 2024 i.e., 814 and value is low in 2021 i.e., 144.98 (Billion US$). For IT Sector Volume and value both

is high in 2021 i.e., 5979 and 767.19 (Billion US$) and Volume is low in 2024 i.e., 3607 and value is low in 2023 i.e., 281.92 (Billion US$). For Energy and Natural Resources Sector, the value is high in 2019 i.e., 4876 and value is high in 2021 i.e., 817.96 (Billion US$) and both the value and the volume is low in 2024 i.e., 2860 and 577.78 (Billion US$).
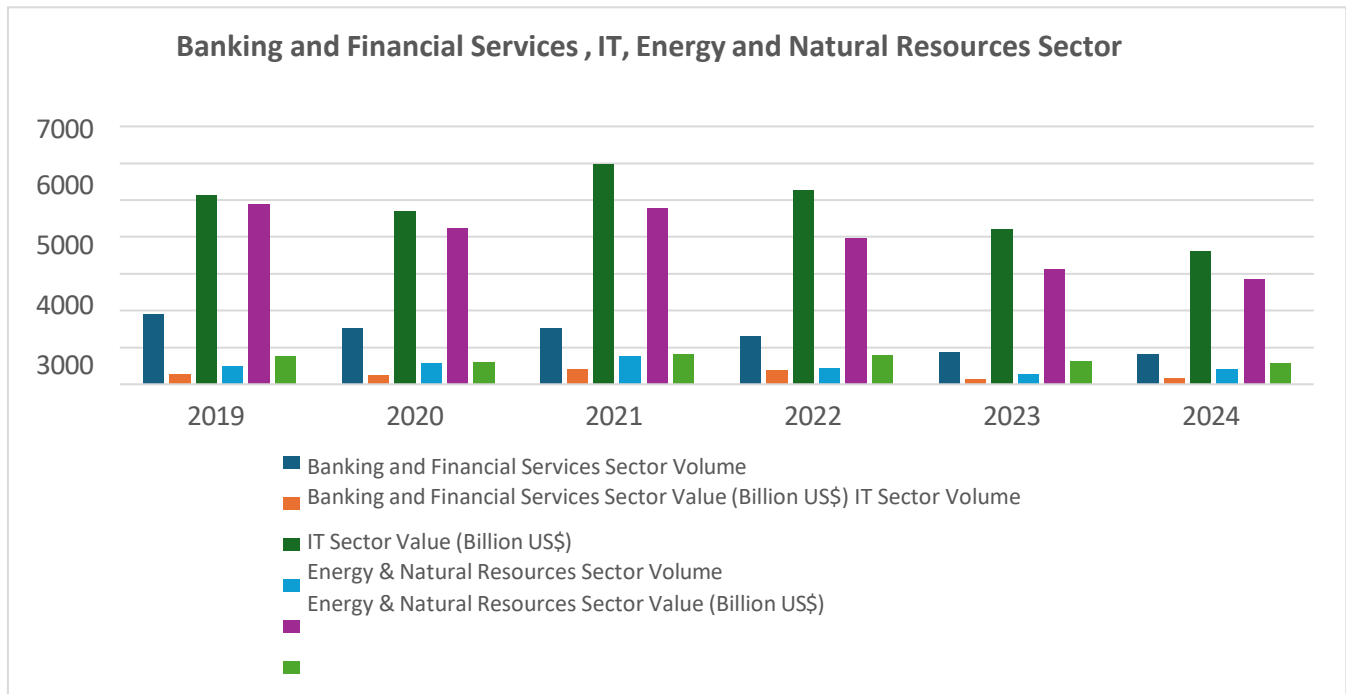

Figure 1. Shows M&A Deals in Banking & Financial Services, IT and Energy and Natural Resources Sector

TABLE 2: Descriptive Statistics: M&A Deals in BFSI Sector, IT Sector and Energy and Natural Resources Sector

Groups	Banking and Financial Services Sector		IT Sector		Energy & Natural Resources Sector	
	Volume	Value	Volume	Value	Volume	Value
Num of observations	6	6	6	6	6	6
Minimum	814	144.98	2,860	577.78	3,607	281.92
Maximum	1,904	403.31	4,876	817.96	5,979	767.19
Range	1,090	258.33	2,016	240.18	2,372	485.27
Mean ($\bar{x}$)	1,322.83	266.6217	3,976.67	697.4783	4,810.17	493.2517
Sum	7,937	1,599.73	23,860	4,184.87	28,861	2,959.51
Standard Deviation (S)	419.4765	103.358	837.8173	104.8421	835.9982	164.413
Variance (S^2)	1,75,960.57	10,682.88	7,01,937.87	10,991.87	6,98,892.97	27,031.63
Q1	875	167.93	3,129	603.07	4,203	406.43
Median	1,408.50	258.43	4,101	701.235	4,906.50	467.05
Q3	1,527	366.65	4,793	783.59	5,259	569.87
Interquartile range	652	198.72	1,664	180.52	1,056	163.44
Skewness	-0.0356	0.2149	-0.3632	-0.01534	-0.1283	0.7307
Excess kurtosis	-1.1704	-1.5698	-1.7405	-2.7803	-0.3055	1.1467

Regression line equation for Banking and Financial Services Sector $\hat{Y}$ = 78.2311 + 0.1424X
R^2 = .33, $F (1,4)$ = 2.01, p = .230.
β = .14, p = .230, α = 78.23, p = .602.

Regression line equation for IT Sector $\hat{Y}$ = -224.5601 + 0.1492X
R^2 = .58, $F (1,4)$ = 5.43, p = .080.
β = .15, p = .080, α = -224.56, p = .511.

Regression line equation $\hat{Y}$ = 325.4925 + 0.09354X
R^2 = .56, $F (1,4)$ = 5.07, p = .088.
β = .094, p = .088, α = 325.49, p = .125.

TABLE 3: Regression ANOVA of Banking and Financial Services Sector, IT Sector and Energy and Natural Resources Sector

Sector	Source	DF	Sum of Square	Mean Square	F Statistic (df1, df2)	P-value
Banking and Financial Services	Regression (between ŷi and ȳ)	1	17844.05	17844.05	2.0066 (1,4)	0.2296
	Residual (between yi and ŷi)	4	35570.34	8892.586		
	Total (between yi and ȳ)	5	53414.39	10682.88		
IT Sector	Regression (between ŷi and ȳ)	1	77818.2741	77818.2741	5.4286 (1,4)	0.08026
	Residual (between yi and ŷi)	4	57339.8802	14334.97		
	Total (between yi and ȳ)	5	135158.1543	27031.6309		
Energy and Natural Resources Sector	Regression (between ŷi and ȳ)	1	30710.2365	30710.2365	5.0658 (1,4)	0.08757
	Residual (between yi and ŷi)	4	24249.1062	6062.2765		
	Total (between yi and ȳ)	5	54959.3427	10991.8685		

The statistical analysis of Mergers and Acquisitions (M&A) in various sectors of India reveals significant insights into the relationship between deal volume and deal value. In the Banking

and Financial Services sector, the R-squared value of 0.3341 indicates that 33.4% of the variability in deal value can be explained by deal volume, suggesting a moderate correlation. In contrast, the IT sector shows a stronger relationship with an R-squared of 0.5758, while the Energy & Natural Resources sector also demonstrates a robust correlation with an R-squared of 0.5588. These findings highlight the varying degrees of impact that deal volume has on deal value across different sectors.

TABLE 4: The following are the Results of Hypotheses

S. No.	Hypothesis	Extend of relationship	Result
1	There exists no noteworthy connection between the Value and Volume of M&A deals in India over the past 5 years.	Overall direct relationship exists in Value and Volume of M&A deals in India over the past 5 years.	Rejected
2	There is no significant association between the Volume of Deals and the Value of Deals (USD mn) in Banking and Financial services	Shows moderate direct relationship with F $(1,4)$ =2.0066, p-value = 0.2296 (p-value $\geq \alpha$ (0.05)) and 57.8% of correlation.	Rejected
3	There is no significant association between the Volume of Deals and the Value of Deals (USD mn) in IT	Shows strong direct relationship with F $(1,4)$ = 5.4286, p-value = 0.08026 (p-value $\geq \alpha$ (0.05)) and 75.88% of correlation	Rejected
4	There is no significant association between the Volume of Deals and the Value of Deals (USD mn) in Energy and Natural resources.	Shows strong direct relationship with F $(1,4)$ = 5.0658, p-value = 0.08757 (p-value $\geq \alpha$ (0.05)) and 74.75% of correlation.	Rejected

Findings

- The study of Mergers and Acquisitions (M&A) in India reveals a moderate correlation between deal volume and deal value.
- The overall regression models across sectors did not significantly outperform models without independent variables, indicating potential limitations in predictive power.
- Among the 3 sectors, there is high mean in volume for Energy and Natural Resources sector with 4,810.17 and high mean in Value for IT Sector with 697.4783
- As per the 3 sectors values, there is high deviation in Energy and Natural Resources sector i.e., 164.413 and less deviation in Banking and Financial Services sector i.e., 103.358.
- As per the 3 sectors volume, there is high deviation in IT Sector i.e., 837.8173 and slight deviation when compared with IT is Energy and Natural Resources is 835.9982.
- There is low deviation in Banking and Financial services sector with 419.4765 as per Volume.
- The linear regression model assumes normality for residual errors for all the sectors.

Banking & Financial Services Sector

- For Banking and Financial Services Sector, volume is high in 2019 i.e., 1904 and value is high in 2021 i.e., 403.31 (Billion US$).

- For Banking and Financial Services Sector, volume is low in 2024 i.e., 814 and value is low in 2021 i.e., 144.98 (Billion US$).
- In the Banking and Financial Services sector, 33.4% of deal value variability can be explained by deal volume, indicating a moderate correlation.
- The minimum volume for Banking and Financial sector is 814 and value is 144.98 and maximum volume is 1904 and value is 403.31
- The mean for volume is 1,322.83 and for value is 266.6217.
- The Standard Deviation for volume is 419.4765 and for value is 103.358.
- R-Squared (R^2) is 0.3341, indicating 33.4% shows moderate explanatory power.
- Correlation (R) is 0.578, 57.8% suggesting a moderate direct relationship.
- Slope (b_1) is 0.1424, meaning a unit increase in volume leads to a 0.1424 increase in value.
- The Shapiro-Wilk p-value of 0.1126 indicates that the data is assumed to be normally distributed.

IT Sector

- For IT Sector Volume and value both is high in 2021 i.e., 5979 and 767.19 (Billion US$),
- For IT Sector Volume is low in 2024 i.e., 3607 and value is low in 2023 i.e., 281.92 (Billion US$).

- The IT sector shows a stronger relationship with an R-squared of 0.5758.

- The minimum volume for IT sector is 2,860 and value is 577.78 and maximum volume is 4,876 and value is 817.96

- The mean for volume is 3,976.67 and for value is 697.4783

- The Standard Deviation for volume is 837.8173 and for value is 104.8421

- R-Squared (R^2) is 0.5758, indicating 57.58% shows a strong relationship.

- Correlation (R) is 0.7588, reflecting 75.88% a strong direct relationship.

- Slope (b_1) is 0.1492, indicating a similar increase in value with an increase in volume.

- The data is assumed to be normally distributed, as indicated by the Shapiro-Wilk p- value of 0.05735.

Energy and Natural Resources Sector

- For Energy and Natural Resources Sector, the value is high in 2019 i.e., 4876 and value is high in 2021 i.e., 817.96 (Billion US$)

- For Energy and Natural Resources Sector, the value and the volume both is low in 2024 i.e., 2860 and 577.78 (Billion US$)

- The Energy & Natural Resources sector demonstrates a robust correlation with an R- squared of 0.5588.

- The minimum volume for Banking and Financial sector is 3,607 and value is 281.92 and maximum volume is 5,979 and value is 767.19

- The mean for volume is 4,810.17 and for value is 493.2517.

- The Standard Deviation for volume is 835.9982 and for value is 164.413.

- R-Squared (R^2) is 0.5588, showing 55.88% a strong relationship.

- Correlation (R) is 0.7475, indicating 74.75% a strong direct relationship.

- Slope (b_1) is 0.09354, suggesting a smaller increase in value compared to other sectors.

- The data is assumed to be normally distributed, as indicated by the Shapiro-Wilk p- value of 0.8338.

