

# IITM Journal of Business Studies(JBS)

**“A UGC CARE Approved Journal”**

Annual Journal of Institute of Innovation in Technology & Management

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# CHATGPT'S POTENTIAL IN ACADEMIA AND BEYOND: AN EMPIRICAL EXAMINATION

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## ABSTRACT

This paper presents a thorough investigation into the multifaceted impact of ChatGPT on academia and research, with emphasis on revolutionizing these domains through the integration of AI models. The primary objective is to develop a comprehensive survey instrument to capture various parameters and nuances associated with the influence of ChatGPT. The study engages in a thorough exploration of participants' perspectives, examining factors such as perceived usefulness, willingness to explore innovative applications, and beliefs about the potential role of AI models in shaping academic research and publication. Ethical considerations, bias mitigation strategies, and user satisfaction are also integral components of the study.

Methodologically, the research employs Principal Component Analysis (PCA) as the primary statistical tool to unravel latent factors of the phenomena. Primary data collected through carefully drafted survey questionnaire intends to capture the nuances of AI's potential impact on the academic writing by analysing diverse perceptions of academics and researchers.

As AI technologies drive a paradigm shift in academia, this study sheds light on ChatGPT's potential to revolutionize traditional practices. The findings are expected to significantly contribute to the discourse on AI's role in academia, offering insights into the challenges, prospects, and ethical considerations involved. This research provides a timely exploration into AI's transformative potential, paving the way for informed and responsible embracing in academic and research endeavors.

**Keywords:** *ChatGPT, Academia, Research Impact, AI Integration, Survey Instrument*

## INTRODUCTION

The AI-based chatbot known as ChatGPT (Chat Generative Pre-trained Transformer) was introduced on November 30, 2022, by OpenAI as a prototype. It swiftly gained media attention for its thorough and articulate responses to inquiries covering wide range of technical and professional knowledge domains (GPT, 2022). A natural language processing (NLP) system powered by artificial intelligence (AI) called ChatGPT is competent at simulating

human-like dialogue with the user. This virtual assistant makes it possible to respond to questions and support tasks like writing emails, essays, and software code (Ortiz, 2022). It creates literary content that bears an uncanny resemblance to human-generated writing by exploring through enormous databases, at times challenging our very perceptions of machine capabilities (Brown et al., 2020). Such a tool has the promise to revolutionise academics. It can speed up procedures like literature surveys, suggest areas for future research based on the body of prevailing knowledge, and even help with the creation of strong academic arguments (Wang et al., 2021). Additionally, it acts as a democratising force in education, advancing teachers in settings with low resources and giving them real-time feedback. (Zhang et al., 2022). A paradigm change in human-machine interaction, its effects are deemed outside of academia in areas including journalism, content development, customer relations, and more (Smith & Anderson, 2022). The importance of attention mechanisms in NLP, which serve as the basis for models like ChatGPT, was highlighted by Vaswani et al. (2017). According to Chen et al. (2020), the model has the potential to bypass linguistic barriers by delivering translations and interpretations. Looking ahead, it is crucial to manage the ethical issues and difficulties presented by such technology, making sure that it enhances rather than replaces human talents (Bostrom & Yudkowsky, 2014; O'Neil, 2016).

This paper delves into the transformative impact of ChatGPT on academia and research, unveiling its multifaceted impact on conventional practices. With a particular attention on the integration of AI models, our exploration aims to provide a nuanced understanding of the evolving

dynamics and implications for academics and researchers.

The primary objective of this paper was construction of a sophisticated survey instrument which is meticulously designed to capture diverse parameters associated with the potential of ChatGPT for academics. This questionnaire seeks to unravel the intricate layers of impact, including participants' perceptions of ChatGPT's usefulness, their willingness to explore innovative applications, and their beliefs regarding the future role of AI in academic research and publication.

In conclusion, this research aspires to make a substantial contribution to the field of AI in education. It achieves this by comprehensively reviewing existing literature, shedding light on responsible and ethical implications, offering strategies to address challenges, and emphasizing the critical role of educators. In due course, this study aims to inform future research endeavours and contribute valuable insights to the policymaking process in the rapidly evolving landscape of Artificial intelligence.

## LITERATURE REVIEW

### **Applications in Academic and Research Settings Ethical Consideration**

According to Keiper(2023) operating ChatGPT has many advantages for both faculty and students, particularly for text-based tasks. AI can be used to analyze enormous amounts of data, identify patterns, and generate hypotheses (Azzani & Moore, 2019). This can assist researchers to make new discoveries and develop new theories (Amodei & Hernandez,

2022). AI can also be used to personalize learning experiences, providing students with direction and feedback that is tailored to their individual needs (Hefferman et al., 2019). AI can enable automation of several tasks that are currently done manually by academics, such as grading papers, scheduling appointments, and managing research data (Bost, 2016). This can unblock academics to focus on more creative and high-value activities, such as research and teaching (Davenport & Kim, 2017).

ChatGPT can also help students learn new languages and improve their writing skills by providing real-time feedback on grammar, syntax, and vocabulary, enhancing their fluency and accuracy (Cunha & Rezende, 2023; Pérez-Martí & Moreno-Sánchez, 2023). ChatGPT can enhance accessibility of education to students with disabilities by providing alternative communication and learning methods, such as text-to-speech and speech-to-text technology, allowing them to participate more fully in the classroom (García-Holgado et al., 2023; Isbell et al., 2013).

### **Possible Threats Around Chatgpt**

The current buzz surrounding Generative AI (GAI), propelled into the spotlight since November 2022 with the advent of ChatGPT by OpenAI, posits itself as a landmark development with substantial impacts evident in both industry (Chui et al., 2022; McKinsey, 2023) and academia (Stokel-Walker & Noorden, 2023). This technology holds the potential to reshape the employment landscape, posing a threat to certain roles while integrating GAI into others (Pringle, 2023b).

Notwithstanding recognized shortcomings, including lapses in judgment leading to the disclosure of confidential company information (Winder, 2023) and instances of impolite responses (Pringle, 2023a), the momentum behind this trend appears relentless. Notably, recent discussions even broached the question of whether AI could be recognized as an inventor on a patent, a notion debunked by Morales (2022).

The evolution and degeneration of human nature have been pushed to a deeper and more fundamental level by the creation of generative artificial intelligence, such as ChatGPT. As a result, the problem is not with how human nature has evolved and degenerated, but rather with how this evolution and degeneration might be permanently controlled ( Juan Dempere, Kennedy Modugu, 2023).

AI chatbots like ChatGPT have raised issues in schooling since their 2022 launch. Although there are dangers that students' ability to think independently and express themselves in language may suffer, eliminating the technology from educational institutions shouldn't be the solution (Dwivedi et al., 2023). With AI-driven chatbots like ChatGPT, teachers and professors are concerned about possible academic fraud (Meckler and Verma, 2022). The range of ChatGPT's expertise includes anything from helping with academic research to polishing learners' literary compositions (Roose, 2022; Shankland, 2022). However, students might utilize softwares or tools like ChatGPT to speed up essay writing, potentially hindering the development of essential skills making them dependent upon technology a bit too much(Shrivastava, 2022). Coursera CEO Jeff

Maggioncalda suggests that the introduction of ChatGPT will significantly impact all forms of written assessments in schools, as many students will rely on AI to prepare their assignments. This will make it challenging for teachers to evaluate them, as nearly everyone will submit near-perfect work (Alrawi, 2023). ChatGPT can be a helpful tool if utilised morally, but there are concerns that it could lead to plagiarism and make academics and students dependant on this technology (Fawaz Ali Ahmed, 2023). In order to help researchers and publishers reduce the percentage of unethical works, like plagiarism, the authors (Qasem, 2023) explored future concerns and assurances regarding the nature of ChatGPT-3 use in the fields of scientific research and academic works and assignments.

In conclusion, rigorous scholarly research is imperative to thoroughly comprehend the potential of ChatGPT within the realm of academia and research. Existing studies have revealed significant benefits, such as enhanced productivity, innovative pedagogical approaches, and streamlined data analysis processes. However, these studies also underscore serious challenges, including ethical dilemmas, potential biases, and issues of reliability. Building upon this existing body of research, we can conduct a systematic evaluation of the multifaceted impacts of ChatGPT's integration into academic environments. Our attempt at designing a survey instrument to explore the various dimensions of ChatGPT's impact on academia will aid future researchers in conducting further experiments and extending the phenomenon further by providing analytical findings.

## RESEARCH METHODOLOGY AND DATA COLLECTION

### Design of Survey Instrument

The survey instrument was precisely crafted to encompass a broad spectrum of perspectives related to the impact of ChatGPT on academia. It included five-point Likert scale statements addressing specific latent constructs and other closed-ended questions covering various facets of ChatGPT's influence, such as perceived usefulness, willingness to explore innovative applications, beliefs about AI's future role, ethical considerations, bias mitigation, user satisfaction, user-friendliness, and long-term potential. The table 1 containing the scale items of the constructs identified in this study is given below for reference of future researchers.

### Sample and Data Collection

The population for this study is primarily undergraduate and masters students who are well versed with technology and use AI tools for their academic assignments. A diverse and representative sample of 230 undergraduate and masters research students from various academic backgrounds were recruited to participate in the survey using convenience sampling. Respondent diversity in terms of gender, course and streams will allow generalizability of the study's findings to the broader academic community. The survey was administered electronically with clear instructions to standardize responses. Anonymization measures were implemented to safeguard respondent confidentiality, thereby enhancing the accuracy and reliability of the collected data.

**Table 1: Scale items used to measure latent constructs**

SL.No.	Latent Variable	Scale items
1	Potential Impact of ChatGPT on Academics	Overall usefulness, exploring innovative uses of ChatGPT, AI models- future of Academics, Influence on academic publishing, Potential to improve academic writing, Continue using ChatGpt for academics
2	User Experience and	quality of responses generated by ChatGPT for academic or research tasks, user-friendliness and ease of interaction
3	Ethical Considerations	Guidelines for ethical use, potential impact of AI models on traditional research methods
4	Addressing Potential Bias in Responses	Potential of bias and misinformation, bias can be easily recognised

### Analysis Tool

Factor analysis is considered a robust analytical tool to identify latent constructs. Considering, the study of AI tools on academia is exploratory stage, Factor analysis is deemed suited to elucidate the latent constructs associated with ChatGPT's potential utility in scholarly and research contexts. Principal Component Analysis (PCA) with Varimax rotation was used as the primary extraction method for analyzing the data. The validity and reliability of the factor analysis were examined using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. In addition, internal consistency measures, such as Cronbach's alpha, were computed for each factor to ensure the validity and reliability of the identified factors.

### Ethical Considerations

The study adhered to rigorous ethical guidelines, obtaining informed consent from all participants and ensuring the confidentiality of their responses. Data was anonymised throughout analysis and reporting to safeguard participant identities and other sensitive information.

## RESULTS

### Factorability and Suitability for Factor Analysis

The KMO measure measures the sampling adequacy for the variables included in the analysis. It ranges from 0 to 1, with higher values indicating better suitability for using factor analysis. Bartlett's Test examines whether or not the correlation matrix is an identity matrix, which would mean that variables are unrelated. A significant result ( $p\text{-value} < 0.05$ ) indicates that there are significant relationships between at least some of the variables, justifying the use of factor analysis. The data appears to be suitable for factor analysis, as indicated by the KMO value of 0.766. Bartlett's Test suggests (See Table 2) that there are significant relationships between at least some of the variables, providing further justification for proceeding with factor analysis.

Initially, an evaluation of the factorability of the 12 ACS items was undertaken, employing various well-established criteria for assessing correlation factorability. Primarily, it was noted that a significant number of items demonstrated correlations of at least 0.3 with at least one

other item, indicating a reasonable degree of factorability. Additionally, the Kaiser-Meyer-Olkin measure of sampling adequacy exceeded the commonly recommended threshold at 0.766, surpassing the value of 0.6. Furthermore, Bartlett's test of sphericity yielded a significant result ( $\chi^2 (66) = 346.125, p < .000$ ), affirming the suitability of the data for factor analysis. The diagonals of the anti-image correlation matrix consistently registered values exceeding 0.5. Lastly, the communalities for all items were above 0.3, providing further confirmation that each item shared common variance with others. Given these comprehensive indicators, the appropriateness of factor analysis for all 12 items was established.

The calculated Cronbach alpha exceeded the threshold of 0.7, indicating strong internal consistency. Additionally, the item-total correlation for each factor individually surpassed 0.45, further affirming the robustness of the factors. Subsequent separate factor analyses conducted on each factor illustrated their unidimensional nature, as evidenced by a single factor reported in the rotated component matrix with eigenvalues exceeding 1. The Kaiser-Meyer-Olkin (KMO) measure for each factor also surpassed 0.7, providing additional evidence of the factors' reliability and validity.

With these compelling statistics confirming the consistency and accuracy of the factors, we proceeded to analyze the rotated component matrix (Table 3)

### Factors Unveiled in the Analysis

The subsequent factor analysis (Table 3 and 4) unveiled four distinct factors, collectively elucidating 60.40% of the variance in the phenomenon of the 'Future of Academia in ChatGPT.' The primary factor extracted, as discerned from the rotation matrix, is termed "Potential Impact of ChatGPT on Academics," explaining 24.3% of the variance. This is succeeded by "User Experience," elucidating 12.32% of the variance, followed by "Ethical Considerations in Using ChatGPT," explaining 11.906% of the variance, and "Potential Bias in Responding," accounting for 11.809% of the variance in the overall impacts and influences of AI-based models in academia and research. These factors collectively provide a nuanced understanding of the diverse dimensions and considerations surrounding the integration of AI models, particularly ChatGPT, in academic and research environments.

**Table 2: Reliability and Validity**

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.766
Bartlett's Test of Sphericity	Approx. Chi-Square	346.125
	df	66
	Sig.	0.000

**Table 3: Rotated Component Matrix**

	Component			
	1	2	3	4
How would you rate the overall usefulness of ChatGPT in your academic or research work (if applicable)?	0.712			
How likely are you to explore innovative uses of ChatGPT in your academic or research work as its capabilities continue to evolve?	0.657			
Do you believe that AI models like ChatGPT will play a more prominent role in shaping the future of academic research and publication?	0.716			
To what extent do you believe ChatGPT and similar AI models will influence academic publishing, particularly in terms of generating research summaries, abstracts, and even full papers?	0.577			
Do you believe there should be guidelines or ethical considerations in place when using AI models like ChatGPT for academic or research work?			0.755	
In your experience, have you or others encountered issues related to bias or misinformation when using ChatGPT for academic or research work?				-0.824
How confident are you in your ability to recognize and mitigate potential biases in AI-generated content produced by ChatGPT for academic purposes?				0.774
please rate your overall satisfaction with the quality of responses generated by ChatGPT for academic or research tasks.		0.821		
How would you rate the user-friendliness and ease of interaction with ChatGPT for your academic or research needs?		0.844		
Do you believe that ChatGPT has the potential to improve the quality of academic and research outputs in the long term?	0.713			
How likely are you to continue using ChatGPT for academic or research work in the future?	0.719			
Are you concerned about the potential impact of AI models like ChatGPT on traditional research and educational practices?			0.771	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 5 iterations.				

## DISCUSSION

The factor analysis elucidated four key factors, collectively explaining a substantial portion (60.40%) of the variance in the

'Future of Academia in ChatGPT.' The first factor, "Potential Impact of ChatGPT on Academics," emerges as a pivotal dimension, capturing 24.3% of the variance within

**Table 4: Variances explained**

Total Variance Explained									
Component	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	3.372	28.099	28.099	3.372	28.099	28.099	2.924	24.363	24.363
2	1.530	12.747	40.845	1.530	12.747	40.845	1.479	12.325	36.688
3	1.289	10.744	51.589	1.289	10.744	51.589	1.429	11.906	48.594
4	1.058	8.814	60.403	1.058	8.814	60.403	1.417	11.809	60.403
5	0.922	7.686	68.089						
6	0.767	6.396	74.485						
7	0.602	5.015	79.499						
8	0.589	4.912	84.411						
9	0.529	4.405	88.816						
10	0.484	4.030	92.847						
11	0.434	3.613	96.460						
12	0.425	3.540	100.000						
Extraction Method: Principal Component Analysis.									

the overarching theme of the 'Future of Academia in ChatGPT.' This factor signifies a collective perception among respondents that ChatGPT holds significant transformative potential within academic settings. It implies a recognition of ChatGPT as a catalyst for innovation, capable of reshaping traditional educational paradigms. In practical terms, this suggests that respondents foresee ChatGPT influencing various aspects of academia, from content creation and curriculum development to scholarly communication and research methodologies. The factor also prompts reflection about the adaptation required

within educational institutions to effectively incorporate and harness the capabilities of ChatGPT. Furthermore, it sets the stage for a nuanced exploration of the challenges and opportunities associated with the integration of AI, encouraging future research to delve deeper into definite implications for teaching, learning, and research activities in academia.