4. CONCLUSION

The mergers and acquisitions (M&A) activity that transpired during the preceding financial year has undeniably exerted an influential and transformative impact on the configuration and dynamics of the global business landscape, thereby establishing itself as a pivotal element within the broader economic context. The inherently dynamic and resilient characteristics of M&A activity are profoundly underscored by the observable trends that have emerged and become apparent throughout this particular year, reflecting a robust marketplace. Given the relentless and continual evolution of technological advancements, the ongoing process of economic recovery that is being witnessed, coupled with an abundance of capital that is readily accessible for investment purposes, it appears increasingly probable that M&A activity will not only persist but may also thrive and expand in the foreseeable future. Consequently, it is imperative for corporations and investors alike to remain both agile and vigilant in order to effectively navigate the ever-changing trends and capitalize on the myriad opportunities that exist within the intricate M&A landscape. In light of the current environment characterized by globalization, intense competition, and the rapid pace of technological change, the necessity for swift and strategic transformation has become an essential requirement for the majority of companies seeking to maintain relevance and competitiveness in this complex arena.

The M&A activity that unfolded in the previous financial year has had a profoundly significant impact on the overall structure of the global business landscape. The trends observed this year serve to highlight the resilience inherent in M&A activities, demonstrating their capacity to adapt and thrive even amidst challenging circumstances. The rapid advancements in technology, the global economy's recovery, and the substantial investment capital available indicate that M&A activities are expected to continue growing and developing in the future. It is critical for corporations and investors to remain agile and highly observant of the evolving trends as well as the multitude of opportunities that present themselves within the expansive M&A landscape. Rapid and strategic change has become a fundamental necessity for the majority of companies operating in an era defined by globalization, hyper-competition, and the accelerated pace of technological innovation.

5. SUGGESTION

- This suggests that while volume and value are related, other factors may also play critical roles in determining M&A outcomes.

- As per the latest data of 2024 of Volume, the IT Sector is growing well with 3607 when compared with Banking and Financial services and Energy and Natural resources sector.

- As per the Values of current Year 2024, the Energy and Natural resources sector is high with 577.78 (Billion US$) when compared with Banking and Financial services and IT sector.

- Overall, when we are considering all the sectors it is suggested to go ahead with Energy and Natural Resources as its mean is high when compared with other two sectors.

- Going with Banking and Financial services is not recommended as it is giving less mean when compared with other sectors.

- Based on the data from 2019 to 2024, it has been seen that the volume is showing increase in IT sector when compared with other sectors, so we can suggest that in future too it is going to increase.

- As per the data from 2019 to 2024, it has been seen there is more fluctuations available in Value for all 3 sectors, but we can go ahead with IT and Energy and Natural Resources sector as there is slight changes available when compared with Banking and Financial Resources sector.

- Depending on the Technological, Market, Government policies and other factors there may be changes in the volume and value of the sector, before doing ahead with the M&A deals once we have to check it properly instead of just believing the past/Previous data.

REFERENCES

[1.] Cassiman B, Colombo MG, Garrone P, Veugelers R The effect of M&A on the R&D prepare: an observational investigation of the part of technological-and advertise – relatedness Res Approach. (2005) 34:195–220. doi: 10.1016/j.respol.2005.01.002

[2.] Chen FQ, Ge YH, Liu HQ Abroad M&A integration and mechanical development: a think about based on inner and outside information arrange reconfiguration Innovation Investigation & Key Administration. (2023) 35:573–585.

[3.] David C. Cheng, (2009) "Monetary determinants of Bank Takeovers" Diary of Monetary Financial matters 31, pp. 135-175.

[4.] Enerdata "World Vitality and Climate Measurements – Yearbook 2022" Gotten to October 8, 2022.

[5.] Gupta, A., & Kumar, A. (2017) Affect of Mergers and Acquisitions on Innovation Exchange in the IT Industry: A Case Think about of India Worldwide Diary of Designing Innovation Science and Inquire about, 4 (8), 964-968.

[6.] GurbakshSingh and Sunil gupta (2015), "An affect of merger and securing on efficiency and productivity of solidification keeping money segment in India" Abhinav worldwide month to month alluded diary in merger and innovation, Vol-4

[7.] Parveen Kumari (2014), "Mergers and Acquisitions in Indian Managing an account Division: A Vital Approach" Worldwide Diary of Fund and Administration. ISSN 0975-6477 Volume 6, Number 3 (2014), pp. 217-222

[8.] Prof. Ritesh Patel & Dr. Dharmesh Shah (2016), "Mergers and Acquisitions: A Pre-post Chance – Return Examination for the Indian Managing an account Sector" Diary of Connected Fund & Keeping money Distributer: Scienpress Ltd. Volume Number: Vol. 6 (3) Page Number: 99-113 Distributed Year: 2016 ISSN/ISBN No: 1792-6580

[9.] Reddy, S. S., & Singh, V. (2016) "Mergers and Acquisitions in Indian Vitality Segment: An Observational Investigation" Worldwide Diary of Commerce and Administration Investigate, 2 (5), 35-43.

[10.] Sharma, S., & Jain, V. (2018) "Cross-Sectoral Investigation of Mergers and Acquisitions in India: An Experimental Consider" Worldwide Diary of Administration, IT and Building, 8 (3), 49-66.

[11.] Srivassan, R., Chattopadhyay, G., & Sharma, A. (2009) "Merger and procurement in the Indian managing an account division – Key and money related suggestions" IIMB Administration Review.

[12.] Yang Q, Zhou SN "Can innovation mergers and acquisitions bring innovative advancement impact – the viewpoint of development potential of securing companies" Sci Technol Prog Counter. (2019) 36:100–8. doi: 10.6049/kjjbydc. Q201908468]

[13.] Zhang XY, Liu YY, Rodan, et al "The affect of development capability on the execution of recorded companies in mergers and acquisitions" Blade Resh. (2017) 3:159–75.

[14.] Zhao X "Innovative development and acquisitions" Manag Sci. (2009) 55:1170–83. doi: 10.1287/mnsc.1090.1018

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Optimizing Primary Health Center Resources: An ANOVA Analysis of PHC Distribution at Madhya Pradesh

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ABSTRACT

The Primary health centres are critical component of the This study evaluates the efficiency of supply chain management for essential drugs in Madhya Pradesh, India, by analysing the distribution of Primary Health Centers (PHCs) across districts. Utilizing a one-way ANOVA, the study compares the population per PHC in the top 5 and bottom 5 districts with the highest and lowest number of PHCs, respectively. The findings reveal significant disparities in the distribution of PHCs relative to the rural population, suggesting inefficiencies in healthcare delivery that warrant targeted interventions.

Keywords: Supply Chain Management, Primary Health Centers, ANOVA, Essential Drugs, Healthcare Efficiency, Madhya Pradesh

1. INTRODUCTION

The availability of essential drugs in rural healthcare settings is crucial for effective healthcare delivery. In India, Primary Health Centers (PHCs) serve as the first point of contact for rural populations, making their efficient distribution vital for public health. This study examines the supply chain management of essential drugs in Madhya Pradesh by analyzing the distribution of PHCs in relation to the rural population across districts.

Long before the Declaration of Alma Ata, India adopted a primary health care model based on the principle that inability to pay should not prevent people from accessing health services. Derived from the recommendations of the Health Survey and Development Committee Report (the "Sir Joseph Bhore Committee Report") of 1946, the Indian Government resolved to concentrate services on rural people. With programs such as the national family planning program, launched in 1952, and the policy of one community health worker per 1,000 people in the 1970s, India had already committed to most of the Alma Ata principles when the global primary health care movement began. Right from its inception, this noble mission has been plagued with mismanagement and corruption. The problem here isn't a lack of funds. In fact, nearly three-fourths of the country's health budget goes into addressing PHC through the National Rural Health Mission (NRHM). The country spent close to Rs 21,000 crore in 2012-13 alone.

MP, India is a large relatively socio-economically backward province (60.4 million in 48 administrative districts). Three quarters of the population (73%) is rural and 37.4% live below poverty line. Though the province has some of India's poorest health indicators, there has been a steady improvement in these indicators over the last twenty-five years

Existing research highlights the challenges of drug distribution and other health services in Madhya Pradesh, including logistical inefficiencies, inadequate infrastructure, and uneven resource allocation. Studies have shown that an inequitable distribution of healthcare facilities can lead to disparities in health outcomes. However, there is limited empirical evidence on the effectiveness of supply chain management for essential drugs at the PHC level, particularly in the context of Madhya Pradesh.

2. PROBLEM STATEMENT

Despite the critical role of PHCs in rural healthcare, there is growing concern that the current supply chain management for essential drugs may not be efficient. This inefficiency could lead to uneven access to essential drugs across different districts, particularly in areas with fewer PHCs. This study seeks to assess whether the existing distribution of PHCs meets the needs of the rural population in Madhya Pradesh.

3. RESEARCH OBJECTIVES

- To assess the efficiency of supply chain management for essential drugs at PHCs in Madhya Pradesh.
- To determine whether there is a significant difference in the population per PHC between districts with more and fewer PHCs.
- To identify the need for interventions in the existing drug distribution schemes.

4. RESEARCH HYPOTHESES

- *H01: There is no efficient supply chain management for essential drugs at PHCs in Madhya Pradesh.*

- **H02:** *There is no requirement for interventions in the existing drug distribution schemes of the government.*

5. METHODOLOGY

A one-way ANOVA was conducted to compare the population per PHC across the top 5 and bottom 5 districts in Madhya Pradesh. The analysis focused on the efficiency of service delivery, measured by the population served per PHC. Data was collected from government health reports, and the districts were categorized based on the number of PHCs.

For the ANOVA test:

- **Null Hypothesis (H0):** There is no significant difference in the population per PHC across the districts (i.e., the efficiency of supply chain management is consistent).

- **Alternative Hypothesis (H1):** There is a significant difference in the population per PHC across the districts (i.e., the efficiency of supply chain management varies significantly).

6. DATA RECAP

The top 5 districts with the highest number of PHCs are Chhindwara, Khargone, Dhar, Satna, and Mandsaur, while the bottom 5 districts with the lowest number of PHCs are Harda, Sheopur, Agar, Ashoknagar, and Guna. The population per PHC in these districts was calculated and used for the ANOVA analysis.

TABLE 1 Top 5 Districts with Highest Number of PHCs

District	Rural Population	PHCs	Population per PHC
Chhindwara	1,841,041	64	28,766
Khargone	1,869,494	58	32,224
Dhar	2,124,422	49	43,354
Satna	2,047,315	45	45,496
Mandsaur	1,256,762	40	31,419

TABLE 2 Bottom 5 Districts with Lowest Number of PHCs

District	Rural Population	PHCs	Population per PHC
Harda	520,703	7	74,386
Sheopur	797,568	7	113,938
Agar	522,216	6	87,036
Ashoknagar	832,615	6	138,769
Guna	1,132,484	5	226,497

7. RESULTS

The one-way ANOVA revealed a significant difference in the population per PHC between the top 5 and bottom 5 districts. The F-statistic was 34.27, with a p-value of 0.0005, indicating that the efficiency of supply chain management varies significantly across districts.

Interpretation

- F-statistic: 34.27
- p-value: 0.0005

Since the p-value (0.0005) is less than the significance level (typically 0.05), you would reject the null hypothesis (H01). This suggests that there is a significant difference in the population per PHC between the top 5 and bottom 5 districts, indicating varying levels of efficiency in supply chain management across districts.

8. ANALYSIS

The mean population per PHC was significantly lower in the top 5 districts compared to the bottom 5 districts, suggesting that districts with more PHCs provide better access to healthcare services. This disparity indicates that the current supply chain management for essential drugs is not equally efficient across all districts.

9. DISCUSSION

The findings of this study highlight the need for a more equitable distribution of PHCs in Madhya Pradesh. The significant variation in population per PHC suggests that districts with fewer PHCs are overburdened, leading to potential inefficiencies in healthcare delivery. These results align with existing literature that emphasizes the importance of resource allocation in improving health outcomes. Scarcity of resources for healthcare is a well-acknowledged problem. In this context, efficient utilization of existing financial and human resources becomes crucial for strengthening the healthcare delivery. The assessment of efficiency of health facilities can guide decision makers in ensuring the optimum utilization of available resources. A good practical model has not been developed because of acute shortages of important medical resources. The government of India is now allotting around 26% of the whole health budget for procurement of drugs and consumables which is around Rs. 8580 Cr, which is over the demand, however, this is an astonishing question that also stays before India is why will the shortage still exist? The answer is hidden in these 3 words Convergence, Cross checking and Co-ordination. There is lack of intersectoral coordination, major loopholes and an absence of monitoring mechanisms within the system. This reflects an absolute lack of convergence between all the govt schemes.

10. RECOMMENDATIONS

Based on the ANOVA analysis, the following recommendations are proposed:

Targeted Interventions: The government should consider reallocating resources to districts with fewer PHCs to reduce the population burden per PHC.

Policy Revisions: Existing drug distribution schemes should be reviewed and updated to address the disparities in healthcare access.

11. CONCLUSION

This study provides empirical evidence of the inefficiencies in supply chain management for essential drugs at PHCs in Madhya Pradesh. The significant differences in population per PHC between districts suggest a need for targeted interventions to improve healthcare delivery. Future research should focus on identifying specific factors contributing to these inefficiencies and developing strategies to address them.

12. DECLARATION

I, Akshat Mandloi, hereby confirm that the manuscript titled "Optimizing Primary Health Center Resources: An ANOVA Analysis of PHC Distribution at Madhya Pradesh" authored by Akshat Mandloi, has not been submitted for publication, review, or consideration to any other journal, conference, or publication venue.

I affirm that this work is original and is not under consideration elsewhere. All the authors listed have approved the manuscript and agreed to its submission to " International Management Perspective Conference 2025 (IMPeC-25)".

I/we declare that all necessary permissions have been obtained for any third-party materials included in the manuscript, and appropriate citations and acknowledgments have been made where required.

REFERENCES

[1.] Costa, A. D. (2007). Where is the public health sector?': Public and private sector healthcare provision in Madhya Pradesh, India. Health Policy,Volume 84, Issues 2–3.

[2.] Jat, T. R. (2013). Technical efficiency of public district hospitals in Madhya Pradesh, India: A data envelopment analysis. Global health action.

[3.] Mandloi, A. (2024). Supply Chain Management for India's Health. Journal of Chemical Health Risks, Vol. 14. 2251-6727.

[4.] Samuel, M. V. (Nov. 2014). Tackling Supply Chain Bottlenecks of Essential Drugs in Primary . IOSR Journal of Business and Management (IOSR-JBM) Volume 16, Issue 11.Ver. I.

Transforming Seafood Waste into Gold: Innovative Solutions for Sustainable Aquaculture in India

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ABSTRACT

India's seafood industry is a significant contributor to the economy, supporting millions of fishermen and coastal communities. The country ranks among the top global exporters of seafood, with products such as shrimp, fish, and molluscs being highly sought after. Efforts to improve sustainable fishing practices and enhance the quality of exports continue to bolster the industry's growth and international reputation.

Unfortunately, the Indian seafood processing industry is plagued with several challenges. The most important among them is the significant amount of waste, which poses environmental challenges and economic inefficiencies. However, this waste harbours untapped potential for sustainable aquaculture. This study explores innovative solutions to convert seafood processing discards into valuable resources, thereby transforming a problem into an opportunity for economic gain and environmental stewardship.

Through a detailed analysis of current practices, the research identifies key areas where technological advancements can play a pivotal role. Innovative approaches such as the production of fishmeal and fish oil from processing residues, the utilization of chitin and chitosan from crustacean shells, and the development of biofuels from organic waste are examined. These methods not only provide sustainable alternatives to conventional products but also reduce the environmental footprint of seafood processing activities.

The study emphasizes the importance of a circular economy in the seafood industry, where waste is minimized, and resources are efficiently reused. It highlights successful case studies from India and other countries, showcasing the economic and environmental benefits of valorizing seafood waste. Furthermore, the research delves into policy frameworks and industry collaborations necessary to support these sustainable practices, ensuring they are scalable and financially viable for small and large-scale producers.

To conclude, transforming seafood waste into valuable resources is not only feasible but also imperative for the sustainable growth of India's aquaculture sector. By adopting innovative solutions and fostering a culture of sustainability, the industry can achieve significant advancements in environmental conservation and economic development. This study serves as a comprehensive guide for stakeholders looking to implement sustainable practices and underscores the potential of seafood waste valorization in shaping the future of sustainable aquaculture in India.

Keywords: Sustainable Aquaculture, Waste Valorization, Circular Economy, seafood industry

1. INTRODUCTION

Seafood export industry in India is more than 50 years of age. Indian seafood Industry has made some amazing progress; shipping seafood items to more than 100 countries across the globe. This is all possible due to India's vast sea coast and rich aquatic fish available (Kulkarni, P.2005). Today Indian production lines have developed to have world-class offices, with better quality control; meeting the stringent international standards. Then again, International Seafood trade has been changing throughout the years; last decade had seen huge changes in the 'supply', 'request' and 'International trade norms'; because of the impulses from the importing nations. Globally there is increasing demand for

seafood due to expanded interest on 'diet enhancement' among the customers.

The sector not only supports the livelihoods of millions of fishermen and coastal communities but also contributes significantly to the nation's economy. Different varieties of fish, shrimp, Crabs, and many other varieties of seafood from India is attracting international clients. This is because of their distinctive taste which is not present in several other nations' seafood. This has created a great demand for Indian seafood on the global market which led to a substantial rise in fishing and other ancillary industries. The below picture shows the increase in seafood exports from India.
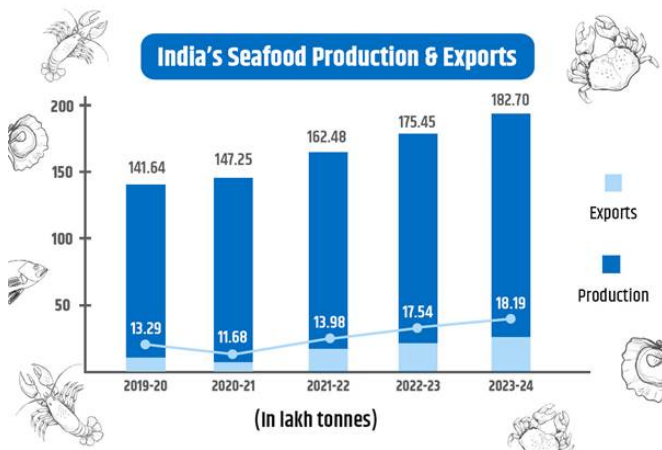
Source: Press Information Bureau-Government of India

Despite these developments, the industry is facing a lot of challenges, in particular about the waste generated. The seafood processing industry generates substantial waste, which poses environmental risks and economic inefficiencies. About 40–60% of the wet weight of raw materials is made up of processing byproducts, which are produced in large quantities by the seafood industry and are unfit for human consumption (García et al., 2005). However, if this waste can be reused or harnessed properly, it can create multiple avenues that are sustainable in nature. However, holds untapped potential that, if harnessed correctly, can lead to sustainable practices with new avenues of income. The potential for using solid waste from the seafood processing industry as feedstock in bio refineries to create chemicals and value-added products including chitin, pigments, proteins, fatty acids, glycerol, and alcohols is enormous (Venugopal, 2021). Recent decades have seen a global increase in efforts to reduce and manage organic waste, motivated by environmental concerns and objectives related to resource conservation and sustainable development (Tun et al., 2018).This study aims to study and explore innovative solutions to transform seafood processing waste into valuable resources, thereby fostering both economic growth and environmental sustainability in the aquaculture sector.

2. REVIEW OF LITERATURE

The industry of managing seafood waste has attracted a lot of attention because of its potential to support both economic growth and sustainable aquaculture. Many studies have investigated different facets of this sector, emphasising the value of creative solutions and frameworks for policy.

P.K. Binsi, (2023) in his study on Overview of Waste Generation in Fish and Shellfish Processing Industry provided a comprehensive overview of waste generation in the fish and shellfish processing industry, highlighting the significant volume of waste generated and the need for effective waste management practices.

C.G. Joshy et al., (2023) in their article on Estimation and Management of Shrimp Processing Waste in Organised Shrimp Processing Sector in India focused on the estimation and management of shrimp processing waste in India, discussing the opportunities and challenges in utilizing shrimp waste to produce valuable by-products such as chitin and chitosan.

Toms C. Joseph et al., (2023) in their study, Fishery Industry Waste: A Resource to Be Valorised has explored the potential of fishery industry waste as a resource, highlighting the various high-value products that can be derived from fish waste and the environmental benefits of efficient waste management.

Farook Abdullah Sultan et al., (2023) in their study "Understanding Fish Waste Management Using Bibliometric Analysis" examined various challenges and opportunities in fish waste management using bibliometric analysis. They have identified key areas for improvement, such as hydroxyapatite production, bio-methane generation, and biomass utilization. The study underscores the importance of addressing supply chain-related issues to enhance waste utilization.

Neeraj Kumar, (2024) in his article explores the adoption of innovative technologies such as Biofloc Technology (BFT) and Recirculating Aquaculture Systems (RAS) in India. These technologies offer advantages such as intensified production, sustainability, and reduced environmental impact. The article emphasizes the role of government support and scientific research in promoting these technologies.

Shahidi, F., &Ambigaipalan, P. (2015) "Utilization of marine by-products for the recovery of value-added products" explores the recovery of high-value products from marine by-products, emphasizing the potential for innovation in seafood waste management.

Ghaly, A. E., Ramakrishnan, V. V., Brooks, M. S., Budge, S. M., & Dave, D. (2013) in their research work titled "Fish processing wastes as a potential source of proteins, amino acids and oils: A critical review." In Journal of Microbial & Biochemical Technology, reviews the potential of fish processing wastes as sources of valuable proteins, amino acids, and oils, highlighting innovative solutions for waste utilization.

Kristinsson, H. G., & Rasco, B.A.(2000), in their study, "Fish protein hydrolysates: Production, biochemical, and functional properties." in Critical Reviews in Food Science and Nutrition, discussed the production and properties of fish protein hydrolysates, focusing on their potential applications and benefits in aquaculture and food industries.

FAO Fisheries and Aquaculture Department (2020). "The State of World Fisheries and Aquaculture 2020: Sustainability in Action." Food and Agriculture Organization

of the United Nations. This report provides a comprehensive overview of the global fisheries and aquaculture sector, with a focus on sustainable practices and innovative solutions for waste management.

Abhilash Sasidharan et al., (2013) in their study utilised face to face survey method through semi structured interview schedule for gathering information regarding the quantity of seafood raw materials procured and the associated waste generation pattern, waste management issues and ultimately the impact excreted by the waste produced to the local community, in India's one of the major seafood processing zone, the Cochin Corporation (CC), in the state of Kerala.

Network for Fish Quality Management and Sustainable Fishing (NETFISH) (2024). "Capacity-Building Programs for Sustainable Fishing Practices." This article discusses NETFISH's initiatives in educating fishers and stakeholders about fish quality management, conservation, and responsible fishing.

Rustad, T., Storrø, I., &Slizyte, R., (2011) in their study "Possibilities for the utilisation of marine by-products." International Journal of Food Science & Technology, has explored various possibilities for utilizing marine by-products, highlighting innovative approaches to waste management and sustainability.

Kobayashi, M., Msangi, et al., (2015) in their article "Fish to 2030: The Role and Opportunity for Aquaculture" in the journal Aquaculture Economics & Management, has underlined the importance of aquaculture in developing the livelihoods of various segments. The study concentrated on different aspects pertaining to both fresh water as well as sea water aquaculture.

Zornu, Tavornpanich, Brun, et al, (2023) in their article mentioned that due to significant pathogen-induced mortalities, aquaculture, which provides half of the world's aquatic protein, faces difficulties in providing a safe and sustainable fish supply.

Mohanty, Biswajit & Swain, Sambid & Hauzoukim, & Swain, Sagarika. (2020). A Review on Fish Processing Wastes Generation in India and Its Further Utilization Prospects into Different Value-Added Compounds, discussed in detail about the waste generated by Seafood units in India and the ways to curtail the waste by utilizing them for sustainability.

National Centre for Sustainable Aquaculture (NaCSA) (2024). "Promoting Good Aquaculture Practices (BMPs) in India." This article highlights the efforts of NaCSA in advocating for Good Aquaculture Practices among farmers, including proper documentation, water quality assurance, and measures against the abuse of banned antibiotics

Bhattacharya et al., (2022), in their research article "Fish processing wastes: Environmental impacts and mitigation

measures" published at Indian J Anim Health (2022), 61(2)-Special Issue: 67-82 mentioned that Bioconversion techniques, assist in recovering important ingredients from by-catch, . and nutrients are converted by these biological processes into useful biodiesel and other important products. They have attributed all these developments to the to the recent advancements in the field of biotechnology.

Little, D. C., Newton, R. W., & Beveridge, **M. C. M. (2016).** "Aquaculture: a rapidly growing and significant source of sustainable food? Status, transitions and potential." Proceedings of the Nutrition Society, 75(3), 274-286. This article discusses the status and potential of aquaculture as part of a broader food landscape, examining its growth, societal impact, and sustainable intensification.

Maulu, S., Hasimuna, O. J., Haambiya, L. H., Monde, C., Musuka, B. P., Phiri, K. J., & Nsekanabo, J. D. (2021). "Climate Change Effects on Aquaculture Production: Sustainability Implications, Mitigation, and Adaptations." Frontiers in Sustainable Food Systems, 5, 609097. This review explores the potential effects of climate change on aquaculture production and its implications for sustainability, including adaptation options and mitigation measures.