The prominence of the "Potential Impact of ChatGPT on Academics" factor underscores its significance in discussions surrounding the advancing role of artificial intelligence in education. It indicates a recognition of ChatGPT

as a potential game-changer, prompting a shift in pedagogical approaches, scholarly practices, and the overall educational experience. While emphasizing the positive transformative potential, this factor also hints at the requirement for a nuanced approach, considering ethical considerations, potential biases, and the development of guidelines for responsible use. The intersection of ChatGPT with broader trends in educational technology is obvious, positioning it as a key player in the ongoing digital transformation of academia. As this factor lays the foundation for identifying the complex dynamics between ChatGPT and academia, it opens avenues for future research to explore in-depth the specific ways in which ChatGPT might shape the future landscape of education.

### **User Experience and Ethical Considerations**

The second factor, “User Experience” factor, constituting 12.32% of the variance in the analysis, sheds light on the paramount importance attributed to the end-user perspective in determining perceptions of AI tools, particularly ChatGPT, within the academic landscape. This factor implies that ahead of the technical functionalities, the success of ChatGPT in academia is intricately tied to the ease of use, accessibility, and overall satisfaction of those who interact with the tool. The precision of instructions, the intuitiveness of the interface, and the responsiveness of ChatGPT play pivotal roles in influencing how educators, students, and researchers embrace this AI technology. The factor emphasizes that a positive user experience not only facilitates the smooth integration of ChatGPT into existing

workflows but also contributes to its broader educational impact. It underscores the need for user-centric design considerations, recognizing that user satisfaction and comfort significantly induce the successful adoption of AI tools in educational settings.

“User Experience” not only focuses the immediate impact on user satisfaction but also signals potential implications for the broader adoption and integration of ChatGPT in academia. Positive user experiences can advance trust in the tool and contribute to its effective utilization, potentially enhancing educational outcomes. On the other hand, any negative experiences or concerns among users might pose challenges to the tool’s successful integration. The prominence of this factor induces future research directions, urging a deeper exploration of the nuanced dynamics between users and ChatGPT within academic contexts. Future studies could possibly divulge into user preferences, satisfaction levels, and potential barriers faced, providing valuable insights for refining the user interface, addressing concerns, and optimizing the overall user experience for successful AI integration in education.

The third factor, “Ethical Considerations in Using ChatGPT,” which explains 11.906% of the variance, emphasizes the pivotal need for stakeholders in academia to navigate complex ethical terrain when integrating ChatGPT. It highlights the urgency for robust ethical frameworks catering to AI deployment in education, emphasizing transparency, data privacy, and the mitigation of biases. This factor stresses the accountability of educational institutions to uphold ethical standards,

ensuring ChatGPT aligns with educational values and respects diversity while prompting ongoing inquiries into the evolving ethical implications of AI in academia and research.

The fourth factor, “Potential Bias in Responding,” unraveling 11.809% of the variance, illustrates critical concerns regarding bias in AI-generated responses. This factor directs attention to the profound importance of facing and mitigating biases inherent in the training data and algorithms of AI models, specifically exemplified by ChatGPT. It emphasizes that addressing biases to safeguard fair and unbiased outcomes in academic and research applications is of paramount importance.

The factor prompts a deeper echo on the potential repercussions of biased responses generated by ChatGPT, recognizing that such biases can perpetuate existing inequalities, reinforce stereotypes, and compromise the integrity of academic content. It underscores the need for a meticulous examination of the training datasets to identify and rectify biases, ensuring that ChatGPT’s responses align with ethical standards.

In the context of academic and research applications, where objectivity and impartiality are paramount, the factor signals a call to action for developers, educators, and institutions to prioritize continuous monitoring and refinement of AI models. It advocates for transparency in the development process, ethically sound practices, and a commitment to continually addressing biases to adopt a trustworthy and equitable integration of ChatGPT in academic environments.

## Limitations and Conclusion

The study’s findings are based on a specific sample which is small in size, and the diversity of respondents may be limited. Future research with a more diverse and vast participant pool could enhance the generalizability of the results. Also, technology evolves rapidly, and the study’s findings may be subject to changes in the capabilities and applications of ChatGPT in times to come. Continuous monitoring of technological advancements becomes crucial for keeping the research relevant. Despite these limitations, the findings offer a foundation for future investigations into the evolving role of AI in academia and research.

In conclusion, this study contributes to the constant discourse on the integration of ChatGPT in academia. The identified factors—Potential Impact on Academics, User Experience, Ethical Considerations, and Potential Bias—offer a nuanced understanding of the multifaceted inferences of AI in educational settings. The factors unveiled in the analysis provide a framework for educators, researchers, and policymakers to traverse the integration of AI tools responsibly. Understanding the potential impact on academic practices, prioritizing user experience, addressing ethical considerations, and mitigating biases are critical steps toward harnessing the benefits of AI in education.

As technology continues to advance, future research should adapt to evolving perspectives and explore specific dimensions identified in this study. This includes further investigation into user interface design, the development of robust ethical frameworks, and ongoing attempts to minimize biases in AI-generated

content. Overall, this research lays the groundwork for continued probe into the dynamic intersection of artificial intelligence and academia. More sophisticated statistical tools may be applied to understand human-technology interface in academic backdrop.

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# IMPACT OF FINANCIAL LITERACY ON INVESTMENT BEHAVIOR OF YOUNG INVESTORS IN INDIA: AN EMPIRICAL STUDY

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## ABSTRACT

Financial literacy and knowledge lead to perceived financial understanding. These contribute to the decision-making for savings and investments. Such literacy is a function of awareness, experience, and skills. Financial literacy forms a positive financial attitude towards the achievement of financial goals and freedom. The level of financial literacy of an individual makes them more rational in making their financial decisions. Having good financial knowledge and understanding would help in the management of their finances and further planning of their money in a better way. This study is descriptive in nature. In this study, a structured questionnaire was used to measure the financial literacy of the young investors ranging between the ages of 18 to 35. The sample size of the study is 390. The data were collected with the help of a structured questionnaire. With the help of “Exploratory Factor Analysis” and

“Multiple Regression Analysis,” it was found that there is a significant impact of Financial Literacy (Financial Behavior, Financial Attitude, Financial Knowledge-Basic, and Financial Knowledge-Advanced) on the investment behavior of young investors in India.

**Keywords:** Financial literacy, financial attitude, financial knowledge, investment behavior, young investors.

## INTRODUCTION

Knowledge, as well as experience, makes an impact on the decisions of an individual through perceived skills, knowledge, and capabilities. Financial attitude is associated with how people treat, manage, and make use of financial resources that are available to them. People who have financial responsibility need to be effective in the usage of their finances, making

their budget, savings of money, investments, etc. (Dwiastanti, 2015). As a part of financial discipline, the concept of behavioral finance examines the association between human behavior and the financial system and behavioral dimensions of the company, where the human and financial system exist and are acknowledged. The landscape of finance is complicated and competitive. Furthermore, finance-related financial literacy is more important and essential as it not only affects the finance-related decisions of people at a basic level but also the wider level of financial well-being along with the socio-economic development of the nation. Financial literacy is associated with the decisions related to investments and their determinants, which impact the attitude of individual investors that are influential to other factors as well. All such factors are grouped into demographic factors, economic factors, psychological, and social factors (Janor et al., 2016). Financial knowledge or literacy is the understanding of financial terms. It is an efficient skill that is needed by people to make proper and effective financial decisions with reference to their financial investments. Financial literacy should be considered a primary right and a universal requirement instead of a privilege for customers that have special accessibility to financial literacy or advice. It is a fundamental literacy like the ability to write and read to attain complete potential, individual as well as society needs to come together (Lusardi, 2019). At the present time, the finance-related process has become more complex, including investment funds, a wide range of banking products, insurance, pension reforms, and many more. All such things put full pressure on people to have financial knowledge and understanding

along with financial educational courses. Being equipped with financial literacy and knowledge has become important for people in the present time as the financial market has become complicated in comparison to two decades ago. Immediate measures need to be taken by policymakers because people who are financially illiterate might cause issues in terms of managing their money, debts, and investments, which can have negative consequences for society as a whole (Kimiyağhalam & Safari, 2015). It has been found that people save money habitually and donate money to charity. All of these conditions have an influence on people's financial literacy. Financial awareness, knowledge, and experience are important for making financial decisions, developing a positive financial attitude, and achieving financial goals. The outcomes should attract the interest of policy-makers who are involved in determining how to shape financial knowledge and literacy (Dewi et al. 2020). Financial literacy significantly reduces economic risks. In the present day, people are trying to improve their understanding and knowledge of finance along with different financial products. Financial literacy and people's competencies are becoming essential due to the dynamic, rapidly developing, and globally connected financial market and its requirements. Individuals' financial needs have become more complex and extensive. These needs can only be handled with proper education in finance and various other aspects of finance, taxes, etc., in order to improve their knowledge of financial products, projects, services, concepts, etc., so that they can make appropriate, ethical, and safe financial decisions. The globalized economy has provided many opportunities to

purchase economic goods and services anytime and anywhere. People living in less sophisticated financial markets are not insulated from more sophisticated options. Consistent assessments of financial literacy are vital in determining whether financial literacy contributes to improved financial attitudes, which ultimately improves overall well-being. Establishing the link between financial understanding and attitudes can be challenging due to issues related to definition and measurement. Nowadays, people have a wide range of investment choices, and the decision of how much money to invest depends on the individual. It also depends on different financial products available in Indian and international financial markets (Mehra & Indapurkar, 2020). Financial knowledge or literacy involves having a basic understanding of economic and financial concepts, as well as the ability to use that knowledge to make financial and investment decisions and effectively manage financial resources throughout one's lifetime.

The financial literacy helps people to make good choices of financial products as well as decisions for steady returns and the maximization of financial welfare. The major factor behind financial knowledge among young investors is financial literacy, maturity, family background, and cognitive capabilities. The relative importance of all such elements would vary from investor to investor (Singh & Kumar, 2015). Present and future financial choices of young investors would probably be very challenging compared to their parents because of the complexity of the financial products and market, usage of digital technology, new and complicated financial market, and its rules and regulations. There are many examples where well-trained people in the

financial field have become victims of investment scams and financial frauds. However, not many people disagree that good knowledge and understanding of finance would give the ability to have complete and basic financial literacy (Hayei & Khalid, 2019). The investment-related decisions of investors get influenced by their level of financial literacy. A significant role is played by financial literacy with reference to the financial framework of the nation. Financial literacy has become more remarkable with the growing and developing banking and financial system of the economy (Yadav & Raman, 2019). Financial knowledge and literacy are acknowledged worldwide and are considered an essential element for stability and development in finance. Good activity in financial planning, control, and management shows healthy economic behavior. Personal management of financial management is highly associated with the capability and understanding of financial literacy concepts. Hence, almost every aspect of financial literacy gets impacted, including planning and spending of money that includes the economic behavior of an individual (Muizzuddin et al. 2017). The globalized economy has given many opportunities to purchase economic goods and services at any time and any place. People who live in less sophisticated financial market nations are not insulated from sophisticated varieties. Consistent estimations of financial literacy are vital if financial literacy helps in improving financial attitude, which would ultimately improve their well-being as well. The proof of the association between financial understanding and attitude is varied because of the issues related to the definition and measurement (Nicolini, Cude & Chatterjee, 2013). The importance

of such financial instruments is deceptive in the economic development of the nation by channelizing the savings of an individual. From the viewpoint of the young generation, the level of awareness related to financial investments is found to be lacking. This work deals with the attitude and behavior of the young generation towards investment-related opportunities in the market (Azhar, Juliza, Azilah, & Syafiq, 2017). The importance of financial knowledge lies in the sense that it assists people in having a basic understanding of financial terms and thus applies the knowledge to making the best decisions related to their personal finances. Well-informed financial investment decisions ensure good returns in the coming future. It has been observed in various studies that people who have a low level of financial knowledge face difficulties in taking finance-related decisions and making plans for themselves and their families like savings, borrowings, investments, valuing their money, interest rates, etc. All these things are important to choose the best financial investment option. Over time, the financial market has changed drastically and has become more organized and complicated. A lot of complicated and sophisticated financial products are available in the market for which there needs to be a good understanding as well as financial literacy for good decisions and to avoid obstacles in the future of the common man of society. It is observed that the behavior of the young generation gets influenced by two non-economic elements, which are financial knowledge and literacy and the financial behavior of their parents with regards to savings and investments (Owusu, Ansong, Koomson, & Addo-Yobo, 2022).

Using long-term investment for the development of the economy and the economic development of an individual is not a new idea. It has acquired a lot of attention from people in the past few decades. After the selection of the security, the investor starts making an estimate of the amount of money available to them, which they can spend on purchasing the security. Finally, an investor starts analyzing the price of the security and makes their decision about the security that they should choose (Anitha & Bhargavi, 2014). Financial education makes a positive and significant impact on investment-related decisions of young savers. Moreover, when the study focused on dimensions of financial literacy, one of the most substantial dimensions was financial skills. One of the least significant dimensions of investment decisions is knowledge about financial products among young investors. Hence, it is concluded by researchers that financial skills are considered a major determinant of financial education for enhancing and improving investment decisions among young investors. The second most influential dimension is knowledge of financial investment options. There is a need for investors to develop the habit of investing to reduce the influence of the economy on them. The outcome of the work has significant managerial implications that can be utilized by investment companies for the restructuring of their present policies, practices, as well as the innovation of new products and new methods of service delivery (Dayana & Rodrigues, 2021). An individual wants their money to be invested in a secure option that would give good returns with low risk. The chosen investment option is dependent upon the risk-taking ability of an investor. The investment attitude of a young investor is linked

to the activities of investment that an investor makes, such as searching, analyzing, evaluating, acquiring, and reviewing the investment options that are available in the market. The investment behavior of an investor shows how they allocate and distribute their surplus income in different investment avenues that are available in the market (Ansari & Moid, 2013). Financial literacy helps in the arrangement of ensuring long-term investment to avoid any kind of financial pitfalls in the future. Financial understanding plays an important role in the management of expenses, making it possible to control them in a planned way. Good financial management helps enhance the ability of individuals to plan their finances wisely in every phase of life. The study's outcome reveals every aspect of finance, including skills in financial management, budget planning, savings, and control. Thus, more efforts need to be applied to expand financial education levels and attitudes among young savers. The study also reveals the importance of creating awareness among people about the importance of having financial education and investment opportunities for a better and safer future.

## LITERATURE REVIEW

Financial education is stated in the context of awareness and mindfulness, and the investment decision-making of investors. It is expressed as the action of investors as well as the way they expect, understand, examine, and evaluate the phases or transactions for decision-making. It also includes the risk of investment, the process, and the model of investment decision-making. However, creating awareness among people about the importance of financial literacy will

upgrade investment decisions among investors. The majority of investors are aware of the different investment options available in the market, and investors are not investing in any single investment avenue. It is found that many investors invest around 10% of their annual income in the investment options available in the market. One of the most important factors that impact the investment decision is the returns on investment. The investment attitude of young investors also gets impacted by their personal factors like knowledge and understanding of the financial market, pattern of savings, pattern of consumption, influence of friends and family, and the surplus amount of money that can be invested (Dewan, Gayatri, & Dewan, 2019).

Young investors are more interested in making an investment plan with their surplus money, and most of them invest in bank deposits and gold as well. Young investors opt for these investment options because they are not prepared to take high risks in the market and prefer safer options that have less risk but provide good returns. The study found that most young investors do not have enough knowledge and understanding of finance and its concepts. Good financial literacy is required for all of this. Poor financial literacy is the reason behind a structured portfolio. The portfolio must include avenues that have a low level of risk and maximum profits and returns in various sectors (Gadde & Gupta, 2020).

The study found that, compared to women, men are more risk-averse. Investors who are educated are ready to take risks. The age of investors does not have a significant impact on risk tolerance, and investors with low income levels have a lower level of risk tolerance compared

to investors with high income levels. Public employees do not have much ability to bear risk. It is the responsibility of the government to motivate people to make investments by adopting policies that provide incentives when they make any investment (Rahmawati et al., 2015).

People who are curious, love to learn new things, and are knowledgeable are always ready to take risks. Investment firms need to pay more attention to the fact that gender does not make a difference in investors' risk tolerance at present. Male and female investors have almost the same risk tolerance ability. Thus, when looking for prospective investors, companies must focus on those who like to explore new things and have emotional stability along with a low level of agreeableness (Mathur & Nathani, 2019).

There is an urgent need for women to become more literate regarding financial terms and concepts. Finance companies and policymakers need to educate people, especially women, and help them improve their level of financial knowledge for a bright future. Educating women would help them structure their finances and invest their surplus money in safe investment options, earning good returns for a secure future. The female section of the society needs to be educated as they are the one who can make a significant contribution to the nation's growth. There has been an improvement in women's literacy levels in our nation, but it is still not up to global standards. Therefore, it is essential to target a large number of women to join financial literacy programs and gain good knowledge about financial concepts, products, and policies (Rani & Goyal, 2021). Risk-taking ability of young investors is related to factors such as age, gender, income, occupation, and education. It has been

observed that young investors are generally risk-oriented and tend to choose investment options like mutual funds, bank deposits, fixed deposits, gold, etc. They are neither risk-seekers nor risk-averse because of some of the investment options, which are characterized as high-risk options. Investors choose their investment avenues as per their risk-taking ability. There is a gender gap in financial literacy within the context of their parental characteristics. Variables like level of education of a mother and father is found to be correlating with the level of education of their children and their level of financial education. The study suggests that the education level of parents, particularly mothers, can have a positive impact on the financial education of their children, bridging the existing gender gap (Chambers, Asarta, & Farley-Ripple, 2019).

Financial education programs have different scopes and approaches. In India, there is an urgent need to improve financial literacy, especially among the large number of illiterate individuals. Access to finance for the poor and uneducated depends on their level of financial literacy. To reduce poverty in the country, it is important to enhance financial literacy among these individuals so they can access financial services and products. To understand types and importance of investment options available in market, some small camps and activities should be conducted in schools, colleges, and local areas to increase knowledge and understanding of investments. It is necessary to analyze the impact of these programs and gather feedback from the people (Anshika & Singla, 2017).

Financial literacy is also a crucial factor in determining the level of financial inclusion. It refers to the ability of individuals to understand

finance, make informed financial decisions, and utilize it for their own benefit and that of their households. Financial inclusion in recent development is known to be important element and considered essential for rural development who are not only facing deficiencies in resources as well as social and economic aspects. Financial literacy and education can help backward people understand finance through which they would do management of their finances effectively, and adopt investment options to earn good returns in the future. It is the responsibility of the government and other communities to educate people about the benefits of investments (Kandari, Bahuguna, & Salgotra, 2021).

Increasing complications in the financial market have upstretched the essentiality of financial education and understanding among people, particularly in developing countries like India. Knowledge of finance can lead to economic and social involvement of people, increase the level of competition along with market efficiencies in the financial service sector, which would ultimately reduce regulators' interference. The majority of the Indian population is still financially disqualified. Financial education is an essential tool for the promotion of financial inclusion and for the achievement of financial stability. For that, there must be some effective approach to a national strategy with the inclusion of spreading awareness among people with regards to financial knowledge, financial products, and services that are available in the financial market. Experts must educate present users of financial products, helping them to make correct choices of investment options and, at the same time, ensuring the protection of customers from any kind of fraud in the financial market (Thakur, 2018).

Talking about India, the same situation is found here as well. The majority of people do not have enough financial knowledge. They even do not know how to invest their money and which investment option is beneficial for them. Researchers found that age, gender, education, and family background are some of the main factors that influence the financial education of an individual as well as their financial behavior. It also impacts their ability to understand finance and use those concepts in making investment-related decisions. Therefore, it is concluded that financial literacy is very important to take correct investment decisions (Laxmi & Maheshwary, 2018).

Perception of risk has a considerably negative influence on short-term investment goals (meaning people who perceive high financial risk have a lesser intention for short-term investment), no considerable influence on long-term investment goals, and does not work as a mediator between financial education and investment goals. Financial education has a considerable positive influence on long-term investment goals. Risk perception has no considerable influence on the goal of long-term investment, which does not work as a mediator between financial education and investment goals (Sadiq & Khan, 2018).

The factor of investment decisions requires special attention, which needs to be understood by investors. It is the responsibility of investors to chase risks in financial decisions. A higher level of investment experience and financial education would lead to more risk-bearing capacity, and then investors choose more risky investment avenues to match it up with their risk-bearing capacity.

Sensible investors learn from their experience and should learn to deal with risky situations (Awais et. al., 2016). The decision to invest is crucial and is impacted by many different factors like the income level of the investor, knowledge of finance, financial soundness, and many other demographic and social factors.

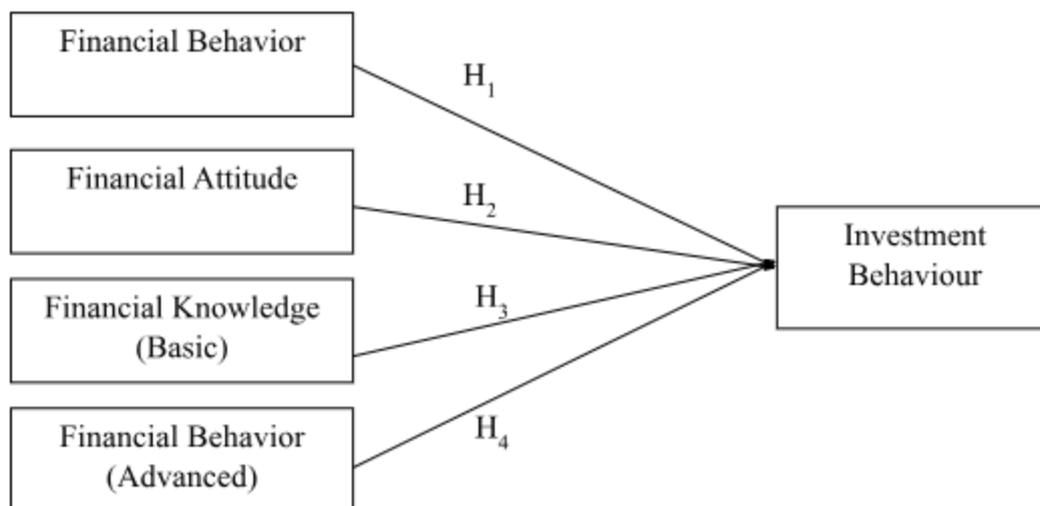
For the promotion of financial inclusion, financial literacy and education are vital factors, which ultimately lead to financial stability. People who are financially excluded would be benefited by financial literacy by making them understand advantages and ways to join the financial system formally. It would also benefit people who are financially included by assisting them in making informed choices related to financial products and services that are available in the market. Households that are financially strong have high levels of consumption and are willing to make major acquisitions.

### Research Gap and Need for the Study

Most of the studies that have been reviewed for this research indicate the importance of financial literacy in overall investment behavior. However, there is a lack of studies that empirically test this relationship. Similarly, the empirical studies are either on financial literacy or on other aspects of investment behavior, but not both investment behaviour. The studies in extant literature fail to establish the relationship between financial literacy and investment behavior. The previous studies have taken a general group of respondents across all is groups rather than studying specifically about the young investors.

### Conceptual Framework of Study

Impact of Financial Literacy on Investment Behavior has been depicted in Figure 1.



**Fig. 1: Conceptual Framework of Study**

## Objectives

- To determine the factors of financial literacy that affect the investment decision.
- To measure the impact of various financial literacy dimensions on the investment decision.

## Hypotheses

Financial behavior positively influences investment behavior.

H2: Communication of financial attitude positively influences investment behavior.

H3: Basic financial knowledge positively influences investment behavior.

H4: Advanced financial knowledge positively influences investment behavior.

## Methodology

**Research Design:** This study has a descriptive research design. Such a design is useful when the variables are well-defined, and research demands a well-structured and well-defined format. This research establishes the relationship between variables and compares the variables with the help of empirical evidence (Cooper & Schindler, 2003; Chawla & Sondhi, 2011). The data has been collected with the help of a closed-ended structured questionnaire. The responses have been captured on a five-point Likert Scale.

**Instrument Design:** Significant inputs for developing the statements and constructs were obtained from contemporary studies by Chhatwani (2021), Bajaj & Kaur (2022), and Muktadir-Al-Mukit (2022). This also helped in establishing the content validity of the questionnaire.

**Sample Size:** The minimum recommended sample size is 10 times the number of variables (Hair et al., 2010). In this study, there are 22 variables under the “Exploratory Factor Analysis.” Therefore, a sample size of 220 was sufficient, although a much larger sample size was taken (390 respondents) to obtain more robust results.

**Sampling Method:** Judgement sampling method has been used to select the sampling unit. Only those respondents have been selected which belongs to the age range of 18 to 35.

**Statistical Techniques:** “Exploratory Factor Analysis (EFA)” and “Multiple Regression Analysis”

## FINDINGS

Table 1 shows general details of the respondents, showing that 63.8% of males and 36.2% of females contribute to a total of 390 respondents. Among them, 20.3% are aged 18-24, 54.6% fall in the age category of 25-29, and the remaining 25.1% are aged 30-35. Of the respondents, 15.6% have intermediate or below education, 19.0% have university or higher education, 42.3% are graduates, and the remaining 23.1% have technical or professional degrees. Additionally, 11.8% of the respondents are students, 15.9% are housewives, 34.6% are salaried, 26.4% are professionals, and the remaining 11.3% are in business or self-employed. Furthermore, 22.3% of the respondents have a monthly income below Rs. 50,000, 48.7% earn between Rs. 50,000-1,00,000 every month, and the remaining 29.0% earn above Rs. 1,00,000 monthly.

## Level of Financial Literacy among Young Investors

To determine the various levels of financial literacy among young investors, “Exploratory Factor Analysis” was applied. The value of KMO is 0.912, which means that the sample size for

Factor Analysis is adequate, and the “Bartlett’s Test of Sphericity” is also significant. Table 2 shows that 22 variables form 4 factors. The factors explained the variance of 23.369%, 18.815%, 15.710%, and 15.276% respectively, and the total variance explained is 73.170% as per Table 3.

**Table 1: General Details**

Variables	Respondents	Percentage
<b>Gender</b>		
Male	249	63.8
Female	141	36.2
<b>Total</b>	<b>390</b>	<b>100</b>
<b>Age (years)</b>		
18-24 Years	79	20.3
25-29 Years	213	54.6
30-35 Years	98	25.1
<b>Total</b>	<b>390</b>	<b>100</b>
<b>Educational Level</b>		
Intermediate and below	61	15.6
University or Higher	74	19.0
Graduate	165	42.3
Technical or Professional Degree	90	23.1
<b>Total</b>	<b>390</b>	<b>100</b>
<b>Occupation</b>		
Students	46	11.8
Housewife	62	15.9
Salaried	135	34.6
Professional	103	26.4
Business or Self Employed	44	11.3
<b>Total</b>	<b>390</b>	<b>100</b>
<b>Monthly Income</b>		
Below Rs. 50,000	87	22.3
Rs. 50,000-1.00000	190	48.7
Above 1,00000	113	29.0
<b>Total</b>	<b>390</b>	<b>100</b>

**Table 2: KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.912
Bartlett's Test of Sphericity	Approx. Chi-Square	7237.731
	df	231
	Sig.	.000

**Table 3: Total Variance Explained**

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.546	43.392	43.392	5.141	23.369	23.369
2	2.828	12.855	56.247	4.139	18.815	42.184
3	2.032	9.236	65.483	3.456	15.710	57.894
4	1.691	7.687	73.170	3.361	15.276	73.170
5	.791	3.596	76.766			
6	.666	3.027	79.793			
7	.622	2.828	82.621			
8	.489	2.225	84.846			
9	.455	2.068	86.914			
10	.441	2.005	88.918			
11	.362	1.645	90.564			
12	.311	1.416	91.979			
13	.278	1.266	93.245			
14	.244	1.110	94.355			
15	.220	.998	95.353			
16	.201	.916	96.269			
17	.197	.894	97.162			
18	.156	.709	97.872			
19	.139	.632	98.504			
20	.125	.567	99.071			
21	.112	.511	99.582			
22	.092	.418	100.000			

### Development of Factors

Table 4 presents the factors and corresponding statements with factor loading and reliability values. The first factor is named Financial

Behavior, which includes variables such as avoiding extra charges by paying credit card bills on time, habitually preparing expense and revenue spreadsheets, saving money, regularly

checking credit card invoices, analyzing financial status, reviewing investment portfolios before making big purchases, and changing investment portfolios as needed. The second factor is named Financial Attitude, with associated variables including having good control over expenses, establishing financial targets for the future, staying within budget, being a regular investor to attain targets in long term and I always following a monthly expense plan. The third factor is Financial Knowledge (Basic), which includes variables such as comparing investment options, before investing, I am aware of market's financial products, I know that high return investments

involve high risks, reducing investment risks by purchasing a wide range of options, and knowing how to manage debts. The last factor is Financial Knowledge (Advanced), with associated variables including knowledge about inflation rates, awareness of changes in interest rates, considering price/performance ratio before purchasing products or services, following predictions of stock market earnings, and understanding how to invest in mutual funds. The reliability values for the four constructs are as follows: Financial Behavior (.943), Financial Attitude (.935), Financial Knowledge (Basic) (.878), and Financial Knowledge (Advanced) (.862).

**Table 4: Factors and Variables**

S. No.	Statements	Factor Loading	Factor Reliability
	<b>Financial Behavior</b>		<b>.943</b>
1.	I avoid extra charges by paying my credit card bills on time	.851	
2.	I am in habit of preparing expense and revenue spread sheet	.849	
3.	I am in the habit of saving my money	.845	
4.	I regularly check the invoice of my credit cards	.794	
5.	I always analyze my financial status, before going for any big purchase	.794	
6.	I always keep on reviewing my investment portfolio	.774	
7.	I keep on changing my investment portfolio as per my requirement	.549	
	<b>Financial Attitude</b>		<b>.935</b>
8.	I have a good control on my expenses	.903	
9.	I establish my financial targets for time ahead	.867	
10.	I always try to stay within my budget	.865	
11.	I am a regular investor to attain targets in long term	.864	
12.	I always follow a monthly expense plan	.791	
	<b>Financial Knowledge (Basic)</b>		<b>.878</b>
13.	I always compare the investment options before investing	.844	
14.	I am aware of market's financial products	.827	
15.	I know that high return investment has high risks	.793	

16.	I reduce my investment risks by purchasing wide range of options	.710	
17.	I know how to manage my debts	.658	
	Financial Knowledge (Advanced)		.862
18.	I know about inflation rates	.804	
19.	I am aware of changes in interest rates	.788	
20.	Before buying any product or service, I look for its price/performance ratio	.774	
21.	I follow the predictions stock market stock earnings	.717	
22.	I know how to invest in mutual funds	.701	

The reliability for 4 constructs that includes a total of 22 numbers of items is 0.933 (Table 5).

**Table 5: Reliability Statistics**

Cronbach's Alpha	N of Items
.933	22

The model explained 13% of the variance with R Square value 0.135 (Table 6).

**Table 6: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	.368 <sup>a</sup>	.135	.126	.66056

a. Predictors: (Constant), Financial Behavior, Financial Attitude, Financial Knowledge (Basic), Financial Behavior (Advanced)

The significance value is less than 0.05 (0.000), which reflects that one of more of the IDVs significantly influences the DV. (Table 7).

**Table 7: ANOVA**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.323	4	6.581	15.082	.000 <sup>b</sup>
	Residual	167.992	385	.436		
	Total	194.315	389			

**DV: Investment Behavior**

b. Predictors: (Constant), Financial Behavior, Financial Attitude, Financial Knowledge (Basic), Financial Behavior (Advanced)

**Table 8: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.695	.033		110.463	.000
Financial Behavior	.167	.033	.237	4.991	.000
Financial Attitude	.087	.033	.123	2.592	.010
Financial Knowledge (Basic)	.074	.033	.105	2.206	.028
Financial Knowledge (Advanced)	.164	.033	.231	4.882	.000
<b>DV: Impact of Financial Literacy on Investment Behavior</b>					

Table 8 above shows that all the factors namely Financial Behavior, Financial Attitude, Financial Knowledge (Basic), Financial Behavior (Advanced) has significant impact on “Investment Behavior”.