Coastal Aquaculture Authority (CAA) (2024). "Regulatory Framework and Certifications for Sustainable Aquaculture in India." This article discusses the strict regulations and certifications in place to ensure sustainable aquaculture practices, including the Coastal Aquaculture Authority license and international certifications such as Best Aquaculture Practices (BAP) and Hazard Analysis Critical Control Point (HACCP).

Obirikorang, K. A., Quagrainie, K., Kassah, J. E., & Von Ahnen, M. (2024). "Editorial: Sustainable aquaculture production for improved food security." Frontiers in Sustainable Food Systems, 8, 1485956. These editorial highlights the role of aquaculture in achieving food security, discussing its potential contributions and challenges in the context of global food demands.

Abentin Estim, Rossita Shapawi, Sitti Raehanah M. Shaleh, Ching Fui-Fui, and Saleem Mustafa (2023). "Transformative Research in Aquaculture for Sustainable Seafood Security." This chapter highlights the significance of research and development for aligning sustainability perspectives with global issues and concerns pertaining to seafood security.

Dauda Abdullateef Ajadi, M.S., Dr. Adenike Susan Tola-Fabunmi, and Dr. Akeem Babatunde (2020). "Waste in Aquaculture: Part 1 - Responsible Seafood Advocate." This article discusses waste production from aquaculture, its sources and components, and management methods for different culture systems.

These studies provide a comprehensive understanding of the challenges and opportunities in seafood waste management

and sustainable aquaculture in India. They underscore the importance of innovative solutions, policy frameworks, and industry collaboration to achieve sustainable development in the seafood industry

3. OBJECTIVES OF THE STUDY

The primary objective of the study is to find out the innovative and sustainable ways of transforming the seafood waste into useful products. Other objectives include:

- To find out the Challenges faced by the seafood processing industry.

- To study the different types of seafood wastage obtained from the processing units.

- To find out solutions in managing and converting the waste obtained into economically and environmentally viable ones.

4. RESEARCH METHODOLOGY

This study has used secondary data from reputable sources such as State Fisheries departments, research papers and from the Statutory body MPEDA (Marine Products Export Development Authority).

5. SCOPE OF THE STUDY:

This study has focused only on the seafood sector and is limited to study the waste obtained from that sector which can be commercialized. This study has not covered the waste obtained from fresh water procure or conditioned aquaculture.

6. LIMITATIONS OF THE STUDY

- Data quality and availability of data on seafood waste and its management practices in India may be limited and inconsistent.

- Different regions in India may have varying practices and levels of efficiency in seafood waste management. This regional variability can make it challenging to generalize findings across the entire country.

- The adoption of innovative technologies for seafood waste management might be limited due to the high costs or lack of technical expertise among various stakeholders. This can affect the feasibility and scalability of proposed solutions.

- Inconsistent or evolving regulatory frameworks can pose challenges for implementing standardized waste management practices and ensuring compliance across the industry.

- Financial constraints faced by small-scale fishers and aquaculture farmers can limit their ability to invest in advanced waste management technologies and practices.

- Socio-cultural attitudes and traditional practices in different coastal communities may affect the acceptance and adoption of new waste management methods.

7. CURRENT CHALLENGES IN THE INDIAN SEAFOOD PROCESSING INDUSTRY

The seafood industry in the Country, India particularly, is grappling with several challenges, waste management probably being one of the biggest. Most of the waste in this industry consists of fish heads, bones, skins, shells, and several other products which are often deposited in landfills or thrown into water bodies, thus polluting those. Such a mode of waste disposal is not only detrimental to the environment but also serves as a pointer to the waste of some useful resources. The following are some of the Challenges faced by the Indian Seafood processing Industry:

Environmental Impact

The management of aquaculture activities is important to avoid pollution of water bodies and mitigate climatic change. Seafood waste decomposes in landfills producing methane – a harmful gas for the climate. Nutrient release through the decomposition of seafood waste also causes eutrophication in bodies of water, creating dead zones that are harmful to marine organisms. There are several concerns regarding land pollution, and also water bodies pollution due to release of harmful organic as well as chemical waste released from these processing units.

Economic Inefficiencies

The other eco-system service value that is lost because of seafood processing has to do with the waste that is produced and left unattended. Most of the times such cost-effective raw materials are left out during production because the producers do not have the means to utilize them effectively, such as fish meal and fish oils, and biopolymers. Poor disposal practices mean there are higher costs of disposal and loss of income that could have been gained from those resources. While in developed countries, the waste has been transformed into useful substances, in India, still it is in the nascent stage.

Technological Gaps

There is a need for advanced technologies and infrastructure to efficiently process and convert seafood waste into valuable products. Many processing plants in India operate with outdated equipment, hindering the industry's ability to implement sustainable practices. The absence of modern waste processing technologies further aggravates environmental and economic issues.

Seafood Waste Composition

| Type of Waste Material | Percentage (Approximate |

	value)
Fish Heads, Bones	30%
Crustacean Shells	20%
Organic Waste	25%
Fish/ Shrimp Skin	15%
Processing Residues	10%

Source: Press Information Bureau-Government of India

Policy and Regulatory Challenges

Even though, the regulatory authorities such as MPEDA (Marine Products Export Development Authority) and state fisheries departments are governing waste management in the seafood industry, it is often fragmented and lacks stringent enforcement. There is a need for comprehensive policies that promote sustainable waste management practices and provide incentives for the adoption of innovative technologies. Moreover, the industry requires better support in terms of infrastructure development and financial assistance to implement sustainable solutions.

8. INNOVATIVE SOLUTIONS FOR SEAFOOD WASTE VALORIZATION

1. Production of Fishmeal and Fish Oil

The most important by-products obtained from fish processing units in India are Fishmeal and fish oil. These by-products are rich in nutrients and are commonly used in animal feed and aquaculture. Technological advancements have made it possible to extract high-quality fishmeal and fish oil from waste, providing a sustainable alternative to traditional sources.

2. Utilization of Chitin and Chitosan from Crustacean Shells

Crustacean shells of crabs and shrimps are a rich source of chitin and chitosan. These natural biopolymers are having several uses in various industries such as biomedicine, textile Table: Sea food wastage types and their utility industry, agriculture, cosmetic, and pharmaceutical industry. The extraction and processing of these biopolymers from seafood waste can create new revenue streams while reducing environmental impact.

TABLE: Sea food wastage types and their utility

Type of Waste	Valorization Technique	End Products
Fish Heads, Bones	Fishmeal and Fish Oil Production	Fishmeal, Fish Oil
Crustacean Shells	Chitin and Chitosan Extraction	Chitin, Chitosan
Organic Waste	Biofuel Production	Biofuels (Biogas, Biodiesel)
Fish Skins,	Collagen Extraction	Collagen for

Type of Waste	Valorization Technique	End Products
Carcasses		Medical and Cosmetic Use
Processing Residues	Aquaculture Feed Production	Fish Feed
Organic Waste	Composting and Organic Fertilizers	Organic Fertilizers

Source: Ministry of Fisheries, Government of India

3. Development of Biofuels from Organic Waste

Sea food processing units produces a variety of organic waste which can be converted into useful biofuels through fermentation process and anaerobic digestion. This will reduce water and land pollution to a greater extent and also these biofuels serve as renewable energy sources, helping to reduce the industry's carbon footprint and provide an alternative to fossil fuels.

4. Biotechnological Conversions

Latest developments in the field of biotechnology offer promising ways to convert the waste obtained from seafood industries into products with high value. Treatments such as Enzymatic method can break down complex organic materials into simpler compounds that can be used in food, pharmaceuticals, and cosmetics industry. For instance, collagen from fish skin has been extracted through various enzymes has many applications in cosmetic as well as pharmaceutical industry.

5. Composting and Organic Fertilizers

High-quality organic fertilisers can be made from the composting of maritime wastage. These fertilizers are rich in nutrients and can enhance soil health, promoting sustainable agriculture. The composting process also reduces the volume of waste, making it easier to manage and dispose of any remaining by-products.

6. Aquaculture Feed

The aquaculture industry will also be benefited by the waste from seafood. The Processed waste can be used as an ingredient in aquaculture feed, in specific fresh water shrimp cultivation. The industry will reduce its dependence on traditional feed sources, which are often expensive and unsustainable, by integrating these by-products into the feed. This will help not only in waste management but also in the growth of the aquaculture industry through cost-effective feed options.

7. Nutraceuticals and functional foods

Nutraceuticals are prepared from seafood waste and are developed food products that have health benefits beyond basic nutrition. Fish protein hydrolysates derived from waste in processing have been found to contain antioxidant and antihypertensive properties. Functional foods can be

developed based on these compounds, which confer health benefits to consumers while creating new market opportunities.

TABLE: Percentage Contribution of sustainable products obtained from seafood waste

Product	Percentage Contribution
Fishmeal and Fish Oil	40%
Chitin and Chitosan	25%
Biofuels	15%
Collagen	10%
Aquaculture Feed	5%
Organic Fertilizers	5%

Source: PIB-Government of India

8. Economic Benefits

The production of fish oil, and many useful products from the marine products waste has created new revenue streams for the seafood industry. The high-quality products are in demand both domestically and internationally, providing a competitive edge to Indian seafood exporters. Additionally, new employment opportunities have been generated in the region, benefiting local communities. Veraval Research Centre of ICAR-CIFT which is located at Gujarat has been working on valorizing fishery industry waste. Their research focuses on converting solid and liquid waste generated during fish processing into high-value products. For example, they have developed methods to produce protein-rich food products from fish carcasses, viscera, and skins. The centre's efforts have led to the reduction of waste disposal issues and the creation of valuable products. Their work has also highlighted the importance of efficient waste management practices in the fish processing industry.

9.Technological advancements

Technological advancements in processing units can benefit various stakeholders of seafood industry. In the port city of Visakhapatnam, Andhra Pradesh state, ICAR-CIFT carries out research and development activities in harvest and post-harvest season of fisheries sector. They have developed technologies to convert fish waste into aqua feed and V-form double slotted otter board for trawling sector. Also, they have standardised a simplified process for the direct conversion of fish market discards into high quality floating or sinking fish feed.

In Norway, the seafood industry has achieved significant success in utilizing fish waste to produce biogas, fishmeal, and other valuable products, demonstrating the potential for similar initiatives in India.

Policy Framework and Industry Collaboration

To support sustainable practices in the seafood industry, a robust policy framework and collaborative efforts between

stakeholders are essential. Government regulations, incentives for sustainable practices, and partnerships between industry players can facilitate the adoption of innovative waste management solutions.

9. SUGGESTIONS

The key suggestions for immediate policy framework which will develop sustainability in aquaculture include:

- Strengthening the national and state fisheries boards.

- Recognising and promoting the industries which promote sustainable practices in disposal of waste materials from seafood.

- Implementing best practices in seafood waste disposal.

- Fostering research and development in the areas of waste management of aquaculture.

- Building capacities at various levels, including Human Resources.

- Creating another statutory body under MPEDA, which concentrates only on seafood waste utilisation for economic growth.

- Improving and supporting supply chain participants for creation of value to all the stakeholders.

- Providing Training and assistance in sustainable practices to small and medium processing units.

10. CONCLUSION

Transforming seafood waste into valuable resources is not only feasible but essential for the sustainable growth of India's aquaculture sector. By adopting innovative solutions and fostering a culture of sustainability, the industry can achieve significant advancements in environmental conservation and economic development. This research highlights the potential of seafood waste valorization and provides a roadmap for stakeholders to implement these practices effectively. We can make seafood waste into valuable products by creating an environment feasible for development.