### Theoretical and Managerial Implications

This study finds that Financial Behavior and Financial Knowledge (Advanced) are the two most important factors that affect the investment behavior of the youth. These are followed by Financial Attitude and Basic Financial Knowledge. This study presents many significant inputs for academic theory building. The study tests the constructs pertaining to financial literacy, which may work as the cornerstones of future studies. This study has built important links between investment behavior and financial literacy. It establishes a firm foundation for the research with a large number of variables, qualitative and quantitative in nature. This study sheds light on how financial service marketers can adopt a two-fold approach – spreading knowledge

about financial products and then selling the financial products. It has been noticed from the study that higher financial literacy leads to better investment behavior. The findings of this study may also be utilized for drafting financial products as well as financial literacy literature.

### CONCLUSION

An individual is said to be financially literate if he or she can read, interpret, analyze, and communicate about personal financial status that affects their material well-being, calculate, develop autonomous decisions, and have the capability to take actions on the results of their financial processes in order to achieve success in the multifaceted financial world. Financial literacy also includes “the ability to discern financial choices, discuss money and financial issues without discomfort, plan for the future, and respond competently to life events that affect everyday financial decisions, including events in the general economy”. In comparison to the older generation, the young people of today’s time are more creative and technology-

savvy when it comes to the financial sector. At the same time, it is a big concern whether the young people are aware enough of their financial status and future investments. Studies have examined the awareness among young adults belonging to the age group of eighteen to twenty-eight years towards investments, focusing on factors such as financial literacy, personal interest, and awareness of investment. It is found that awareness of investment is significantly influenced by financial literacy and personal interest. The study was conducted to determine the impact of financial literacy on the investment behavior of young investors in India and concludes that there is a significant impact of financial literacy on the investment behavior of young investors.

### Scope for Future Research

Future studies may focus on how financial literacy leads to changes in the risk perception of youth. Another important aspect to investigate is how financial literacy leads to exploration of new investment avenues, such as the stock market, mutual funds, the commodity market, investment in foreign stock exchanges, and cryptocurrency. Similarly, it would be interesting to investigate how risk perception moderates the relationship between financial literacy and the selection of investment avenues. Investors are also consumers. Lifestyle is a very important aspect that affects most consumers' preferences. Future studies may be carried out on how youth with the same financial democracy and geographical background, but with different social class and lifestyle, differ in the selection of financial investment avenues, financial literacy, and risk perception.

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- [An Outcome of Centre of Excellence, Sri Guru Gobind Singh College of Commerce, University of Delhi Sponsored Research Project, 2022-23]**

# DETERMINANTS OF EXAMINING BEHAVIORAL ASPECTS OF USING EMERGING TECHNOLOGY IN ONLINE FOOD DELIVERY APPS. AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL APPROACH

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## ABSTRACT

**Purpose** – The study aims to examine factors that influence customers' intention to use emerging technology (such as chatbots, AI-based recommendations, robotics delivery, Augmented Reality/Virtual Reality) in online food delivery applications. The factors examined in this study are based on the existing theory of Technology Acceptance Model (TAM), namely perceived usefulness, perceived ease of use, attitude towards intention to use the applications, and this research expanded with an additional dimension: perceived enjoyment, which leads to the intention to use online food delivery services.

**Design/methodology/approach** – The study employed a quantitative method, and 201 respondents participated in this study. The questionnaires were distributed using a convenience sampling technique, and the data was analyzed using the partial least square

approach. The study focused on measurement properties via Confirmatory Factor Analysis (CFA) and SEM using Smart PLS 4.0. Descriptive analysis and hypothesis testing provided insights into factors influencing OFD app adoption among consumers, ensuring methodological rigor and credibility.

**Findings** – The results show that four (4) constructs, i.e. Perceived usefulness, Perceived ease of use, Perceived Enjoyment, and Attitude towards Behavioral intention. The study indicates that user experience factors, such as enjoyment and ease of use, play a crucial role in determining the behavioral intention to use technology-based online food delivery applications in Delhi.

**Practical implications** – The output of this study has several practical contributions, such as enhancing the existing knowledge and skillset of the shared-economy industry. OFD industry practitioners can use these results to better understand how to improve the behavioral

intentions of their customers. Additionally, this study advances the ongoing investigation into the use of TAM in OFD platforms.

**Originality/value** – The current work examined consumers' intentions regarding emerging technology in online food delivery services.

**Keywords:** Technology Acceptance Model, perceived enjoyment, emerging technologies, online food delivery, and structural equation modeling.

## INTRODUCTION

The widespread adoption of smartphones and the proliferation of mobile applications (apps) has led to a significant transformation in the lifestyles of Indian consumers (Gupta, 2019; Singh, 2018). Consumers enthusiastically embrace the internet and Online Food Delivery Applications (OFDAs) due to the convenience, information availability, and interaction they offer (Chen et al., 2009; Gupta et al., 2019). This rapid integration of innovative technological solutions propels the growth of previously untapped market segments within the food industry. The surge in mobile-based ordering, evidenced by a remarkable 380 percent rise in delivery app installations, signifies a notable shift in consumer preferences towards convenient and effective solutions. This trend aligns with the broader digital transformation across various industries, particularly in services. Businesses adapting to this shift by offering user-friendly mobile applications for ordering and delivery stand to gain increased revenues (Wang et al., 2010). Online food

delivery (OFD), facilitated by platforms enabling customers to purchase a wide range of products or services, is a burgeoning trend (Cho et al., 2019). Platforms like Zomato, Swiggy, and Food Panda empower users to order food from multiple restaurants via apps or websites. Alalwan (2020) suggests that restaurants can boost their revenue potential through these platforms, while Cho et al. (2019) highlight their assistance in selecting from a diverse range of food providers. Projections indicate that by 2028, the market will reach a value of US\$81.91 billion. A Rakuten Insight survey in April 2023 found that approximately 20 percent of female respondents in India ordered food via delivery apps once or twice weekly, while about 19 percent of male respondents placed one or more weekly orders through such apps.

Indian consumers are attracted to the ease of online shopping through digital apps and portals and seek a similar convenience when ordering food online. Digital ordering is a straightforward process, indicating to customers that restaurants are capable of embracing technological advancements (Ramesh et al.). In 2023, the online food delivery market in India is projected to generate US\$33.36 billion in revenue, with a compound annual growth rate (CAGR) of 19.68% for 2023–2028. Although numerous studies have examined the online food delivery market, limited research has investigated the effectiveness of emerging technology-based OFD apps in influencing consumer behavioral intentions. This study aims to evaluate the effectiveness of integrating cutting-edge technologies such as chatbots, AI-based recommendations, and robotics delivery into India's online meal delivery service,

aiming to provide pragmatic functionality and a pleasurable ordering experience. Investigating the influence of technologically-driven Online Food Delivery Apps (OFDA) on customer orders, particularly among women, was a central research objective. The Technology Acceptance Model (TAM), developed by Davis et al. (1989), guides this research, emphasizing the importance of perceived usefulness, ease of use, and perceived enjoyment in shaping technology acceptance.

Moving beyond the introduction, Section 2 outlines the research constructs and hypothesis construction, followed by the research methodology in Section 3, data analysis results in Section 4, study conclusions in Section 5, implications in Section 6, and limitations in Section 7.

### **Theoretical Background:**

Davis' Technology Acceptance Model (TAM), introduced in 1989 and substantiated by subsequent studies (Gao & Bai, 2014), is pivotal in comprehending technology adoption aligned with user expectations. TAM amalgamates perceived ease of use and usefulness to gauge user intentions (Davis, 1989). Subsequently, Davis et al. (1992) enhanced TAM by integrating perceived enjoyment, acknowledging the significance of intrinsic satisfaction alongside utility. Perceived enjoyment denotes the inherent pleasure in technology interaction (Davis et al., 1992). Researchers such as Agarwal, Heijden, Shang, Teo, and Venkatesh have investigated the influence of both intrinsic and extrinsic motivators on technology acceptance.

By incorporating perceived enjoyment, TAM provides a comprehensive perspective on technology adoption dynamics.

Perceived ease of use evaluates the simplicity of comprehending a system, influenced by user interaction and frequency of usage (Zuniarti et al., 2021). Bassiouni et al. (2019) suggest that ease of use reflects the effort exerted by users, akin to video game usage. Zhang et al. (2014) define perceived ease of use concerning IT systems in restaurants. Rauniar et al. (2014) discuss Facebook's ease of use in terms of comprehension and navigation. Higher perceived ease of use of cloud computing correlates with increased adoption (Ratten, 2014). Hubert et al. (2019) relate ease of use to users' confidence in understanding smart home systems and effortless interaction. In hospitality technology, ease of use hinges on interaction desirability and simplicity (Zhang et al., 2014). Rauniar et al. (2014) elaborate on Facebook's ease of use criteria, encompassing flexibility, accessibility, skill acquisition, user-friendliness, and interaction clarity.

Perceived usefulness, defined by Kowalczyk (2018), pertains to users' belief in the smart speaker system's ability to enhance work output. Moghavvemi et al. (2016) highlight Malaysian entrepreneurs employing innovative systems to improve tasks and skills. Rauner et al. (2014) discuss.

Perceived usefulness in social media concerns goal-oriented users. The usefulness of cloud computing is influenced by information accessibility, as noted by Ratten (2014). Zhang et al. (2014) emphasize the usefulness of hospitality technology in improving performance and simplifying tasks. The utility of Facebook, as

per Rauniar et al. (2014), is measured through reconnecting with influential connections, improving life, maintaining relationships, staying in touch, and staying informed. Wu et al. (2017) propose measurement items for usefulness, emphasizing faster payments and streamlined transactions. Perceived enjoyment, described as hedonic, enhances individuals' comfort with technology, particularly in video games (Bassiouni et al., 2019). Comfort with information technology fosters positive attitudes and effective task performance (Zhang et al., 2014). Technological application boosts comfort and usage, particularly in entrepreneurial pursuits (Moghavvemi et al., 2016; Kunz et al., 2020). Kowalczyk (2018) links perceived enjoyment with the pleasantness of smart speaker usage. In restaurant settings, information technology systems are designed for user-friendly enjoyment (Zhang et al., 2014). Wu et al. (2017) use factors like pleasure and excitement to measure enjoyment in mobile payment tools like WeChat. Behavioral intention to use technology represents the propensity to persist in its usage. Moghavvemi et al. (2016) define it as the decision to adopt or reject technology for enhancing business performance, particularly among entrepreneurs. Hospitality classes in the USA emphasize the acceptance and application of behavioral intentions towards information technology systems by restaurant staff (Zhang et al., 2014). Smart home technology usage can be predicted based on users' attention to it (Hubert et al., 2019). Zhang et al. (2014) identify indicators of behavioral intentions in restaurants, including continuous and prolonged use of IT systems. Similarly, Hubert et al. (2019) outline criteria

such as home usage frequency for measuring behavioral intention in smart homes.

## LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

### **Perceived Usefulness and perceived ease of use of Technology based Online food delivery service**

Service simplicity not only saves users' time and effort but also significantly enhances their overall experience. Perceived ease of use consistently shapes users' perceptions of usefulness across various contexts. For example, Rauniar et al. (2014) found that Facebook's straightforward interaction positively influenced its perceived usefulness. Gathering insights through electronic surveys, as suggested by Tarigan et al. (2019), facilitates comfortable sharing of thoughts. In the realm of smart homes, Hubert et al. (2018) stress that simplicity directly impacts perceived usefulness, contributing to a more convenient lifestyle. Similarly, Setiawan and Widanta (2021) report that Traveloka's user-friendly interface enhances its perceived benefits in Bali. In education, cloud computing's utility is closely tied to ease of use (Ratten, 2014), emphasizing intuitive interfaces for a better user experience in large universities. Lastly, in the context of Korean consumer sports and fitness wearable devices, perceived ease of use positively influences perceived usefulness, as demonstrated by Kim and Ciu (2019). Thus, we hypothesize that.

**H1:** Perceived ease of use has significantly influence perceived usefulness of Technology based online food delivery apps.

### **Perceived ease of use affects perceived enjoyment of Technology based online food**

“Technology systems play a pivotal Role in enhancing user convenience, leading to a sense of ease when interacting with these systems (Tarigan et al., 2020). For instance, the perception of smart homes as user-friendly and enjoyable stems from their ability to provide comfort and a feeling of being at home (Hubert et al., 2018). Intrinsic motivation, often associated with perceived enjoyment, significantly influences user acceptance of systems. Consider video games, which are both easy to play and understand. Their simplicity facilitates game selection and optimal family playtime. Notably, perceived ease of use directly impacts perceived enjoyment in the context of video games (Bassiouni et al., 2019). A study by Kim and Ciu (2019) highlights the interplay between technology readiness dimensions and perceived ease of use. While optimism and innovativeness positively influence ease of use, discomfort and insecurity related to negative technology readiness can hinder the adoption of sports and fitness wearable devices. Thus, we hypothesize that

**H2:** Perceived ease of use has significantly influences perceived enjoyment of Technology based online food delivery service.

### **Perceived Enjoyment affects Perceived Usefulness of Technology based online food delivery service**

This study focused on several elements that contribute to an enjoyable ordering experience, including a fascinating ordering process,

appealing technology, and a funny and engaging ordering process. The intrinsic motivator, perceived enjoyment, is proposed to influence the use of technology-based meal delivery apps. It is anticipated that an increase in perceptions of extrinsic motivation, specifically perceived utility, will result from intrinsic motivation, such as perceived enjoyment. Individuals finding a system enjoyable are more inclined to perceive it as useful (Sun & Zhang, 2008). Additional studies on various systems, including instant messaging, search engines, and e-learning platforms, demonstrated a positive impact of user enjoyment on perceived usefulness (Li et al., 2005; Liaw & Huang, 2003; Yi & Hwang, 2003). Hence, the hypothesis posits a relationship between intrinsic enjoyment and extrinsic utility in technology acceptance.

**H3:** Perceived enjoyment has a positive effect on perceived usefulness of technology based online food delivery service.

### **Perceived usefulness affect Behavioral intention to use Technology based Online Food Delivery service**

Numerous previous studies have consistently confirmed the significant role of perceived usefulness in shaping behavioral intentions. For instance, research by Venkatesh (2000) and Sun & Zhang (2006) has highlighted this robust relationship. Most of these studies have focused on assessing the impact of perceived usefulness on users' intentions to adopt and utilize technology. Specifically, in the context of online food delivery services, perceived usefulness plays a crucial role in explaining the technology-based ordering process.

Tam's model, which emphasizes the purpose behind adopting information system technology, aligns with the findings of Davis (1989) and Palumian et al. (2021). Furthermore, the acceptance of information system applications by users is likely to increase in the future, as demonstrated by research conducted by Tarigan et al. (2020). In a different context, Krishnanand Koshy (2021) explored the relationship between perceived usefulness and consumer behavioral intentions related to electric cars in Taiwan and Vietnam. Their findings suggest that perceived usefulness significantly influences consumers' intentions to acquire electric vehicles. Similarly, a survey conducted by Taufik and Hanafiah (2019) at the Kulala Lumpus International Airport revealed that perceived usefulness has a direct impact on consumer behavioral intentions in the context of self-service technologies. Thus, we hypothesize that

**H4:** Perceived usefulness has significantly influences Behavioral intention of Technology based online food delivery service

#### **Perceived enjoyment affect Behavioral intention to use Technology based Online Food Delivery service:**

The proposition posits that the extent of perceived enjoyment significantly shapes the intention to use a system. This stems from the notion that individuals deriving pleasure or satisfaction from system usage are more inclined to develop an intention to utilize it, as indicated by Davis et al. (1992). Substantial empirical backing for this relationship exists across various domains, including Internet learning

(Lee et al., 2005), interface agents (Serenko, 2008), the Second Life virtual platform (Shen et al., 2009), and web portals (Van der Heijden, 2004). In the context of ARTP use by students, a perception of enjoyment is likely to foster favorable perceptions and a heightened intention to use it. Thus:

**H5:** Perceived enjoyment significantly influences behavioral intention to use technology-based online food delivery service.