REFERNCES

[1.] Yadav, M., Goswami, P., Paritosh, K., et al. (2019). Seafood waste: A source for preparation of commercially employable chitin/chitosan materials. Bioresource and Bioprocessing, 6, https://doi.org/10.1186/s40643-019-0243-1

[2.] Puglia, D., Pezzolla, D., Gigliotti, G., Torre, L., Bartucca, M. L., & Del Buono, D. (2021). The opportunity of valorizing agricultural waste, through its conversion into bio-stimulants, biofertilizers, and biopolymers. Sustainability, 13(5), 2710. https://doi.org/10.3390/su13052710

[3.] Venugopal, V. (2021). Valorization of seafood processing discards: Bioconversion and bio-refinery approaches. Frontiers in Sustainable Food Systems, 5, 611835.

https://doi.org/10.3389/fsufs.2021.611835

[4.] Roy, V. C., Islam, M. R., Sadia, S., Yeasmin, M., Park, J.-S., Lee, H.-J., & Chun, B.-S. (2023). Trash to treasure: An up-to-date understanding of the valorization of seafood by-products, targeting the major bioactive compounds. Marine Drugs, 21(9), 485. https://doi.org/10.3390/md21090485

[5.] Lal, J., Deb, S., Singh, S. K., Biswas, P., Debbarma, R., Yadav, N. K., Debbarma, S., Vaishnav, A., Meena, D. K., Waikhom, G., & Patel, A. B. (2023). Diverse uses of valuable seafood processing industry waste for sustainability: A review. Environmental Science and Pollution Research, 30(1), 123-135. https://doi.org/10.1007/s11356-023-28890-2

[6.] Guerard, J., Bhaskar, S., Suresh, K., & Prabhu, S. (2011). Sustainable valorization of seafood processing by-product/discard. In Nutraceuticals and Bioactive Compounds from Seafood Processing Waste*(pp. 123-135). Springer. https://doi.org/10.1007/978-981-10-7431-8_7

[7.] MDPI. (2024). Valorization of seafood waste for food packaging development. Foods, 13(13), 2122. https://doi.org/10.3390/foods13132122

[8.] Sultan,F. A., Routroy,S., & Thakur, M. (2023). Understanding fish waste management using bibliometric analysis:A supply chain perspective.Waste Management & Research, 41(3), 531-553. https://doi.org/10.1177/0734242X221122556

[9.] Department of Animal Husbandry, Dairying & Fisheries (DAHDF). (2008–2009). The Department of Animal Husbandry, Dairying & Fisheries, Government of India annual report. (Accessed September 2009). http://dahd.nic.in/annualreport2008-09/Book%201-100.pdf

[10.] Yang, Y., Gu, X., Tan, R., Hu, W., Wang, X., Zhang, P., & Zhang, T. (2004). Fabrication and properties of a porous chitin/chitosan conduit for nerve regeneration. Biotechnology Letters, 26(22), 1793-1797.

[11.] Kobayashi, M., Msangi, S., Batka, M., Vannuccini, S., Dey, M. M., & Anderson, J. L. (2015).Fish to 2030:The role and opportunity for aquaculture. Aquaculture Economics & Management, 19*(3), 282–300. https://doi.org/10.1080/13657305.2015.99424

[12.] Chakrabarti, P. P., Chakrabarty, N. M., & Mondal, S. C. (2009). Breeding and seed production of butter catfish, Ompok pabda (Siluridae) at Kalyani Centre of CIFA, India. Aquaculture Asia, 14, 33-35.

[13.] Central Institute of Freshwater Aquaculture. (2004). CIFA technologies. Bhubaneswar, Odisha, India: Author.

[14.] Department of Animal Husbandry, Dairying and Fisheries. (2017). Annual report 2016-17. Ministry of Agriculture, Government of India.

[15.] Das Mahapatra, K., Jayasankar, P., Saha, J. N., Murmu, K., Rasal, A. R., Nandanpawar, P., Patnaik, M., Sundaray, J. K., & Sahoo, P. K. (2016). "Jayanti" rohu: Glimpses from the journey of first genetically improved fish in India. Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar.

[16.] Kumar, K., Kumar, R., Mohanty, U. L., Saurabh, S., Sahoo, M., Mohanty, A. K., Sahu, A. K., Jena, J. K., & Jayasankar, P. (2012). Climbing perch, Anabas testudineus: Consumers' delicacy. Fishing Chimes, 32(6), 40-43.

[17.] Roy, A. K. (2015). Public private partnership and aquaculture. In Sinha, V. R. P., Keshavanath, P., Sharma, A. P., & Mohanty, B. P. (Eds.), Public private partnerships in aquaculture (pp. 17-31). Narendra Publishing House.

[18.] Sugiyama, S., Staples, D., & Funge-Smith, S. (2004). Contribution of fisheries and aquaculture in the Asia-Pacific. In Status and potential of fisheries and aquaculture in Asia and the Pacific. RAP Publication-2004/25. FAO Corporate Document Repository, FAO.

[19.] Ngasotter, S., Panda, S. P., Mohanty, U., Akter, S., Mukherjee, S., Waikhom, D., & Devi, L. S. (2020). Current Scenario of Fisheries and Aquaculture in India with Special Reference to Odisha: A Review on its Status, Issues and Prospects for Sustainable Development. International Journal of Bio-Resource and Stress Management, 11(Aug, 4), 370–380.

[20.] Bhatta, R. (2003). Socio-economic issues in the fisheries sector in India. In Anjani, K., Pradeep, K. K., & Joshi, P. K. (Eds.), A profile of people, technologies and policies in fisheries sector in India (pp. 17–42).

[21.] Rao, G. R. M., & Ravichandran, P. (2001). Sustainable brackishwater aquaculture. In Pandian, T. J. (Ed.), Sustainable Indian fisheries (pp. 134–151). National Academy of Agricultural Science.

[22.] ICAR-ICLARM Project. (2004). Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poor households in India.

[23.] Srinivasagam, S., Kathirvel, M., & Kulasekarapandian, S. (2000). Captive brood stock development, induced breeding and larval stages of mud crab (Scylla spp.). Central Institute of Brackishwater Aquaculture (CIBA), Bulletin, 12, 1–26.

[24.] Sarangi, N., Kumaraiah, P., Rangarcharyulu, P.V. & Giri, B.S. (2004) Status of Freshwater Aquaculture in Krishna-Godavari Delta: A Profile. Regional Research Centre, Central Institute of Freshwater Aqua culture, Vijayawada, Andhra Pradesh.

[25.] Krishnan, M. T., Ravishankar, P. S. P., Vimala Gupta, D. D., & Gopinathan, K. (1995). The economics of production of brackish water aquaculture in Krishna District of Andhra Pradesh. Seafood Export Journal, 26(8), 19–26.

[26.] Katiha, P. K., & Bhatta, R. C. (2002). Production and consumption of aquacultural products in India: Past trends, present status and future prospects. Presented at special session on strategies and options for sustainable aquacultural development at World Aquaculture 2002, Beijing, China, April 23-27, 2002.

[27.] Narsale, S. A., Prakash , P., Mohale, H. P., Baraiya , R., Sheikh , S., Kirtikumar , P. B., Mansukhbhai, C. R., Kadam , R. V., & Tekam, I. (2024). Precision Aquaculture: A Way Forward for Sustainable Agriculture. Journal of Experimental Agriculture International, 46(5), 83–97. https://doi.org/10.9734/jeai/2024/v46i52360

[28.] Department of Fisheries, Government of India. (2023). Handbook on fisheries statistics 2023. New Delhi: Department of Fisheries, Government of India.

[29.] Dinesh, R., & Durai, V. (2021). An outlook on Indian shrimp feed industry and manufacturers. Feed Additives: International Magazine for Animal Feed & Additives Industry, December 2021(Issue 11), 72–77.

[30.] Food and Agribusiness Strategic Advisory and Research Team (FASAR). (2015). Indian feed industry: revitalizing nutritional security (p. 7). Gurgaon, India: YES Bank.

[31.] Kim, S.-K., & Mendis, E. (2006). Bioactive compounds from marine processing byproducts – a review. Food Research International, 39, 383–393.

[32.] Shahidi, F. (1994a). Proteins from seafood processing discards. In Z. E. Sikorski, B. S. Pan, & F. Shahidi (Eds.), Seafood Proteins (pp. 171–193). New York: Chapman and Hall.

[33.] Rustad, T., Storrø, I., & Slizyte, R. (2011). Possibilities for the utilisation of marine by-products. International Journal of Food Science & Technology, 46(10), 2001-2014.

[34.] Arana, I. (Ed.). (2012). Physical properties of foods: Novel measurement techniques and applications. CRC Press.

[35.] Bhaskar, N., Benila, T., Radha, C., & Lalitha, R. G. (2008). Optimization of enzymatic hydrolysis of viscera proteins of Catla (Catla catla) for preparing protein hydrolysate using a commercial protease. Bioresource Technology, 99(10), 4105-4111.

[36.] Folke, C., Kautsky, N., Berg, H., Jansson, A., & Troell, M. (1998). The ecological footprint concept for sustainable seafood production: a review. Ecological Applications, 8(1, Supplement), S63-S71.

[37.] Nellemann, C., MacDevette, M., Manders, T., Eickhout, B., Svihus, B., Prins, A. G., & Kaltenborn, B. P. (2009). The environmental food crisis – the environment's role in averting future food crises. A UNEP rapid response assessment. United Nations Environment Program. GRID-Arendal. http://www.unep.org/pdf/FoodCrisis_lores.pdf

[38.] Jayathilakan, K., Sultana, K., Radhakrishna, K., & et al. (2012). Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review. Journal of Food Science and Technology, 49(3), 278-293.

[39.] Kandra, P., Challa, M. M., & Kalangi Padma Jyothi, H. (2012). Efficient use of shrimp waste: Present and future trends. Applied Microbiology and Biotechnology, 93(1), 17–29.

[40.] Demirbas, A. (2011). Waste management, waste resource facilities and waste conversion processes. Energy Conversion and Management, 52, 1280–1287.

[41.] Wiriyaphan, C., Chitsomboon, B., & Yongsawadigul, J. (2012). Antioxidant activity of protein hydrolysates derived from threadfin bream surimi byproducts. Food Chemistry, 132, 104–111.

[42.] Cadavid-Rodríguez, L. S., Vargas-Muñoz, M. A., & Plácido, J. (2019). Biomethane from fish waste as a source of renewable energy for artisanal fishing communities. Sustainable Energy Technologies and Assessments, 34, 110–115.

[43.] Mo, W. Y., Man, Y. B., & Wong, M. H. (2018). Use of food waste, fish waste and food processing waste for China's aquaculture industry: Needs and challenge. Science of the Total Environment, 613–614, 635–643.

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Provisioning a Better Health Care Services to Ensure an Improved Quality of Life for the Community-A Case of OPGC's CSR Intervention, Odisha, India

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ABSTRACT

This study was carried out in the peripheral areas of OPGC to assess the communities' level of satisfaction of health interventions provided by the organization as part of its CSR programme. The organization spends 5% of its CSR expenditure towards provisioning of primary health care facilities to the community members. Along with that, the organization has ensured drinking water facilities and introduced School health and hygiene programme in the peripheral areas. The availability of such facilities addresses the health care needs of all groups of people. The community members have expressed their satisfaction over immediate accessibility of primary healthcare facilities.

Keywords: CSR, Healthcare, Quality of Life

1. INTRODUCTION

Health and Wellness are two important indicators of Human Development Index. A country is well thought-out to be as progressive when the health parameters are gaining significance in country's financial budget. There must be considerable investment in creation of infrastructure facilities and better means to reach out to the people for provisioning of better health care services. Consequently, the improved health care services enhance the health indicators of the country like reducing infant and maternal mortality rate, increase in life expectancy rate. In view of that, majority of the country spend a significant percentage of budget towards providing better health and its related services to its people. It is increasingly realized that health issues is highly correlated with the productivity of an individual. Keeping it in consideration, all the countries have prioritized the health care programmes and are primarily funded from Government budget. Nevertheless, it is found from the report of Human Development Index (HDI) that provisioning of better health services and increase in wellness of people are its two important pillars, hence, countries like Norway, Switzerland, Australia are topped the chart of HDI.

In India, the health care programmes are mostly delivered by two mainstream agencies, i.e., Government and Private Sectors. Govt. has allocated fund from its budgetary provision towards creation of health infrastructure facilities and extending support for better delivery of health care programmes at the downstream level with the objective of every member must be accessible to the benefit of the programme. However, various reports indicate that government budgets have not kept pace with population growth. Combined with the rapidly increasing demand for healthcare, this has resulted in unequal access to healthcare across the country, leaving many diseases unaddressed. Further, the health care programme with the private sector is accessible to a certain sections of the society as the availability of facility incurs cost. The health care programme in private sector is limited in major cities, functions with the concept of generating profit and mostly operated by the Corporate Companies. Hence, the purpose of accessing the health benefit to the last man of the society would not be served with the private sector. Moreover, international aid and charitable organizations are involved, but their funding falls short of meeting the needs of a country with 1.35 billion people — two-thirds of whom live in rural areas where access to medical care and the ability to afford services are limited. It is increasingly realized that the inaccessibility of health care programme is posing a challenge for the holistic growth of the society. The success of a country's economy is largely dependent upon healthy workforce and community. India, however, lacks the financial resources needed to strengthen its inadequate healthcare infrastructure and enhance its health outcomes.

TABLE-1: Government Spending on Health

Annual Plan Period	1966-1969	1979-1980	1990-1992	1992–1997	2002–2007	2007-2012
GDP allocation to healthcare (%)	2.1%	1.8%	1.6%	1.7%	0.9%	Less than 1%

Source- Sigamani (2007)

From the above mentioned table it is observed that for the period of three different annual plan periods, the Govt. of India had allocated proportion of financial resources to healthcare from GDP. It is significant to point out that there is an undesirable decline in the allotment of funds in the health sector from 1966 to 1992 regardless of growing population, mounting global load of ailments, monetary challenges and better permanence of life. Moreover, government spending on health significantly declined from 2.1% to less than 1% during the Eleventh Plan (2007-2012), reflecting the state's withdrawal and lack of commitment to prioritizing health as a fundamental human right. With high out-of-pocket expenses and the unchecked expansion of the private healthcare sector, disparities arise in the distribution and accessibility of health services among stakeholders across townships, districts, states, and the central level.

Status of Health Infrastructure in Odisha

When evaluating the health status of Odisha, one of the biggest challenges is the structural deficiency in infrastructure and human resources in the health sector, particularly in underdeveloped districts and rural areas. The health infrastructure and the communication network in tribal dominated areas are in shambles. More than 85 percent of households in the state depend on Public Health System, as private hospitals are inadequate and accessible in major urban areas. Tertiary care facilities are meager and distantly located making it difficult to deliver the critical need based services required by the people at scale and value. The information mentioned in the below table depicts the picture of health infrastructure in Odisha.

TABLE-2: Health Infrastructure in Odisha

Health Infrastructures	Numbers
Sub-Centres	6,688
Sub-Centres in Tribal Areas (Rural)	2,998
Primary Health Centres	1,275
Primary Health Centres in Tribal Areas (Rural)	449
Community Health Centres	376
Community Health Centres in Tribal Areas	112
Sub-Divisional Hospitals (SDH)	33
District Hospitals	32
Medical Colleges and Hospitals	7
Infectious Disease Hospitals	5
Other Hospitals	54

(Source: Annual Report2017-18 7 Outcome Budget 2016-17, Health and Family Welfare Department, Government of Odisha, link: http//www.desorissa.nic.in/pdf/odisha-profile-2018.pdf)

The existence of above mentioned health infrastructures are not able to cater the health needs of Odisha with a population of 419,74 lakh (as per 2011 census) and is the eleventh biggest state in India in terms of population. In consideration of availing the primary health care facility to all targeted population, it would become an uphill task for the Government. Hence, to plug off the gap, the corporate sector must be stepped in to access the better health care facilities to the population in the areas where they are functioning.

Need of Social Responsiveness of Corporate towards Health Care Sector

In this context, our only dependency upon Govt. fund availability and support may not bring any attainment in sustainability of the programme and increase in growth rate. In order to make it a realization, the business and corporate houses must take an active role and have the responsibility to give it back to the society. Such social responsiveness of business houses and corporation may enhance the longevity of business and create an atmosphere of trust among the stakeholders of organization. Many business houses and Corporate have initiated sector based social development programs. The program strategies aimed at promoting social welfare, protecting the environment, and upholding human rights highlight the growing global importance and impact of corporate social responsibility (CSR). For instance, the recent United Nations (UN) Global Compact on Corporate Sustainability seeks to align the goals of the business sector with those of the global community, fostering innovative policies to harness and amplify the momentum of CSR. The CSR funds can be utilized for research and development process in the terms of persuading innovation in healthcare and medical devices for a better delivery of healthcare in a manageable and cost-effective way. Many companies have actively engaged in healthcare-related CSR initiatives, such as organizing eye check-ups, health camps, and establishing health centers. Funds can be utilized to support the healthcare system in two key ways: strategic partnerships can enhance diagnosis, treatment, and patient care, while community programs can promote healthier lifestyles, reducing the need for doctor and hospital visits. Nevertheless, from the empirical analysis of execution of CSR programmes of the corporate organization, it is established that most of such activities are restricted to its peripheral area of operations. For example, SACHI (Save a Child's Heart Initiative), the charitable initiative of Apollo Hospitals Enterprise Ltd. aims at providing paediatric cardiac care and financial support to the children belongs to underprivileged families suffering from heart disease. The facilities are available in its hospitals where they are located. However, the group's reach in rural areas is limited. Since the corporate organization is spending average 2% of net profit and accentuate upon local demands, hence, the allocated CSR funds cannot be able to bridge the existing gap of demand and supply in the healthcare sector or it cannot serve to large chunk of the population of the country.

Apart from various prospective and consequences of CSR programme, a rational CSR strategy based on integrity, sound values and a long-term approach helps in making a positive contribution to the society. While designing the CSR initiative, the corporate organization has to recognize the needs of people of peripheral areas, increase their involvement in the programme and converge with the Govt. programme for wider coverage and tangible impact on the lives of target beneficiaries.

Population Health: The Next Cutting Edge of CSR

Over the past few years, the taxonomy of CSR has changed incessantly. Keeping in pace with the Globalization, there is significant evolution of the programme and has broadly categorized into four distinct phases. Borrowing from the analysis of Professor Wayne Visser of the University of Cambridge, in the beginning, the nature of CSR practices of business houses were self-protective. The programme was undertaken chiefly to fulfill legal necessities and to evade fines and penalties from regulatory authorities. Subsequently, CSR efforts were evolved and focusing upon on philanthropy and marketing aspects.

Here the business houses emphasized upon specific social and environmental motives or endorsed the CSR activities which shall responsible for enhancing their brand image and standing in society. Afterward, business houses takes up more strategic role for CSR to serve the society. Here the prominence was given upon creating business and societal value through the use of company's core business and

existing management systems. In its fourth and latest phase, it is realized by the business houses that the biggest challenges for development of society is to address the root causes of problems. Hence, CSR is being harnessed to generate new innovations and systemic solutions. This most recent phase presents a prospect for companies to elevate the subject of population health as the next frontier of CSR. This phase performs the link between health and the wider ecosystem of social and ecological challenges, from maintaining healthy, productive natural systems to achieve equitable prosperity and economic advancement. These external features persuade and make available the source for human health and growth is too deeply entwined to be dealt independently.

With the growing emphasis on wellness, preventive care, and the critical connections between health and key social and environmental challenges, companies have the opportunity to drive meaningful global change.

They can address health and wellness issues directly through their products, services, operations, and partnerships while also focusing on the broader ecosystem of social and environmental factors affecting public health. CSR teams within companies are well-equipped to support these efforts. Their expertise helps advance progress on social and environmental issues that impact business performance and enables them to approach challenges and solutions holistically, recognizing them as interconnected parts of a larger system.

TABLE 3: The Four Phases of CSR and Health and Wellness

Phase-I	Defensive	Compliance with legal necessities or avoid fines and penalties (e.g., occupational health and safety compliance)
Phase-II	Charitable / Promotional	Company's brand image or reputation can be increased through contribution towards specific health-related causes or promoting health-related CSR activities
Phase-III	Strategic	Generating business value and improving health outcomes through the use of company's core business and existing management systems
Phase-IV	Systemic:	New innovations and systemic solutions are generated to address population health directly and/or the key social and environmental determinants of health

(Source: Visser, Wayne, "The Age of Responsibility: CSR 2.0 and the New DNA of Business," Journal of Business Systems, Governance, and Ethics, November 2010, Volume 5, Issue 3)

The CSR programme is the medium through which the company wins the conviction of stakeholders. It assists the company towards its standing in the market. In view of that, the programme should be deliberated with the concerns of the people and put into practice in a planned manner. The strategic implementation with the help of the target

population brings systematic changes in the intervention areas and lives of people. The process of participation enhances the awareness level, increases the sense of ownership among the beneficiaries, notable changes in socio-economic status of the target population and the programme is strode towards sustainability.

Considering the above aspect, the conceptual framework of the research has elucidated that company must embark upon such health activities under CSR programme which shall

reduce the negative health and wellness impact in the peripheral areas and increases the productive capacity of the individual.
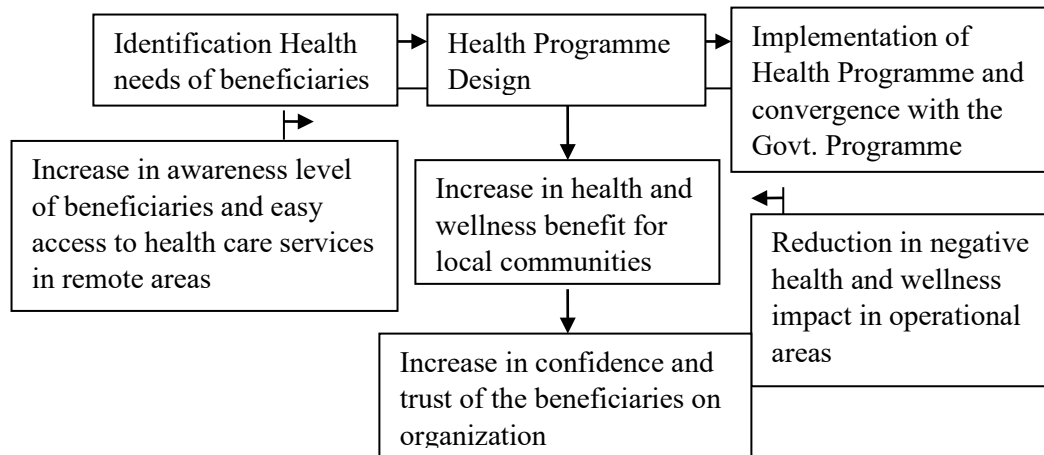

Fig. 1.: The conceptual framework of research

(Source-The Research Model conceptualized by the Authors)

This theoretical diagram illustrates the process and impact of a health intervention program designed for beneficiaries, particularly in remote or underserved areas. Here's a detailed justification for each component and the flow between them:

Identification of Health Needs of Beneficiaries

Understanding the specific health requirements of the target population is a fundamental first step. This ensures the health intervention program is tailored to actual needs. Without accurately identifying needs, any intervention may fail to address core issues or be ineffective.

Health Programme Design

Based on the identified needs, a structured health program is designed. A well-designed program provides a blueprint for achieving health outcomes, ensuring resources are appropriately allocated and goals are clear.

Implementation of Health Programme and Convergence with the Govt. Programme

Executing the designed program and aligning it with government initiatives ensures broader support and resource sharing. Integrating with governmental programs leverages existing infrastructure, avoids duplication, and enhances efficiency.

Outcomes and Impacts

The following outcomes stem from the program's implementation: Increase in awareness level of beneficiaries and easy access to health care services in remote areas

Education and improved access empower beneficiaries, particularly in remote regions, to utilize health services effectively.

Increase in health and wellness benefit for local communities Improved access and awareness lead to tangible health benefits for the community, enhancing overall wellness. Reduction in negative health and wellness impact in operational areas. Effective health programs mitigate health risks and reduce the incidence of negative outcomes, which benefits both the community and operational efficiency (e.g., in workplaces or project areas).

Increased confidence and trust of beneficiaries in the organization

Successfully addressing health needs increases beneficiaries' trust in the organization or agency providing these services. This trust is critical for long-term engagement and cooperation. This diagram shows a logical progression from needs assessment to design, implementation, and ultimately to positive outcomes for the community. The feedback loop (from increased health benefits to trust in the organization) reinforces the sustainability and effectiveness of the program. This structured approach ensures a well-rounded intervention, addressing both immediate health concerns and long-term community confidence.

Review of Prior Studies on Intervention of CSR Programme in Health Activities

Majority of the corporate organization design thematic based CSR programme and execute it in its peripheral areas.

Accordingly, Health Care has been identified as one of the thematic area, which has to be implemented along with other thematic areas like education, rural development and livelihood generation related activities. The corporate organization takes up activities in general to access basic health facilities to the communities in peripheral areas are organizing health camps, provision of infrastructural and equipment support, maternal and child health, availability of drinking water and sanitation facilities and geriatric care.

Considering all literatures related to responsible behavior of corporate organization in addressing the health needs of the people, typical representatives are:

Definitions and Conceptualization of CSR

Hopkins (2007) describes CSR as being concerned with treating stakeholders ethically or responsibly. Richa Gautam and Anju Singh (2010) endorsed the necessitate for CSR activities by quoting "Business houses all over the world are realizing their stake in the society and engaging in various social and environmental activities in relationship with its different stakeholders so that CSR can be best implemented towards its goals – sustained environmental, social and economic growth. The need of the hour is to formulate effective strategic policies and adopt various instruments according to the company history, its content, peculiarity". Bhattacharya, Korschun and Sen (2008) opines that Corporate social responsibility (CSR) is currently a crucial element of the exchange of ideas between companies and their stakeholders and continues to garner attention atop the corporate agenda. Porter and Kramer (2006) stated that in a strategically designed corporate social responsibility (CSR) activities, the business house applies its considerable resources, expertise and insight to the process, which facilitates in bringing significant changes in socio-economic progress of the society. Further, the survey shows that business houses should operate in a way which shall have a secured and long-term economic performance instead of accepting short-term behavior that is socially detrimental or environmentally wasteful.