#### **Perceived Ease of use affect Behavioral Intention to use Technology based Online Food Delivery service:**

Perceived ease of use in cloud computing adoption impacts adoption intentions in 135 respondents (Ratten, 2014). The intention to use cloud computing by students at large universities depends on the ease of use, ease of learning cloud computing, and how to use cloud computing quickly, and it has a direct influence on the desire to buy these services and the desire to access and store data in cloud computing. Perceived ease of use affects the intention to use sports and fitness wearable devices among Korean consumers. The ease of use and interaction in sports and fitness wearable devices is clear and easy to understand, which has an impact on the desire to use these tools regularly and often in the future (Kim and Ciu, 2019). Alawan et al. applied the TAM to examine the intention and adoption of mobile internet service among Saudi Arabians. (Roh et al., 2019) found that ease of use positively influences both usefulness and intention to use food.

These researchers also found that usefulness positively influences the intention to use such applications. The benefits perceived by the user do not affect behavioral intention in a study of food delivery applications in India (Gupta et.al 2021). The researchers studied drone food delivery services, noting that the key variables that predict customer intention are attitude, subjective norms, and perceived usefulness (Waris et. al 2022). Based on the explanation of the relationship, our hypothesis can be established:

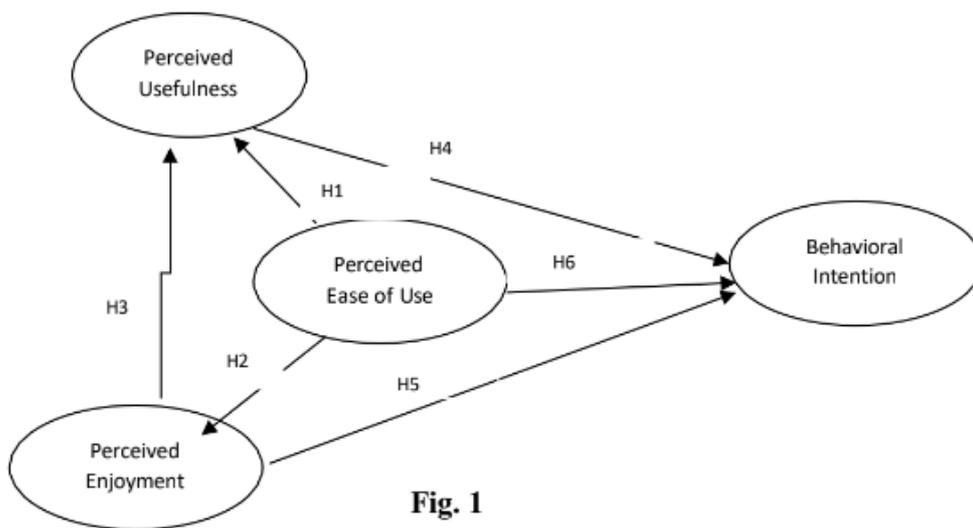
**H6:** Perceived ease of use has significantly influence Behavioral Intention to use Technology based online food delivery service.

The research model, as depicted in Figure 1, is derived from the arguments presented in the introduction and literature review, outlining the interconnections among various constructs. The relationships between factors are identified by corresponding hypothesis numbers. This

model serves as a visual representation of the theoretical framework, providing a structured depiction of the proposed associations. The illustration in Figure 1 encapsulates the comprehensive conceptualization of the research model, offering a guide for understanding the intricate connections between different constructs in the study.

### RESEARCH METHODS

Quantitative research examined causal relationships among constructs and hypotheses regarding the usage of Online Food Delivery (OFD) services like Zomato, Swiggy, and Food Panda in Delhi. PLS-SEM established correlations between perceived ease of use, usefulness, enjoyment, and behavioral intention, with 201 respondents surpassing the recommended sample size. Google Forms distributed the questionnaire, incorporating adapted items from previous research. The



**Fig. 1**  
**Research Framework and Hypotheses**  
**Intention**

study focused on measurement properties via Confirmatory Factor Analysis (CFA) and SEM using Smart PLS 4.0. Descriptive analysis and hypothesis testing provided insights into factors influencing OFD app adoption among Indians, ensuring methodological rigor and credibility.

## RESULTS

### Profile of Respondents

Table 1 presents the demographic profile of respondents. All participants were female, with a significant majority (77%) falling within the

18-23 age group. Regarding the frequency of using food delivery applications, the most common response, chosen by 30%-40% of respondents, indicated a weekly or monthly usage pattern.

### Reliability and Validity

“In assessing the appropriateness of our measurement model, we conducted confirmatory factor analysis (CFA) as outlined in Table 2. The results of the CFA indicate that our model exhibits favorable fit statistics, including a chi-square to degrees of freedom ratio ( $\chi^2/df$ ) of

**Table 1: Participant Demographics.**

Measure	Item	In Percentage
<b>Respondents</b>	Women	
<b>Age</b>	18-23	77%
	24-29	6.3%
	30-35	9.8%
	36-40	4.2%
	41-45	2.1%
	46 and above	0.6%
<b>Educational Qualification</b>	Under Graduate	68.6%
	Graduate	7.2%
	Post Graduate	21.1%
	Doctorate	3.1%
<b>Frequency of using OFD</b>	Weekly	30.4%
	Bi-Weekly	13.2%
	Monthly	29.4%
	Quarterly	15.7%
	Twice a year	2.5%
	Yearly	8.8%

1.71, a root mean square error of approximation (RMSEA) of 0.060, a relative fit index (RMR) of 0.031, and a comparative fit index (CFI) of 0.974. These values align with the recommended thresholds established by Hu and Bentler (1999) and Browne and Cudeck (1992) (RMSEA < 0.08, RMR < 0.05, CFI > 0.90).

Furthermore, all standardized factor loadings for our items exceed 0.60, and the average variance extracted (AVE) is above 0.50, indicating strong convergent validity (Hair, Sarstedt, Ringle & Gudergan, 2017). Additionally, the maximum shared variance is less than the respective AVE for all variables, further supporting convergent validity. Lastly, our variables demonstrate good reliability, with Cronbach's alpha and composite reliability exceeding 0.70."

To assess discriminant validity, the study compared the square root of the average variance extracted (AVE) with interfactor correlations for each construct, as presented in Table 5. Notably, all correlations were below the square root of the respective AVEs, indicating acceptable discriminant validity. The diagonal elements, representing AVEs (in bold), consistently exceeded the recommended threshold of 0.50 according to Fornell & Larcker (1981). Furthermore, squared correlations between constructs (off-diagonal elements) were consistently smaller than the AVE measures, demonstrating that each construct shared more variance with its items than with other constructs. This robustly met the criteria for discriminant validity, ensuring the distinctiveness of each construct in the model.

**Table 2: Validity and reliability of the measurement result**

Variable/Constructs Items		Standardized factor loading	Cronbach Alpha	Composite Reliability	Average Variance Extracted
Perceived Usefulness (PU)	PU1	.84	<b>0.89</b>	<b>0.93</b>	<b>0.67</b>
	PU2	.85			
	PU3	.87			
	PU4	.69			
Perceived Ease of Use (PEOU)	PEOU1	.87	<b>0.91</b>	<b>0.95</b>	<b>0.72</b>
	PEOU2	.92			
	PEOU3	.86			
	PEOU4	.74			
Perceived Enjoyment (PENJ)	PENJ1	.89	<b>0.92</b>	<b>0.96</b>	<b>0.75</b>
	PENJ2	.91			
	PENJ3	.89			
	PENJ4	.78			
Behavioral Intention (BI)	BI1	.82	<b>0.90</b>	<b>0.94</b>	<b>0.69</b>
	BI2	.92			
	BI3	.77			
	BI4	.81			

Note:  $p < 0.001$ .

**Table 3: Discriminant Validity**

Latent Variable	PU	PEOU	PENJ	BI
PU	<b>0.82</b>			
PEOU	<b>0.81</b>	<b>0.84</b>		
PENJ	<b>0.77</b>	<b>0.66</b>	<b>0.86</b>	
BI	<b>0.76</b>	<b>0.72</b>	<b>0.81</b>	<b>0.83</b>

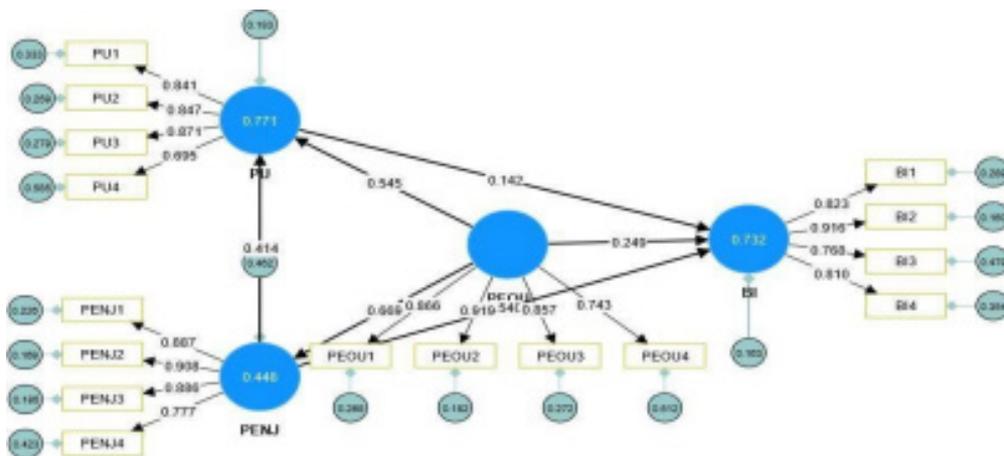
**Testing Hypotheses**

“The structural model exhibited robust fit statistics (Figure 2):  $\chi^2$  (144) = 263.67,  $p < 0.01$ , CFI = 0.97, NFI = 0.94, TLI = 0.96, RMR = 0.03, and RMSEA = 0.04. We tested six research hypotheses, and the results revealed the following: “

1. **Perceived Usefulness (PU):** There was no significant relationship between perceived usefulness and behavioral intention (H4 rejected).
2. **Perceived Ease of Use (PEOU):** PEOU positively influenced perceived usefulness ( $\beta = 0.54$ ,  $t = 7.696$ ), supporting H1. Additionally, PEOU had positive effects on perceived enjoyment and behavioral

intention ( $\beta = 0.67$ ,  $t = 9.687$ ;  $\beta = 0.24$ ,  $t = 2.612$ , respectively), confirming H2 and H6.

3. **Perceived Enjoyment (PE):** PE significantly affected both perceived usefulness and behavioral intention ( $\beta = 0.41$ ,  $t = 6.094$ ;  $\beta = 0.54$ ,  $t = 6.134$ , respectively), supporting H3 and H5.
4. **Variance Explained:** The model explained substantial variance in PU ( $R^2 = 0.77$ ), perceived enjoyment (PENJ,  $R^2 = 0.45$ ), and behavioral intention (BI,  $R^2 = 0.732$ ).
5. **PEOU and PE Relationship:** PEOU explained 54% of the variance in PE. Together, PEOU and PE accounted for 47% of the variance in perceived usefulness.
6. **PEOU and Perceived Enjoyment:** PEOU significantly influenced perceived enjoyment (explaining 45% of the variance).
7. **Overall Impact:** PEOU, PU, and PENJ jointly explained 73.2% of the variance in behavioral intention, with perceived enjoyment playing a more substantial role than perceived usefulness and ease of use.”



**Figure 2. Results of PLS-SEM**

**Table 3: Hypothesis and Path Coefficient**

Hypothesized Path	Standardized Path Coefficients	t-Value	Results
H1: PEOU → PU	0.54	7.696	Supported
H2: PEOU → PENJ	0.67	9.687	Supported
H3: PENJ → PU	0.41	6.094	Supported
H4: PU → BI	0.14	1.194	Rejected
H5: PENJ → BI	0.54	6.134	Supported
H6: PEOU → BI	0.24	2.612	Supported

Note:  $p < 0.001$ .

## V. DISCUSSION

In light of the rapid evolution of cutting-edge technologies, it is imperative to grasp how the food service industry can harness these innovations to enhance efficacy in diverse business domains such as marketing, hiring, customer service, and overall operations (Di Pietro et al., 2012).

Numerous studies underscore the significance of e-service, particularly in restaurants offering Online Food Delivery (OFD) services (Suhartanto et al., 2019). Technological progress has enabled Artificial Intelligence (AI) to furnish e-service agents, aiding businesses in improving offerings and cultivating a favorable clientele (Chung et al., 2018). However, the technology employed by AI in the food service sector requires more attention in academic literature (Ruiz- Molina et al., 2014). This study aims to investigate consumers' intentions to use technology-based online meal delivery services within an Emerging Technology Acceptance Model

(ETAM) framework, offering practical solutions for policymakers. Research on emerging technologies like chatbots, robotic delivery, augmented or virtual reality, and AI-based recommendations for food delivery services is in its nascent stages, necessitating further examination to ensure alignment with customer needs. The current study contributes to the understanding of Online Food Delivery (OFD) and emerging technologies by elucidating how these technologies influence consumer perceptions of OFD services, the study's findings did not reveal a significant correlation between behavioral intention and perceived usefulness, contrary to expectations. This differs from other studies (Ngubelanga et al., 2021; Tarigan et al., 2021; Palumia et al., 2021; Krishanan & Koshy et al., 2021) establishing a positive relationship between these variables in contexts like online food delivery, information systems, and mobile commerce applications for millennials. However, alignment with a study on food delivery apps in India (Gupta et al., 2021) suggests no relationship between user

benefits and behavioral intention, consistent with our results. Despite this, the study uncovered a robust and favorable correlation between Perceived Ease of Use (PEOU) and Perceived Usefulness (PU).

In summary, the study addresses the evolving landscape of technology in the food service industry, emphasizing the need for further research to align technological advancements with consumer needs. The unexpected findings regarding the relationship between perceived usefulness and behavioral intention underscore the complexity of factors influencing consumers' acceptance of emerging technologies in the context of online meal delivery services. The results validated the findings of previous studies (Rauniar et al., 2014; Tarigan et al., 2019; Hubert et al., 2018; Kim & Ciu, 2019). It can be inferred that consumers who are more likely to think about how convenient it is to use food delivery services will quickly determine how useful new technologies are to them. This study also demonstrated that there is a positive correlation between perceived utility and ease of use. Furthermore, as previous research has shown, perceived usefulness was positively impacted by perceived ease of use in a significant way. This suggests that people would consider food delivery services that are simpler to use to be more beneficial.

Our findings are consistent with earlier research, which found that consumers' perceived enjoyment of technology-based online meal delivery applications is a major factor in increasing their intention to purchase (Lee et al., 2005; Serenko et al., 2008; Shen et al.,

2009; Vander herijden, 2004). Specifically, it was discovered that the intention to use was more influenced by perceived enjoyment than by PU and PEOU (Roberta et al., 2020). Finally, it was discovered that intention to use was significantly influenced by perceived enjoyment and ease of use, which is consistent with other research (Lee et al., 2017; Lee et al., 2022; Silva et al., 2022; Yoon et al., 2021). These findings suggest that...

Consumers' intentions to use food delivery applications are positively correlated with their perception of using technology and ease of use. This study's noteworthy achievement is a validated model encompassing diverse evaluation dimensions for online ordering platforms. The measurement model exhibited satisfactory convergent and discriminant validity, ensuring the robust assessment of constructs. The versatility of this model extends to the integration of emerging technology in Online Food Delivery Apps (OFDA), making it applicable to technology-based online food delivery platforms. It is important to take into account the limitations of the current study. First, future researchers should consider the challenge of generalizability, as findings from diverse cultural backgrounds may vary. To enhance generalization, forthcoming studies should aim for higher response rates. Additionally, it's essential to note that the data for this study originated from Online Food Delivery App (OFDA) users who may be particularly attuned to new technologies. The users that were looked at could be given more thought and could offer more information about market segmentation and potential acceptability. It would be interesting to investigate the degree to which

older people plan to adopt new technologies and the reasons behind their intention to use OFDA technologies. Lastly, we think more investigation is necessary to determine whether implementing Emerging Technologies in OFDA could be beneficial in other sectors of the economy.

## CONCLUSION

The findings of our research have consequences for OFD services and emerging technology. To the best of our knowledge, OFD services made possible by emerging technologies—AI-based recommendation, chatbots, AR/VR, and so on—remain unexplored, despite the fact that some studies have begun to examine the role of technologies in application in various domains (Chattaraman et al., 2019; Jung et al., 2018). In light of this, our research provides valuable insights for food delivery businesses looking to target younger clientele by utilizing contemporary interactive technologies to figure out how technology-based OFDA influences consumers' intentions. In this regard, our research emphasizes that expanding the number of touch points available in the OFD segment requires more than simply implementing technology in OFDA. This study extends the Technology Acceptance Model (TAM) by incorporating the constructs of perceived ease of use, perceived usefulness, enjoyment, and behavioral intention specific to Online Food Delivery Apps (OFDA). The outcomes demonstrated the expanded use of TAM on platforms for online meal delivery. Enjoyment and perceived usefulness are positively impacted by perceived ease of use.

Moreover, intention to use is positively and significantly impacted by perceived ease of use and enjoyment. OFD industry practitioners can use this result to better understand how to improve the behavioral intentions of their customers. Additionally, this study advances the ongoing investigation into the use of TAM in OFD platforms.

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## Figure 2. Results of PLS-SEM

**Table 3: Hypothesis and Path Coefficient**

Hypothesized Path	Standardized Path Coefficients	t-Value	Results
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H2: PEOU PENJ	0.67	9.687	<b>Supported</b>
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H4: PU BI	0.14	1.194	<b>Rejected</b>
H5: PENJ BI	0.54	6.134	<b>Supported</b>
H6: PEOU BI	0.24	2.612	<b>Supported</b>

Note:  $p < 0.001$ .

## DISCUSSION

In light of the rapid evolution of cutting-edge technologies, it is imperative to grasp how the food service industry can harness these innovations to enhance efficacy in diverse business domains such as marketing, hiring, customer service, and overall operations (Di Pietro et al., 2012).

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# JOB DEMANDS OF POLICE PERSONNEL: IDENTIFYING THEMES AND RESEARCH CLUSTERS FROM BIBLIOMETRIC ANALYSIS

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## ABSTRACT

Policing is the only arm of the state that is authorized to use coercive force against its citizens, which makes the job uniquely demanding. With the emergence of a work culture characterized by job demands with complex technology, work overload, social isolation, sleep disturbances, and spillover effects leading to work-life imbalance, police work has been identified as one with a highly stressful environment. Despite interest over the years in the predictors and outcomes of police stress, the research findings are inconsistent. No review, to date, has offered a holistic retrospection on the job demands of the police. The current study is an attempt to overview job demands research on police personnel using bibliometric analysis and systematic review of literature. The study highlights the publication trend, the most productive and influential authors, the significant areas of research in the domain, and infers the intellectual structure of job demands research on police personnel. Using the science mapping techniques of co-citation and bibliometric

coupling analyses, the study infers the knowledge foundation and the thematic structure of job demands research in police personnel for the period 1983-March 2024 by uncovering six and eight specific areas of job demands research on police personnel respectively. Additionally, by using co-occurrence analysis, the study also attempts to highlight the influential topics of research in the same period divided into four segments and also outlines the future research directions in the domain of job demands with police personnel as the focal point.

**Keywords:** A Bibliometric Analysis Review

## INTRODUCTION

Work is considered to be the key element of human endeavors, the key element of progress and the achievement of goals. It is further defined as the human being's central identification with leading a productive life. It is every human being's life objective and, simply put, the means to earn a living, as stated by the WHO Occupational Health Programme in 1978. Individuals' ability

to derive meaning from their daily experiences is considered an essential element of their respective well-being (Keyes, 2007; Clausen & Borg, 2011). It is due to this reason that the experience of meaning at work has found a relationship with general well-being (Arnold et al., 2007), reduced rates of turnover (Leiter et al., 1998; Milliman et al., 2003), reduced sickness absence (Clausen et al., 2010), and enhanced organizational commitment (Milliman et al., 2003). The continuous interaction between man and his work environment, consisting of physical and psychological elements, is associated with positive or negative effects on health, and the organizational processes themselves are influenced by the individual's state of physical and mental well-being, which is influenced by job demands (Karasek, 1979; Johnson, 1989; Bakker & Demerouti, 2007).

## REVIEW OF LITERATURE

### Job Demands

Job demands are defined as those aspects of work that require sustained physical and mental effort (Bakker & Demerouti, 2007) and therefore found to have a relationship with certain physiological and psychological costs (Schaufeli & Bakker, 2004) and can be ascertained by the amount of stress caused to the worker participating in the work/job and is therefore dependent on the environment in which the job is to be done (Karasek, 1979). The demands can be categorized as quantitative demands, which are defined as work characterized by high work overload and high pressure of work. Emotional demands require the ability to deal with strong feelings

such as sorrow, anger, desperation, and frustration at work (Johannessen et al., 2013) and effort needed to deal with emotions that are required or desired by the organization from its members in interpersonal transactions. Role demands mean uncertainties that an employee encounters related to his/her responsibilities/role and the associated difficulty in the performance of such roles. It consists of role conflicts (occurs when the information and instructions received to perform a role are mutually exclusive or contradictory) and role ambiguity (when an employee lacks clarity or is not clear about his/her tasks and objectives) and is found to have a positive relationship with stress (Parikh et al., 2004; Wickramasinghe, 2010; Frank et al., 2017) and anxiety (Doby & Caplan, 1995). The physical and motoric aspects of behavior or demands related to musculoskeletal systems are physical in nature. The study of the job demands of police becomes more critical when one considers the potential for societal harm when police personnel are working in distress (Toch, 2002).

### Job Demands and Police

Policing is considered one of the most stressful occupations (Lieberman et al., 2002; Webster, 2013) due to the nature of their duties and particularly the job demands (Violanti & Aaron, 1994), and as they are considered never off duty (Thakre et al., 2019), being at high risk in terms of developing mental health issues (Sharma, 2019), problems related to physical health, psychological well-being, and job satisfaction (Shane, 2010), high prevalence of hypertension and diabetes, cardiac and metabolic disorders (Gershon et al., 2002), sleep disorders, and

work absenteeism (Elgmark Andersson et al., 2017). The stress transcends to their families as well (Burke, 1993). The response time of police officials is often in seconds to complex life-threatening situations, but at the same time, they encounter constant criticism on social media and threats to their lives (Patel et al., 2019), despite their importance for strength and emotional serenity (Burns, 2014). Fox and Spector (2002) found a relationship between emotional work and emotional exhaustion. Selokar et al. (2011) found higher stress among lower ranks. With continuous difficulty in retention (PERF, 2021) and an increasing rate of crime, there have been resultant effects on the quality of investigation and work overload stress prevalent among police personnel (Hart et al., 1995).

Though studies have been conducted on job demands across different occupational groups, there has been a dearth of review studies of job demands on police. The current study provides an evaluation of the available literature through bibliometric analysis and systematic literature review (SLR) and attempts to answer the following research questions:

RQ1. What is the current trend of research in the domain of job demands of police personnel?

RQ2. What are the most productive contributors in job demands research in terms of authors, institutions, countries, and their influence?

RQ3. What are the leading, influential, and impactful sources of the literature?

RQ4. What are the most influential articles in the research domain of job demands on police personnel?

RQ5. How has the conceptual and intellectual structure evolved over the years?

RQ6. Which specific areas are addressed within the study of police and job demands?

RQ7. What are the research directions/ areas/gaps that need to be addressed in the future?

To answer the vital research questions, various bibliometric analyses such as citation analysis, co-citation analysis, bibliographic coupling, co-occurrence analysis, Scopus search and analysis were conducted. The systematic literature review specifically addresses the last two research questions.

The Appendix section of the paper reports the list of studies reviewed after meeting the inclusion criteria (see Table 7).

## RESEARCH METHODOLOGY

The current study adopted a variety of bibliometric analysis techniques and a systematic review of literature approach. The former involves the application of quantitative tools on bibliographic and bibliometric information and aids in eliminating the risk of subjective bias, which is common in qualitative synthesis of literature. Due to its utility in handling large volumes of data, uncovering emerging trends in articles and other research constituents, as well as their performance, to find the interrelationship among them (Cobo et al., 2015), and its ability to deduce the foundational themes and knowledge base of a domain, the approach enables both a retrospective summary of the domain and predicting future research directions (Goodell

et al., 2021). The current study followed Donthu et al.'s (2021) four-step procedure for undertaking a review using a bibliometric approach: (1) define the objective or aims and scope of the study; (2) choose the approach or techniques for bibliometric analysis; (3) collect the data; and (4) use the collected data for running the analysis and reporting the findings.

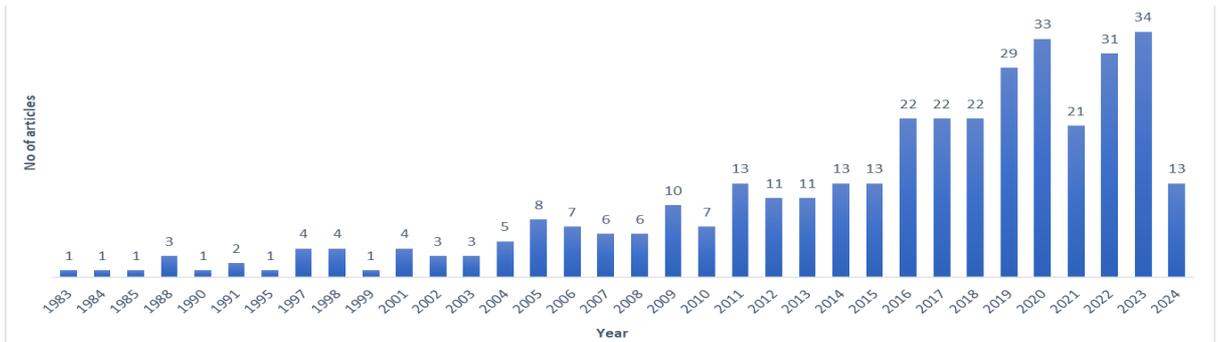
The study aims to report the trend of research efforts in the domain of job demands of police personnel from a retrospective approach. At the same time, it provides directions for future research, deduces the intellectual structure of job demands research of police, establishes the visualizations of thematic evolution of the domain under study encapsulating the influential authors, institutions, and countries that contributed to the literature. For techniques of analysis, performance analysis of the data corpus, which explains the contributions of research constituents to the domain (Cobo et al., 2011), followed by science mapping techniques, which explain the relationships between research constituents and intellectual and structural connections among them (Baker et al., 2021), were applied. Hence, techniques of citation analysis, co-citation analysis (for knowledge

foundations), bibliographic coupling (to unveil the thematic clusters and intellectual structure), and co-occurrence analysis (to predict the topical trajectories and better interpretation of thematic clusters) (Donthu et al., 2021). The study used the Scopus database to acquire the data as it is considered a comprehensive collection of peer-reviewed articles (Pattnaik et al., 2020) and provides the flexibility to search across a diversified bibliographic study domain (Hassan & Ahmi, 2002). Through SLR, the thrust is upon finding the areas that are addressed when job demands research involving police personnel is conducted and on areas of the domain which researchers hold remains to be addressed or needs more research efforts in the future for generalizability and for answering the questions that arise out of gaps in the literature. VOSviewer, along with Rstudio, is employed for analysis and visualizing bibliometric data extracted from the Scopus database. Data extracted from databases is in raw format and contains duplicate, erroneous records, and is not entirely fit to run analysis; hence, data cleaning was applied to remove such entries. Table 1 explains the methodical technique applied in the study to arrive at the figure of 359 articles.

**Table 1: Search criteria and selection of articles**

Corpus Filtering Criteria								Reject	Accept
Criteria for search input									
Search database: Scopus									
Search date: 12 March 2024									
Search query/ term: ("job demands" OR "work demands" OR "workplace demands" OR "occupational demands") AND ("police*" OR "policing" OR "law enforcement" OR "security")									482
Article selection									
Screening Criteria: Language : Include documents in only English								11	471
Erroneous records screening: Include documents with valid title and author information								10	461
Content screening: Include articles if "Titles, abstracts, and keywords" indicate relevance to scope of study (i.e., Job demands in Police personnel) only								102	359

The table presents the systematic technique for arriving at the corpus of 359 articles.



**Fig. 1: Publication Trend**

## RESULTS AND DISCUSSION

### Research trends and scientific productivity

The publication trend of job demands research in the framework of police personnel is shown in Figure 1. The total number of documents is plotted on the Y-axis against their respective year of publication on the X-axis. The figure indicates that research on work demands is not new and has been occurring for more than four decades. The research journey in this domain began with Violanti et al.'s (1983) work on occupational demands and the consumption of alcohol as a coping tool. Findings reported psychological distress as mediating between demands and alcohol consumption, also having a positive effect on alcohol use. However, until 2010, the pace of research has been slow, with the research work remaining mostly in single digits. But since the previous decade, the pace of research has been observing an upward trajectory. The most productive years are 2023 (34 articles), followed by 2020 (33 articles) and 2022 (31 articles). This year's data shows this rising trend is expected to continue in the coming years as well, with 13 documents

published by mid-March this year, making 38.23% of the highest tally of articles published in the previous year.

### Top authors, institutions, and countries of job demand research on police personnel

Table 2 below highlights the authors who contributed most to the domain of job demands of police personnel. Along with that, the table also provides an outline of the authors' affiliations (institution and country) from the period of 1983 to March 2024. Based on the number of citations, Bakker emerges as the most influential and impactful author with 702 citations, followed by Bongers and Van Mechelen with 539 citations each to their name. In terms of productivity, Dollard and Burke top the list with 7 documents each to their name, immediately followed by Bakker with 6 publications. In terms of institutions contributing to the research of job demands of police personnel, Utrecht University and the Department of Social and Organizational Psychology are the most influential as well as the most productive institutions with

**Table 2: Top Authors, institutions and countries of Job Demand research on Police Personnel**

TC	Author	TP	TC	Institution	TP	TC	Country	TP
702	bakker, arnold b.	6	511	utrecht university, netherlands	3	2930	netherlands	47
539	bongers, paulien m.	3	468	department of social and organizational psychology, utrecht university, utrecht, nethe	2	1865	united states	76
539	van mechelen, willem	3	423	tno work and employment, 2130 as hoofddorp, p.o. box 718, netherlands	2	1280	australia	54
537	demerouti, evangelia	4	374	department of clinical chemistry, klinikum grosshadern, university of munich, 8000 mu	1	1243	canada	28
463	dollard, maureen f.	7	374	department of medical sociology, medical school, university of marburg, d-3550 marb	1	1204	united kingdom	35
395	tuckey, michelle r.	5	308	department of social medicine, faculty of medicine, vrije universiteit amsterdam, 1081	1	718	germany	16
380	schaufeli, wilmar b.	5	308	institute for research in extramural medicine, faculty of medicine, vrije universiteit am	1	689	norway	15
375	burke, ronald j.	7	308	tno work and employment, 2130 as, hoofddorp, p.o. box 718, netherlands	1	388	china	20
374	cremer, peter	1	284	department of management, john molson school of business, concordia university, ca	1	333	italy	8
374	junge, astrid	1	284	department of work and organizational psychology, erasmus university rotterdam, ins	1	216	hong kong	4
374	peter, richard	1	284	department of work and organizational psychology, erasmus university, rotterdam, ne	1	194	belgium	9
374	seidel, dieter	1	284	erasmus university, netherlands	1	172	poland	7
374	siegrist, johannes	2	284	norwich business school, university of east anglia, united kingdom	1	141	sweden	13
362	heuven, ellen	2	268	erasmus university rotterdam, netherlands	2	140	taiwan	6
341	winefield, anthony h.	4	240	department of psychology, university of tromsø, n-9037 tromsø, norway	2	134	switzerland	6
308	arins, geertje a. m.	1	224	eindhoven university of technology, netherlands	1	133	south korea	10
308	bouter, lex m.	1	219	norwegian school of management bi, university of tromsø, n-9037 tromsø, norway	1	131	france	6

TC = total citations, TP = total publications. The research constituent appears according to total citations.