CSR and Governmental Collaboration

Nishandar (2015) opined that it becomes impossible for the Government to take part in all social concerned related activities. Hence, it is imperative for the corporate houses to step in and take up more philanthropic activities, which shall improve the health of the society

Policy and Strategic CSR Execution

Maon et al. (2009) proposed an integrative structure of corporate social responsibility plan and its execution. The structure incorporates nine steps: increasing awareness on CSR within the organization, assessing rationality of corporate in a societal context, establishing a working explanation and vision for CSR, appraising current CSR status, developing an integrated CSR strategic plan, executing the CSR incorporated strategic plan, preserving internal and external communication, evaluating CSR related strategies and communication and institutionalizing CSR policy.

CSR and Health Impact

Cronje, Reyneke & Van Wyk (2013) pointed out two factors, i.e., "social and natural" while working with some local communities in South Africa. These two factors to be taken into consideration while assessing the health impacts of mining on communities. The social factors include poverty, unemployment, poor housing and infrastructure, and prostitution, which may lead to the following health impacts: sexually transmitted infections, unwanted pregnancies, malnutrition and mental illness (Cronje et al., 2013). The natural factors include dust and other harmful particles in the air and water, excessive noise from blasting and other mining operations, overcrowded and unhygienic living conditions. Under this factor the health impacts include tuberculosis, silicosis, hearing problem and eye problems (Cronje et al., 2013). Hence, accountability from corporate house has to be indispensable to make certain that mining operations are appropriately appraised with the purpose of ensuring both economic progress and welfare of local communities (Cronje et al., 2013). Agarwal (2011) and Narayan and Singh (2014) highlight the pressure on health infrastructure due to migration of industrial workers, leading to neglected maternal and child health.

Reliance Power has carried out a large number of initiatives such as facility centres, mobile vans offering specialized medical care and free health checkups catering to ophthalmology, gynecological and corrective surgery needs (Maan, 2014). Such accomplishments are of great implication for India since findings revealed death of more than one lakh mothers as calculated to one death in every five minutes, 5.1 million HIV/AIDS inflicted persons, 25 million cardiovascular diseases, 25 million individuals affected by diabetes, 2.4 million suffering with cancer (Kurkure 2005; Ramani & Mavalankar, 2006).

Rai and Bansal (2014) have compared the CSR funding on health among three different sectors, i.e., banking and financial, pharmaceutical and automobile manufacturing sector. It was found that banking and financial sector invested less than half funds on health in comparison to pharmaceutical industries. However, the automobile industry spends 10% more fund on health in comparison to pharmacy industry. It is significant to note that the nature of industry, products and services and the overall advertising policy of the firm influence the share of funds in a specific category, targeting specific communities and people.

CSR Communication and Reporting

Chapple and Moon (2005) compared the reporting of CSR Web Sites of seven Asian countries. It was observed that the reporting is not homogeneous and varies among countries.

The concept of CSR is still in its emerging state in India and the companies involved in it need to be converged stated by Chaudhri and Wang (2007),

Research by Hanke and Stark (2009) put together a conceptual framework as a basis to develop a company's CSR strategy. This paper provides the measures and instruments to make multifarious CSR practices convenient and more noticeable. The conceptual framework splits the processes into two factors: legitimation and sense making/sense giving in the one dimension and the organizational system is separated from the organizational environment in another dimension. It also recommended that conceptual framework facilitates the process to recognize whether the engagement is more driven by legitimating or by sense making.

CSR in Organizational Governance

According to Blomback and Wigren (2009) corporate social responsibility as a part of the industrial sociology shall help the researcher in identification and studying of various issues related to the governance functioning of the organizations. Pederson (2009) developed a model which derives the perception of the managers about the responsibilities of business towards society. Lather (2007) and Paul Hill (2007). A paradigm shift is required in corporate responsibility towards society opined by Sachs et al. (2005).

According to John Simmons (2008) in a globalized business environment, it is imperative for the business house to upkeep the concept of the responsible organization and ethical business conduct. The focus of the study is to operationalize corporate social responsibility in the milieu of employee governance with a purpose to assess critically the principles of "mainstream" human resource management (HRM) and to proposition a substitute stakeholder systems model of human resource management.

Study by Chaudhri and Wang (2007) examined CSR communication undertaken by the top 100 information technology (IT) companies of India in their corporate Websites. The report contains an investigative focus on various dimensions like prominence of communication, extent of information and style of presentation. The findings designate that number of companies with CSR information on their Website is noticeably low. Moreover, these leading companies do not influence the Websites to their benefit in terms of the quantity and style of CSR communication. It also seems that IT companies in India are lagging behind in creative and efficient CSR communication on their Websites. Similarly in consideration of accessibility of poor health facilities is due to migration of industrial workers, who are generally semi-skilled and unskilled laborers from poorly developed towns into urbanized cities and metros acting as "industrial magnets". Such movement has put tremendous pressure on the existing health infrastructure of India. It also questions the intention of the state and central government in

the promised vision of expanding health systems. The result is neglected communities, improper attention to maternal health (Agarwal, 2011) and child health (Narayan & Singh, 2014).

In addition, there is considerable disparity between the approved and accessible facility pertaining to the availability of human resources and funds allocated for the intention of growth of health industry in India. Examples are seen from the commercial market where leading brands like Johnson & Johnson in conjunction with Coca Cola's sub-group called RED to fight HIV/AIDS epidemic. For this purpose the company has donated half of its profits to the cause (Chattu, 2015). While execution, it was realized in the corporate that there is need of sensitizing society in the process of developing drugs and treatments against the virus (Khanna, 2006). For instance,

2. LITERATURE COMMENT

By reviewing literatures, it is observed that former studies are focusing upon designing a framework for implementation of CSR activities in the peripheral areas of business organizations and evaluation of such activities to facilitate the norms set as per the Company Act. Most of the studies discussed that a directionless CSR programme is implemented which fails to yield any result neither on the lives of the people nor any contribution to economic development. Nevertheless, in a globalized business environment and rapid changing business scenario, where prominence is given upon pursuing ethical business and it is needed for all the companies to take up strategic community development activities, which shall address the bigger purpose of the holistic development of the society. The strategic CSR programme with the community member's participation make them empowered, ensures sustained growth and bringing changes in their lives. The processes create a favourable opinion for the business organization in the society.

Meanwhile, for the sake of deep researches on the role of corporate organization in providing improved health facilities and addressing the health issues of the community through CSR programme, it is to be discussed the role of one public sector manufacturing organization in assessing and accessing the health intervention and overall effectiveness of the programme. It is to mention here that the effectiveness of CSR programme is dependent upon earnestness of the governing body members in implementing the programme, incessant monitoring at the governing body level towards proper utilization of allocated fund for the programme, prioritizing the need and implementing the programme in convergence with the Govt. programme for a bigger impact in the intervention area. The programme has to serve varying needs of the community and to increase their trust towards the organization. Therefore, this research paper focuses upon studying the tangible and intangible impact of different

health initiatives initiated under the CSR programme of a public sector undertaking company in its peripheral area.

Keeping this in view, the present study was conducted with the following objectives:

- To find out different programme initiated by the case organization to address the needs of beneficiaries on health and wellness programme.

- To find out the effect of health and wellness programme of the case organization upon the beneficiaries.

3. METHODOLOGY

This study is based on the case approach and a qualitative one. This study has described the health initiative under CSR programmes of one public sector company, i.e., Odisha Power Generation Corporation (OPGC) located in Jharsuguda district, western part of Odisha, India. The main purpose of the study is to present an analysis of the fund allocation of the case organization from the year 2014 to 2019 in regard to execution of health activities under CSR programme and intended to measure the opinion of the beneficiaries regarding the effectiveness of these activities. In this regard, the secondary information of the public sector organization was collected from the published CSR reports and annual reports of the companies from the year 2014 to 2019. Supplement to it, for the purpose of measuring the opinion of the people regarding preventive health measures initiated by the company and its impact on lives of the beneficiaries, 130 numbers of beneficiaries were selected on a simple random basis from 10 peripheral villages of the case organization. The interview schedule was designed on the issues like types of health activities for different target group, infrastructure initiated and accessibility of facilities to the target beneficiaries etc.. Primary information was collected from the beneficiaries and analyzed.

4. RESULTS AND ANALYSIS

OPGC has been involved in initiating CSR activities since 1990. Subsequent to the several amendments in Company Act and emphasis is set upon initiating strategic CSR; the Governing Body of the OPGC has changed its modus operandi in execution of CSR. The company has constituted the CSR Committee comprising of Managing Director; 2) Director (Finance); and 3) Director (Operations) and initiated the activities in a structured manner from 2014-15 in 50 villages of Lakhanpur Block, Jharsuguda district, Odisha. All CSR interventions of the Company are aligned with the activities specified in Schedule VII of the Companies Act, 2013. As per CSR Policy of OPGC and keeping in view the needs of the local community, the priority areas are identified. The company has tied-up with the specialized agencies for focused approach and best outcomes. The company has categorized its CSR initiatives into the following domains: Education, Livelihoods & Skills Development, Preventive Health, Water, Sanitation and Hygiene, Rural Sports Training for Youth and School Children, and Community Infrastructure Projects for Rural Development.

Health Initiatives under CSR Programme

In the year 1993, OPGC started providing health service to the communities of peripheral areas through its well-equipped hospital located at plant site township campus, Banharpali, Jharsuguda District. The hospital provides services to approximately 50,000 people in a year in the form of free-of-cost consultation, laboratory testing and indoor patient facilities. Besides that the company conducts annually six numbers of community based health camps for women, elderly, children and other sections of the society and addresses approximately 8,000-10,000 persons at Panchayat Level. Correspondingly to prevent from spreading of mosquito borne diseases activity like anti-malaria fogging is covered annually in twenty five numbers of villages. The company regularly conduct awareness programme on prevention of malnutrition among children, expectant mothers adolescent girls and HIV/AIDS in forty villages of six Gram Panchayats of Lakhanpur block. During this awareness programme, the participation of members of Women SHGs, Anganwadi Worker and ASHAs, PRI is encouraged. The company is increasingly realized that devoid of accessing of pure drinking water to the community, the aim of maintaining health and wellness cannot be achieved. Considering the circumstances and the problems faced by the people in accessing pure drinking water, the company provides fixed-line water supply to forty villages of peripheral areas.

School health education programme

The company has initiated the WASH project in schools and involves the school children and teachers to convey the message of 'Promotion of Good Health and Hygiene' in community through rallies, Poster and Drawing Competition, Slogan -writing, debate, etc.

TABLE 4: Total Outlay for the CSR Activity and especially for health and wellness programme

Period (2014-15 to 2022-23)	Company Contribution
Health Programmes (Community Based Health Camps; Mosquito Borne Disease Prevention; Malnutrition Prevention; HIV/AIDS Prevention)	Rs. 52.93 Lakhs (5% of total CSR Expenses)
Drinking Water	2014-15 to 2018-19: Rs. 122.14 Lakhs(11% of total CSR Expenses)
WASH	2015-16 to 2022-23: Rs. 280 Lakhs (Community Contribution)-Rs. 38.77 Lakhs

(Source: Annual Report of OPGC)

Each successive year the organization sanctions CSR budget to spend on different CSR activities. Out of it, 5% of the CSR budget has been allocated for addressing the health components in peripheral villages. In this context, opinions of the beneficiaries regarding the effectiveness of the health programme have taken into consideration and its analyses have been presented in subsequent sections.

Analyzing the Impact of Health Activities on lives of Beneficiaries

TABLE 5: Demographic Profile of the respondents

Gender	Nos. of Respondents	Age Group	Nos. of Respondents	Qualification	Nos. of Respondents	Occupation	Nos. of Respondents
Male	86(66%)	Below 18	13(10%)	Below 10th	7 (5%)	Labourer	9 (7%)
		18-35	27(21%)	10th	29(22%)	Agriculture	31 (24%)
		36-53	22(17%)	10+2	38(29%)	Self-employed	23 (18%)
		54-70	19(14%)	Graduate	11 (8%)	Unemployed	6 (5%)
		71 and above	5(4%)	Post Graduate	1 (1%)	Private Job	17 (13%)
Female	44(34%)	Below 18	19(14%)	Below 10th	26 (20%)	Labourer	7 (5%)
		18-35	17(13%)	10th	13 (10%)	Agriculture	29 (22%)
		36-53	6(5%)	10+2	5 (4%)	Self-employed	8 (6%)
		54-70	2(2%)	Graduate	-	Unemployed	-
		71 and above	-	Post Graduate	-	Private Job	-
Total	130(100%)		130(100%)		130(100%)		130(100%)

Source- Primary Data

To assess the impact of health initiatives of the company on lives of the beneficiaries in the peripheral villages, 130 numbers of beneficiaries belongs to 130 households were interviewed. The demographic details of the beneficiaries are given above, who have given their opinion on provision of health services by the company, accessing of health facilities, increase in awareness of the villager on health issues etc. The satisfaction level of the respondents has been ascertained by tracing their agreement level in a 5-point Likert Scale in which 1 is denoted for Strongly Disagreed, 2 is denoted for Disagreed, 3 is denoted for Undecided, 4 is denoted for Agreed and 5 is denoted for Strongly Agreed. For this purpose, seven statements have been given to the respondents to rate on the basis of their agreement.

Statements
1. Villagers access to free medical treatment properly from the Hospital when they visit
2. Provision of health services of company treats all health related problems of peripheral villages
3. Frequency of the visit of the Medical Staff for treatment of health related problems of the peripheral villages
4. Referral services for critical health problem are substantially reduced.
5. Health awareness camps are conducted in the villages at normal period
6. Provision of Health Services has reasonable reduced the health expenses of the villagers.
7. Provision of health services of company has impacted in increasing the competence of villagers in the shape of performance in income, investments and happiness

From these above mentioned statements, the first six statements are considered as constant variables, whereas the last statement is considered as dependent variable. The health services provided by company have made the lives of the villagers more productive and helped them in the form of performance in earnings, savings and cheerfulness.

It is inferred that the respondents who have agreed or strongly agreed to the statements mentioned above have definitely experienced the provision of primary health services by the Company is addressing the day to day health related problems of the people. However, respondents' disagreement or strongly disagreement to the statements does not denote that the provision of rural health facilities have no consequence on the living and health condition.

TABLE 6: ANOVA on impact of health services on way of living of respondents

Model	Sum of Squares	df	Mean Square	F	Significance
Regression	119. 279	8	14.90	56.1	.002
Residual	76.658	122	.628		
Total	195.937	130			

(Source: SPSS output from Primary Data)

Health and well being is considered as an imperative factor in improvement of the socio-economic status of the population. Better health condition improves the productivity level and facilitates the family for more saving. From the above table it is observed that the significant level (p-value) is less than the 'α' value (The level of significance is 5%, i.e., α = 0.05). Since p = 0.000 is less than α = 0.05, hence, it

is assumed that health services made available by the power generation company have made community members lives more proficient in the form of performance in income, investments and happiness.

TABLE 7: ANOVA on impact of health services on different Age group of respondents

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	14.069	4	3.517	1.95	.049
Within Groups	227.871	126	1.808		
Total	241.94	130			

(Source: SPSS output from Primary Data)

One-Way ANOVA is applied to determine the relation between accessing health services of Power Generation Corporation by different age-group respondents of peripheral areas and its affect reflected upon the efficiency of any family in the form of performance in earnings, savings and cheerfulness. For the purpose, the respondents studied have been segregated into five categories; a) below 18yrs b) 18 – 35 years c) 36 – 53 years d) 54 – 70 and e) 71 and above.

These age-groups are denoted respectively as 0, 1, 2, 3 and 4 for the purpose of statistical analysis in the study. The available health facilities enhances the comfort of people are considered as the dependent variable. It is observed from the above mentioned table that the 'p' value is less than the 'α' value. In fact, since p = 0.049 is lesser than α = 0.05, hence, the age-group significantly impacts in appropriating and getting benefitted from the health related facilities provided by the power generation company leading to the efficiency of any family in the form of performance in earnings, savings and cheerfulness.

TABLE 8: ANOVA on impact of health services on different Educational Level of respondents

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	14.069	4	3.517	1.95	.049
Within Groups	227.871	126	1.808		
Total	241.94	130			

(Source: SPSS output from Primary Data)

From the above table, it is observed that the application of one-way ANOVA is applied to determine the educational qualification has significant impact on appropriating and getting benefitted from the health services provided by the organization, leading to improvement in the performance concerning earnings, savings and cheerfulness. In this regard, the educational qualification of the respondents studied has

been segregated into five categories; a) below 10th b) 10th c) 10 + 2 d) Graduate and e) Post-graduates. These qualifications are denoted respectively as 0, 1, 2, 3 and 4 for the purpose of statistical analysis. Provisioning of the health facilities to the community members to lead a better life is considered as the dependent variable. The level of significance is 5%, i.e., α = 0.05 (on the basis of existing researches of similar type). The table reveals that 'p' value is less than the 'α' value. In fact, since p = 0.003 is lesser than α = 0.05. Hence, it is accepted and established that provisioning of health related services by the Company significantly varies with the varied educational qualification of the villagers. The programme has been benefitting the community members in improving the efficiency in the form of performance of villagers in earnings, savings and cheerfulness.

TABLE 9: Expectation of Beneficiary on provisioning of health services by the organization

Preferences of Beneficiary	N=130 (Frequency with %)
Referral Services	42
Provisioning of life saving medicines along with Generic medicines	4
Geriatric Care	2
ICU facility, Secondary Health Care & Surgical Services	36
Accessibility to Advanced Diagnostic Centre	8
Dental Care	1
Physiotherapy Care	1
Vaccination Availability	6
Total	100%

(Note-The number in parenthesis denotes the percentage)

The company as a part of its responsible corporate affairs to the society is accessing its health services to the community members. The targeted beneficiaries have expressed their satisfaction over the provision of health services.

However, the beneficiaries have preferred to access secondary and tertiary health services along with the primary health services provided by the company. In their expectation, the referral services and access to ICU facility and different surgical services should be provided by the company have received highest priority followed by availing vaccination facilities.

5. CRITICAL ANALYSIS OF THE PROGRAMME

- Community members reside near the peripheral areas of the Company avails the health facilities. The direct

expenditure on health programme is 5% of the total CSR fund allocation by the organization.

- Although the OPGC provides health promotion and disease prevention interventions for community members, but, the expectation level is provisioning of modern health facilities.

6. CONCLUSION

Different social classes of people exist in society. Hence, the benefits of growth in business/ industry shall necessarily reach all sections of the population in the society. Instead, the class of people sufferings from the discrimination shall voice their resentment against the very existence of such businesses. CSR should mean sharing the prosperity with the entire community at large. In this context, addressing the health needs becomes one of the important indicators for the prosperity of the community for those organization involved in execution of strategic CSR programme. At the present time, healthcare system in India is frail and crippled due to low government spending on health and for the general, it is high out of pocket expenditure. Nonetheless, the new Companies Act 2013 has brought an agenda for the corporate houses .in India to be involved in diverse social initiatives with the exclusive intention of improving the health, vitality and well-being of deprived and backward communities, who are in pressing need of medical support.

Challenges and Recommendation

1. Only focusing upon primary health care

2. Critical illness is never addressed.

3. The company addresses the 11 thematic issues mentioned in schedule -7 of section135. Hence, the allocation from CSR Fund for thematic areas like health is getting substantially reduced.

4. The company does the job of providing services to the people. The R&D is focused upon increasing productivity of the company. Whereas the company is not focusing upon or not providing any fund for eradicating any diseases from the area.

5. The companies are providing the health facilities to the people residing in its peripheral areas. However, the services are not accessible by the people of remote areas, where it is needed most..

6. Out of the 2% of average net profit, when the companies are addressing 11 thematic areas of the CSR programme, the allocation for health is limited. In the time of disaster or national calamity, on the Govt. Direction, the total CSR fund is diverted. Hence, the priorities towards addressing health issues remain unattended.

7. The Company's CSR department should intensify various health initiatives in close alignment with the Govt. health machineries for a better accessing of health care facilities to the people of nearby villages. However, it is observed that the Govt. machineries become silent in CSR operational areas of the company.

DECLARATION

This manuscript is an original academic work by authors and it has not been submitted elsewhere for publication. Authors declare that, all the ethical standards applicable for this Journal have been complied.

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REFERENCES

[1.] Agarwal S. (2011), The state of urban health in India; comparing the poorest quartile to the rest of the urban population in selected states and cities, *Environment & Urbanization*, 23(1), 13–28.

[2.] Bhattacharya, C.B., Korschun, D. and Sen, S. (2008), Strengthening stakeholder–company relationships through mutually beneficial corporate social responsibility initiatives", *Journal of Business* Ethics, 85 (2), 257-272.

[3.] Blomback, A. and C. Wigren, (2009), 'Challenging the importance of size as determinant for CSR activities', *International Journal of Management of Environment Quality*, 20(3), 255-270.

[4.] Chapple and Moon (2005), Corporate Social Responsibility (CSR) in Asia A Seven-Country Study of CSR Web Site Reporting, *Business & Society*, 44(4), 415-441.

[5.] Chattu, V.K. (2015), Corporate social responsibility in public health: A case study on HIV/AIDS epidemic by Johnson & Johnson Company in Africa, *Journal of Natural Science, Biology and Medicine*, 6(1), 219-223.

[6.] Chaudhri and Wang, (2007), Communicating Corporate Social Responsibility on the Internet A Case Study of the Top 100 Information Technology Companies in India, *Management Communication Quarterly*, 21(2), 232-247.

[7.] Gautam, R. and Singh, A. (2010), Corporate Social Responsibility Practices in India: A Study of Top 500 Companies; *Global Business and Management Research,* 2(1), 41-56.

[8.] Govt. of Odisha, Health and Family Welfare Department (2020, March 13), Notification No.7662/H, Retrieved from https:/health,odisha.gov.in/pdf/7662.PDF

[9.] Hanke, T. and Stark,W.(2009), Strategy Development: Conceptual Framework on Corporate Social Responsibility, *Journal of Business Ethics*, 85 (2), 507-516.

[10.]Hopkins, M. (2007), Corporate Social Responsibility: Is business the solution?, Earthscan, London.

[11.]Simons, J., (2008), 'CSR and management: Ethics and morality in human resource management', *Journal of Social Responsibility*, 4 (1), 8-23.

[12.]Kurkure A. (2005). Onco Care Systems in India, Oncology Tomorrow, Pre-Conference Event, 92nd Indian Science Congress, Ahmedabad, January 3-7.

[13.]Lather, A.S., (2007), 'The case of multinational corporations: Their Corporate Social Responsibility in India and back home', *Journal of Management & IT*, 5(3): 48-64.

[14.]Maon, F., A. Lindgreen and V. Swaen, (2009),'Designing and implementing Corporate Social. Responsibility: An integrative framework grounded in theory and practice', *Journal of Business Ethics*, 3(2), 71-89.

[15.]Maan P. (2014), CSR- Key issues and challenges in India. *International Journal of Science, Environment and Technology*, 3(6):2038-2045.

[16.]Narayan R, Singh A. (2014). Impact of migration on child health in urban India: Evidence from NFHS-3, *PeerJ PrePrints*, doi http://dx.doi.org/10.7287/peerj.preprints.202v1.

[17.]Nishandar, V.V. (2015), "Corporate social responsibility - the way ahead", *The Business & Management Review*, 5(4),1-12.

[18.]Paul Hill, R. and T. Ainscough, T. Shank and D. Manullang, (2007), Corporate Social Responsibility and Socially Responsible Investing: A Global Perspective, *Journal of Business Ethics*, 70 (1) 165-174.

[19.]Porter. M. and Kramer, M (2006), Strategy and Society: The Link between Competitive Advantage and Corporate Social Responsibility, *Harvard Business Review*, 84(12),78-92.

[20.]Rai S, Bansal S. (2014), An analysis of corporate social responsibility expenditure in India, *Economic and Political Weekly*, 49(50), 877-894.

[21.]Ramani KV, Mavalankar D.(2006). Health System in India: Opportunities and Challenges for Improvement, *Journal of Health Organization and Management, 20(6,:560-72.*

[22.]Sachs, S. and E.R. Hli and V. Mittnacht, (2005), Strategy- A CSR framework due to multiculturalism: the Swiss Re case, *Corporate Governance*, 5(3): 52-60.

[23.]Sigamani P. (2007). Relevance of Public Sector Reforms in Healthcare Services- A Case of India, *Journal of Health & Development*, 3 (3&4): 49-56.

[24.]Visser, Wayne(2010), The Age of Responsibility: CSR 2.0 and the New DNA of Business, *Journal of Business Systems, Governance, and Ethics*, 5(3), 121-138

[25.]Rai, S. and Bansal, S. (2015), Factors Explaining Corporate Social Responsibility Expenditure in India, *Review of Market Integration*, 7(1), 1–25.

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