**Table 3: Top journals for Job Demand research on Police Personnel**

Journal	Publisher	TP	TC	h_index	g_index	m_index
International Journal Of Stress Management	American Psychological Association	9	720	7	9	0.333
Journal Of Occupational And Organizational Psychology	Wiley-Blackwell	5	450	5	5	0.333
Journal Of Occupational Health Psychology	American Psychological Association	5	416	5	5	0.227
American Journal Of Industrial Medicine	Wiley-Blackwell	5	410	4	5	0.167
Journal Of Applied Psychology	American Psychological Association	3	408	3	3	0.081
Social Science And Medicine	Elsevier	2	383	2	2	0.057
Journal Of Criminal Justice	Elsevier	3	299	3	3	0.158
Journal Of Managerial Psychology	Emerald	2	237	2	2	0.2
Occupational And Environmental Medicine	Lippincott Williams & Wilkins	7	227	5	7	0.294
Journal Of Management	Sage	1	224	1	1	0.143
Personnel Review	Emerald	2	199	2	2	0.222
Frontiers In Psychology	Frontiers Media	9	196	6	9	0.667
Journal Of Psychosomatic Research	Elsevier	1	195	1	1	0.036
Scandinavian Journal Of Work, Environment And Health	Nordic Association of Occupational Safety and Health	5	179	4	5	0.148
Journal Of Occupational And Environmental Medicine	Lippincott Williams & Wilkins	12	165	8	12	0.308
Journal Of Organizational Behavior	Wiley-Blackwell	2	163	2	2	0.067
International Journal Of Environmental Research And Public Health	MDPI	13	158	7	12	0.875
Anxiety, Stress And Coping	Taylor & Francis	3	155	3	3	0.2
Stress And Health	John Wiley & Sons	3	146	3	3	0.188
Social Psychiatry And Psychiatric Epidemiology	Springer Science+Business Media	2	145	2	2	0.143

TP = total publications, TC = total citations, the remaining three columns indicate the journal's impact presented in the form of h-index, g-index, and m-index.

511 and 468 citations respectively. Furthermore, based on the countries, the Netherlands (2930 citations) and the United States of America

(1865 citations) have the most influential contribution to the job demands research of police personnel.

## Top journals for job demand research on police personnel, their influence, and impact

The top journals that publish research on job demands in police personnel are shown in Table 3 along with the publisher of each journal, the productivity, the total citation score, and the h, g, and m index, which highlight the impact of the journal. In terms of citations or influence, the International Journal of Stress Management tops the list with 720 citations, followed by the Journal of Occupational and Organizational Psychology with 450 citations. The International Journal of Environmental Research and Public Health is the most productive source in the domain with 13 publications, immediately followed by the Journal of Occupational and Environmental Medicine with 12 publications. Both these journals contribute 26.59% of the total articles in the table. Following the trends of publication

as mentioned in Table 1, the journals are becoming more receptive to research work in the area of job demands of police personnel, as more than 43% of total publications from 1983 to mid-March 2024 have been during the last five years.

## Most influential articles on job demands research on police personnel

The top-cited publications in research work on job demands in police personnel have been listed in Table 4, along with the publication title, the authors, the year, and the total citation score based on citation analysis. Siegrist et al.'s (1990) "Low-status control, high effort at work and ischemic heart disease: prospective evidence from blue-collar men" is identified as the most influential article in the domain of this study accredited with the highest citation score in Scopus of 374, followed by Arins et

**Table 4: Top articles on Job Demand research on Police Personnel**

Author	Title	TC
Siegrist et al. (1990)	Low status control, high effort at work and ischemic heart disease: Prospective evidence from blue-collar men	374
Arins et al. (2001)	Psychosocial risk factors for neck pain: a systematic review	308
Bakker and Heuven (2006)	Emotional dissonance, burnout, and in-role performance among nurses and police officers.	284
Miraglia and Johns (2016)	Going to work ill: A meta-analysis of the correlates of presenteeism and a dual-path model.	284
Petrou et al. (2018)	Crafting the Change: The Role of Employee Job Crafting Behaviors for Successful Organizational Change	224
Martinussen et al. (2007)	Job demands, job resources, and burnout among police officers	219
Stansfeld et al. (1997)	Work and psychiatric disorder in the Whitehall II Study	195
Bos-Nehles et al. (2017)	HRM and innovative work behaviour: a systematic literature review	190
Breevaart et al. (2015)	Leader-member exchange, work engagement, and job performance	184
Hall et al. (2010)	Job demands, work-family conflict, and emotional exhaustion in police officers: A longitudinal test of competing theories	179
Mcgonagle et al. (2015)	Individual and work factors related to perceived work ability and labor force outcomes.	155
Richardsen et al. (2006)	Work and health outcomes among police officers: The mediating role of police cynicism and engagement.	140
Miller et al. (2003)	Diversity in Blue: Lesbian and Gay Police Officers in a Masculine Occupatio	129
Amick et al. (2002)	Relationship Between All-Cause Mortality and Cumulative Working Life Course Psychosocial and Physical Exposures in the United States Labor Market From 1968 to 1992	128
Carlson et al. (2011)	Health and turnover of working mothers after childbirth via the work-family interface: An analysis across time.	127
Kirmeyer (1988)	Coping with competing demands: Interruption and the Type A pattern.	126
Loi et al. (2011)	The interaction between leader-member exchange and perceived job security in predicting employee altruism and work performance	118
Ariëns et al. (2002)	High physical and psychosocial load at work and sickness absence due to neck pain	116
Sluiter (2006)	High-demand jobs: Age-related diversity in work ability?	116

Most frequently cited publications on occupational stress in police personnel, along with author(s), publication year, title, and TC = total citations.

al.'s (2001) "Psychosocial risk factors for neck pain: a systematic review" with a 308 citation score, which reported a positive relationship between neck pain and high quantitative job demands. Furthermore, Bakker and Hueven's (2006) "Emotional dissonance, burnout, and in-role performance among nurses and police officers" focused on police officers and found emotionally demanding interactions result in emotional dissonance and further burnout.

### Top references for job demand research on police personnel

This section of the paper focuses more closely on the cited publications that are referred to frequently in the domain of job demands research in police personnel. Hence, this section examines the research work that is often cited to answer or uncover the initial or foundational inquiries in the area of job demand research. Table 5 provides a list of top references in the research corpus under study,

along with each publication, its local citations, the authors, and global citations are also given. "The Job Demands-Resource Model of Burnout" by Demerouti et al. (2001), which first proposed and tested the JD-R model and found job demands related to exhaustion and lack of job resources to disengagement, is the top reference paper in the corpus of research articles with 22 local citations and 7067 global citations. It is immediately followed by Bakker and Demerouti's "The Job Demands-Resource Model: State of the Art" (2007) with 20 local citations and 6399 global citations, which provides an outline of the studies that have taken the JD-R model as one of the focal points in their work. Furthermore, Bakker et al.'s (2005) "Job Resources Buffer the Impact of Job Demands on Burnout" work concentrates on the vital importance of autonomy and the importance of performance feedback, which is found to buffer the negative impact of job demands on burnout and has 13 local citations and 1422 global citations.

**Table 5. Top references for Job Demand research on Police Personnel**

LC	Cited References	Title	GC
22	Demerouti et al. (2001)	THE JOB DEMANDS-RESOURCES MODEL OF BURNOUT	7067
20	Bakker and Demerouti (2007)	THE JOB DEMANDS-RESOURCES MODEL: STATE OF THE ART	6399
13	Bakker et al. (2005)	JOB RESOURCES BUFFER THE IMPACT OF JOB DEMANDS ON BURNOUT	1422
11	Aiken and West (1991)	MULTIPLE REGRESSION: TESTING AND INTERPRETING INTERACTIONS	11
11	Hobfoll (1989)	CONSERVATION OF RESOURCES: A NEW ATTEMPT AT CONCEPTUALIZING STRESS	9540
		JOB DEMANDS, JOB RESOURCES, AND THEIR RELATIONSHIP WITH BURNOUT AND ENGAGEMENT:	
10	Schaufeli and Bakker (2004)	A MULTI-SAMPLE STUDY	4935
8	Blau (1964)	EXCHANGE AND POWER IN SOCIAL LIFE	433
8	Hobfoll (1989)	CONSERVATION OF RESOURCES: A NEW ATTEMPT AT CONCEPTUALIZING STRESS	9540
8	Hobfoll (2002)	SOCIAL AND PSYCHOLOGICAL RESOURCES AND ADAPTATION	2969
8	Shane (2010)	ORGANIZATIONAL STRESSORS AND POLICE PERFORMANCE	243
		WORK-RELATED STRESS AND COPING AMONG CORRECTIONAL OFFICERS: IMPLICATIONS FROM	
		ORGANIZATIONAL LITERATURE	
7	Triplett et al. (1996)		166
7	Bandura (1997)	SELF-EFFICACY: THE EXERCISE OF CONTROL	28

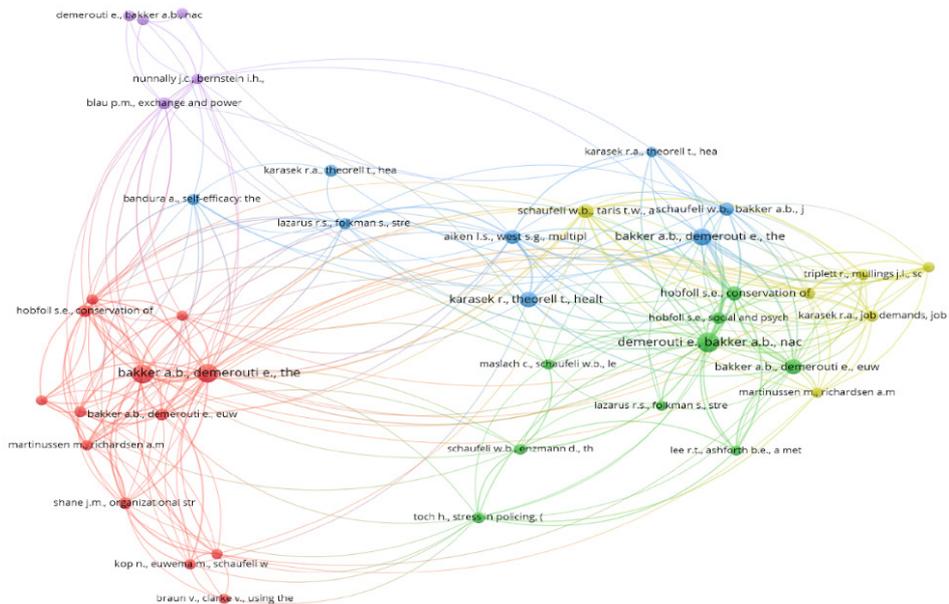
LC = local citations, GC = global citations

### Knowledge foundations of job demands in police personnel through co-citation analysis

Figure 2 shows the co-citation map of references that are cited at least five times by the articles in the review corpus under study for this paper. The objective of drawing a co-citation map based on references is to reveal the intellectual structure of a research domain (Rossetto et al., 2018), for instance, the underlying themes and to uncover the knowledge foundations (Liu et al., 2015; Donthu et al., 2021). Co-citation is a science mapping technique that assumes that those publications that are cited together frequently are similar to each other thematically (Hjørland, 2013). From Figure 2, we can observe that co-citation analysis of co-cited

references reveals that research work in the domain of job demands focusing on police personnel draws upon existing research from five foundational clusters, namely working conditions (red nodes), resources (green nodes), work design relation with burnout, productivity (blue nodes), stress (yellow nodes), and social structure in an organization (purple nodes).

By further examining these groups, we observe that these individual foundational clusters are converging into three overarching foundational clusters. For example, red and blue nodes converge as those focusing on working conditions and work design, whereas green and purple nodes converge as resources, and yellow nodes focus on stress.



**Fig. 2: Co-citation of references cited by articles on job demands research on police personnel. Each node represents a cited reference. Each color of nodes represents a semantic cluster of references based on thematic similarity. The size of nodes represents the degree of local citations wherein larger nodes reflect greater intensity of local citations. The link between nodes represents co-citations. The size of the link between nodes represents the degree of co-citations wherein thicker links reflect greater co-citation intensity.**

## Thematic clusters of job demand research on police personnel through bibliographic coupling

The previous section of the study focused on knowledge foundation through co-citation analysis. We further examine the review corpus in this section through a different science mapping technique called bibliographic coupling to build on the knowledge foundation. Since co-citation analysis concentrates on the publications that are highly cited to build on the themes, it leaves the more recently developed or niche publications out of their scope (Donthu et al., 2021). On the other hand, bibliographic coupling focuses on the citing publication itself to explain the present knowledge in the field (Goodell et al., 2021). Thus, bibliographic coupling not only encapsulates seminal knowledge but also focuses on niche and recent knowledge which might have not received many citations due

to its recent nature and might have thus been overlooked by the co-citation analysis (Donthu et al., 2021). Table 6 provides an overview of five thematic clusters that underpin the knowledge structure of job demand research on police personnel through the science mapping technique of bibliographic coupling.

Cluster 1 consists of 127 articles ranging from 1983 to 2024, which primarily focus on the stressors faced by individuals. These stressors were physical, psychological, and social. The top three cited papers in this cluster are Ariens et al. (2001), Stansfeld et al. (1997), and Amick et al. (2002), with citation scores of 308, 195, and 128, respectively. Ariens et al. (2001) found a positive association between neck pain and high quantitative job demands, low social support from colleagues, low job control, low skill discretion, and low job satisfaction. Stansfeld et al. (1997) found high demands at work to be associated with negative

**Table 6: Thematic clusters of job demand research in police personnel**

Theme	Author(s)	Title	TC
Physical and Psychosocial Stressors	Ariens et al. (2001)	Psychosocial risk factors for neck pain: a systematic review	308
	Stansfeld et al. (1997)	Work and psychiatric disorder in the Whitehall II Study	195
	Amick et al. (2002)	Relationship Between All-Cause Mortality and Cumulative Working Life Course Psychosocial and Physical Exposures in the United States Labor Market From 1968 to 1992	128
Social Support and Work Life Balance	Bos-Nehles et al. (2017)	HRM and innovative work behaviour: a systematic literature review	190
	Breevaart et al. (2015)	Leader-member exchange, work engagement, and job performance	184
	Hall et al. (2010)	Job demands, work-family conflict, and emotional exhaustion in police officers: A longitudinal test of competing theories	179
Work Design	Carlson et al. (2011)	Health and turnover of working mothers after childbirth via the work-family interface: An analysis across time.	127
	Petrou et al. (2018)	Crafting the Change: The Role of Employee Job Crafting Behaviors for Successful Organizational Change	224
	Hu et al. (2017)	How are changes in exposure to job demands and job resources related to burnout and engagement? A longitudinal study among Chinese nurses and police officers	82
Work Engagement	Brenninkmeijer et al. (2010)	Regulatory focus at work: The moderating role of regulatory focus in the job demands-resources model	73
	Bakker and Heuven (2006)	Emotional dissonance, burnout, and in-role performance among nurses and police officers.	284
	Martiniusen et al. (2007)	Job demands, job resources, and burnout among police officers	219
	Richardson et al. (2006)	Work and health outcomes among police officers: The mediating role of police cynicism and engagement.	140
Outcomes of Burnout	Miller et al. (2003)	Diversity in Blue: Lesbian and Gay Police Officers in a Masculine Occupation	129
	Sluiter (2006)	High-demand jobs: Age-related diversity in work ability?	116
	Tuckey et al. (2009)	Workplace bullying: The role of psychosocial work environment factors.	88
	Sherwood et al. (2019)	Identifying the Key Risk Factors for Adverse Psychological Outcomes Among Police Officers: A Systematic Literature Review	46

TC = total citations

mental health and suggested interventions in job design, training, and social support. Amick et al. (2002) examined the relationship between physical and psychosocial work conditions and mortality and found an association between low psychosocial demands, low job control, or passive work and mortality.

Cluster 2 consists of 61 articles primarily focusing on social support and work-life balance, ranging from 2010 to 2024. The top cited papers in this cluster are Bos-Nehles et al. (2017), with 190 citations, who found autonomy, job security, work composition, reward, training and development, and feedback to be practices with a positive impact on innovative work behavior. Breevaart et al. (2015), with 184 citations, found that employees in high-quality leader-member exchange relationships can achieve better job performance and work engagement.

Cluster 3 consists of 54 articles on work design, ranging from 2010 to 2024, with the top three cited articles being Petrou et al.'s (2018) work, with 224 citations, which found that employee resource-seeking behavior has a positive effect on work engagement and that seeking challenges positively affects adaptivity. Hu et al.'s (2017) work, with 82 citations, found that participants working in a highly demanding work environment showed a significant increase in burnout. Brenninkmeijer et al.'s (2010) work, with 73 citations, is on promotion focus and prevention focus. The former affects the motivational processes, whereas the latter influences the exhaustion process.

Cluster 4 consists of 52 articles on work engagement, ranging from 1984 to 2023.

The top three cited articles are Bakker and Hueven's (2006) work, with 284 citations, which found that emotional job demands were associated with disengagement and exhaustion. Martinussen et al.'s (2007) work, with 219 citations, found that burnout is associated with psychosomatic complaints, satisfaction with life, and intention to quit the job. Richardsen et al.'s (2006) work, with 140 citations, found that work engagement partially mediates the effects of job demands, job resources, and individual characteristics on organizational commitment and self-efficacy.

Cluster 5 consists of 23 articles on burnout outcomes, ranging from 2006 to 2023. The top three cited articles are Sluiter's (2006) work, with 116 citations, Tuckey et al.'s (2009) work, with 88 citations, and Sherwood et al.'s (2019) work, with 46 citations. These articles suggest that diversity thinking should be used to make decisions regarding the workability of aging workers in a highly demanding work environment.

### **Thematic trends of job demand research on police personnel through co-occurrence analysis.**

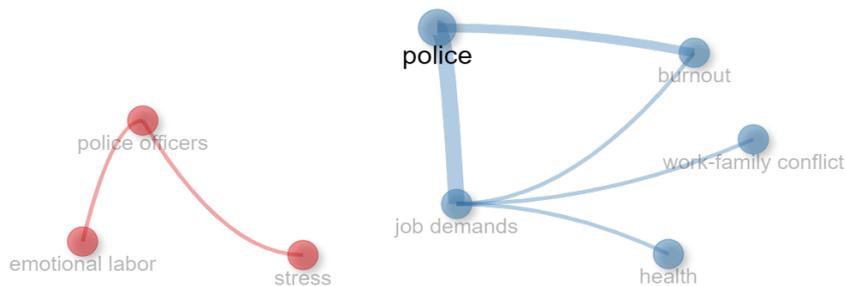
In this part we attempt to further explore the thematic trends in the job demands research through co-occurrence analysis to build on the foundations and themes revealed in previous sections. Co-occurrence analysis explores the existing and future relationships among topics in a research domain, the former helps to elaborate the content of each of the thematic clusters whereas the latter is performed by analysing words from managerial implications

and future research direction content of the paper (Donthu et al. 2021). Figure 3-6 describes the evolution of topics in job demands research on police personnel in chronological order by using author keywords.

The study conducted on the theme of job demands research on police personnel between 1983-2011 (figure 3) focused more on stressors as a whole, police in general (red nodes), and the association of job demands with health and burnout (blue nodes). It is the initial phase of research in the area of job demands that focuses on police personnel.

The study conducted on the theme of job demands research on police personnel between 2012 and 2017 (figure 4) focused on job demands and association with stress (green nodes), resources part of the job demands-resources model (blue nodes), and outcomes (red nodes).

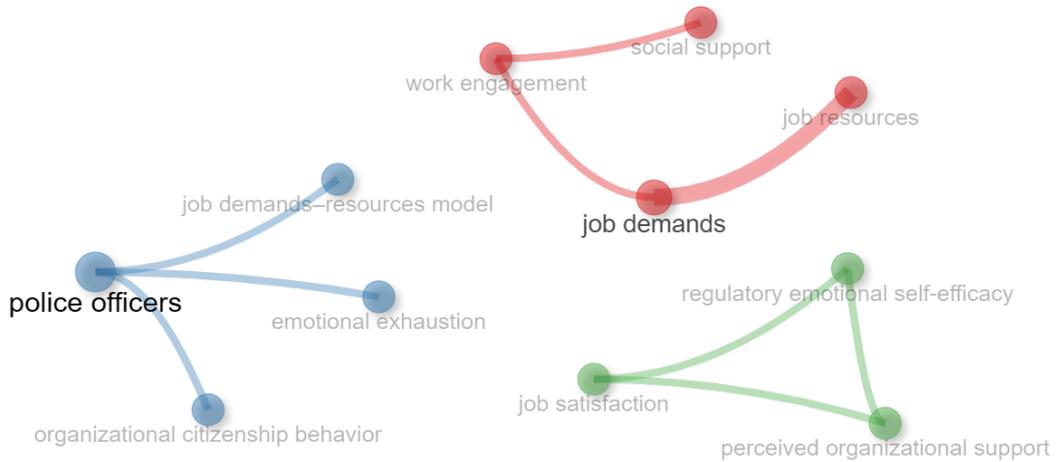
The study carried out between the period of 2018 and 2020 (figure 5) on the theme of job demands research on police personnel focused on work engagement (red nodes) and work design (blue nodes), and there is also a focus on outcomes and social support variables (green nodes).



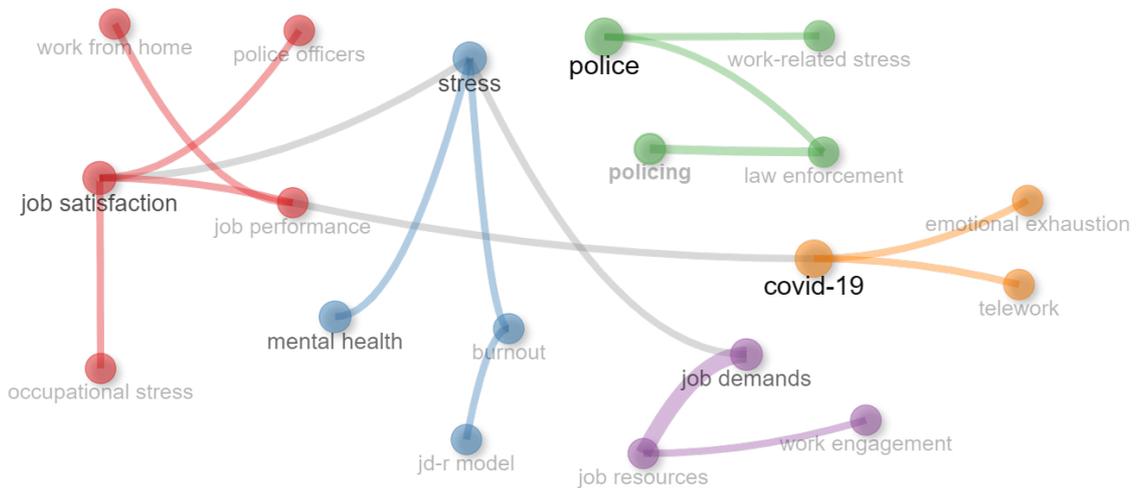
**Fig. 3: Influential topics in the period of 1983-2011**



**Fig. 4: Influential topics in the period of 2012-2017**



**Fig. 5: Influential topics in the period of 2018-2020**



**Fig. 6: Influential topics in the period of 2021-2024**

The study was carried out between the period of 2021 and 2024 (figure 6) on the theme of job demands research on police personnel, emphasizing the areas of work design (red nodes), outcomes (blue nodes), work engagement (purple nodes), and policing in general (green nodes). Additionally, COVID-19, work settings like telework, and work from

home are seen as emerging areas (yellow nodes) of research in the same period.

**Systematic Literature Review**

The same keywords and database were used for the systematic literature review, excluding letters, conference reviews, and books under

the document type tab in Scopus. The search results displayed 348 articles. Then, at each stage, exclusion criteria were applied. For example, those articles that did not address the theme or the topic of the current study in whole or in part were excluded. Figure 7 represents the flow diagram followed for article selection for systematic review.

Table 7 addresses the last two research questions. Firstly, it highlights the specific areas covered in the research domain of job demands involving police personnel. Most of the studies relate to the presence or absence of stress as a consequence of job demands (Violanti et al., 1983) and corresponding resources (Chrisopoulous et al., 2010, Wolter et al., 2019, Tuckey et al., 2012, Oliver et al., 2023, Krause et al., 2023). The effects of increasing job demand without checks and appropriate resources lead to various psychological issues (Hansson et al., 2017, Baka, 2020, Oliver et al., 2023, Opielka and Staller, 2024), such as burnout (Mostert and Joubert, 2005, Martinussen et al., 2007, Smoktunowicz

et al., 2015, Maran et al., 2020, Oliver et al., 2023), work-family conflict (Martinussen et al., 2007, Hall et al., 2010, Duxbury et al., 2018, Maran et al., 2020), and affecting physical health as well (Richardsen et al., 2006, Noblet et al., 2009, Elgmark et al., 2017, Chen and Wu, 2022, Oliver et al., 2023). Mikkelsen and Burke (2004) have discussed different types of job demands often faced by police personnel, such as quantitative demands and hiding emotions, which are particularly considered an important part of police personnel's job as they have to deal with both victims and perpetrators of crime. This often leads to emotional exhaustion, which has been covered widely in research over the years (Mikkelsen and Burke, 2004, Martinussen et al., 2007, Hall et al., 2010, Wolter et al., 2019, Maran et al., 2020, Opielka and Staller, 2024). According to Drew et al. (2024), operational stress can indirectly lead to turnover intention as the former is found to be the strongest predictor of burnout, which can lead to employees leaving the organization (Martinussen et al., 2007). Job

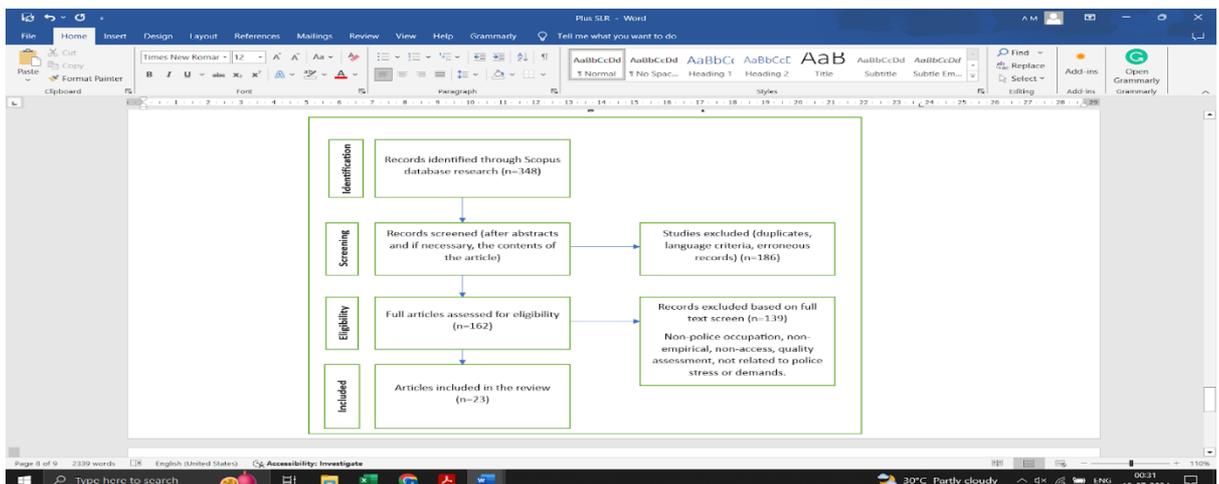


Fig. 7: Flow Diagram of the search process

demands research covers the aspect of resources, both on the job and off the job, as job resources enhance the level of engagement of police personnel. For instance, if the cognitive job demands are matched with cognitive resources, then there is increased efficacy of police personnel. Also, a match between demands and resources mitigates strain (Chrisopoulous et al., 2010), moderates work stress (Oliver et al., 2023). Research on person-centric and situation-centric resources is necessary for stress coping and mental well-being. However, it has also been found that a high level of resources in comparison to job demands is harmful to well-being and, at the same time, matched with high physical demands leads to physical strain (Chrisopoulous et al., 2010). Also, different coping behaviors adopted by police personnel are discussed in job demands research. For instance, alcohol, changes in working style leading to depersonalization, and other job-related attempts to cope (Violanti et al., 1983). Social support and other job resources have been found to moderate the negative effects of job demands, preventing burnout, harassment at the workplace, and counterproductive work behavior. An interesting case was found in the case of police officers engaged in shift work. Mikkelsen and Burke (2004) reported more conflicts and spouse concerns in the case of such officers, whereas Opielka and Staller (2024) found that such officers reported less time overload and better mental well-being. Older officers reported higher exhaustion (Martinussen et al., 2007), and depression was found highest in the 45-50 age group (Baka, 2020). Women reported lower commitment and autonomy (Richardson et al., 2006), low social support, high job strain (Hansson et al., 2017), family

role overload as they have heavier demand outside of work (Duxbury et al., 2018), and higher depression (Baka, 2020) in comparison to male personnel. Autonomy in breaks and holidays is found to be related to job satisfaction and contributes positively to mental health (Krause et al., 2023), and overall autonomy in the job reduces the impact of the stress response (Chen and Wu, 2022).

Future research directions and research gaps have also been discussed in Table 7. Among them, adopting a longitudinal research design is a suggestion shared by the majority of the researchers in this systematic review. There are valid reasons for the same. Firstly, cross-sectional studies make causal relationships problematic. An individual's overall perception of the work environment may get influenced when facing prolonged negative behavior at work. A cross-sectional study cannot overcome this as it records data at a single point in time. Moreover, it limits the findings of research as the perception of stress or work/role overload cannot be examined at a single point in time. For better generalizability, the dynamics of such perceptions have to be recorded over some time, possibly through a longitudinal study design.

Researchers also suggest research on resources like resilience and emotional stability and their effect on job demands and stress. Also, the overall duties performed by police personnel can be divided into complex and standard tasks, and their respective effect on stress response can be recorded. Findings from such an exercise can be inculcated in selection decisions whereby the suitability of the candidate is checked in the initial recruitment stages, thus saving time, cost, and more importantly, lives.

**Table 7: Systematic Literature Review**

S.no	Author	Study Design	Participant Information	Variables	Mediator/Moderator	Findings	Future Research Directions/Recommendations	Location
1	Violanti et al. (1983)	Quantitative; Cross-sectional; Questionnaire	N=500, 21 Police Organizations	Psychological Distress, Occupational Demands (Depersonalization, Authoritarianism, Organizational Defense, Danger Preparation), Police Coping Responses (Cynicism, Secrecy, Deviance, Alcohol Use)	-	Distress associated with alcohol use, Depersonalization directly, and indirectly related to stress and alcohol use, and job-related attempts to cope were ineffective in reducing the stress or impact of demands.	Direct and Indirect effect of depersonalization on distress, Comprehensive study of available coping responses, Panel Analysis to test the causal effects of work factors and distress on alcohol consumption, Impact of occupational stress in other occupations/professions.	United States
2	Mikkelsen and Burke (2004)	Quantitative; Cross-sectional; Questionnaire	N=766, Males (84%), Females (16%), Married (82%), Had children (88%), Constables (62%), Positioned in large departments (36%), worked 36-39 hours per week (86%), born before 1960 (42%)	Work-family conflict, work demands, burnout, work outcomes, coping, psychological and physical health	-	Work-family concerns with psychological health, younger police officers and those working shifts reported more conflicts, Cynicism, Quantitative demands, hiding emotions, and Exhaustion were associated with work-family conflict and spouse concerns, Strong association between burnout and work-family conflict and spouse concerns.	Target Interventions: Check on levels of job demands, alleviating the levels of job demands and exhaustion and focus on the work-family interface.	Norway
3	Mostert K.; Joubert A.F. (2005)	Quantitative; Cross-sectional; Questionnaire	N=340, White (55%), Black (5%), Coloured (39.4%), Indian (0.5%), Male (75.59%), Female (34.4%), Inspector (64.4%), Sergeant (14.1%), Captain (13.8%), Grade 12 (57.6%), Diploma (22.6%), University degree (2.06%)	Occupational Stress, Burnout, Coping.	Coping	Occupational stress strongly influences burnout, Avoidance coping moderated this influence, and Approach coping has a direct influence on burnout.	Interventions at the organizational level to reduce stressors and provide resources, Assessment of coping strategies at personnel selection stages.	South Africa

4	Richardson et al. (2006)	Quantitatives; Cross-sectional; Questionnaire	N=150, Female (20%), Male (80%), Married (78%), had children (50%), Average work experience (13.4 years), Mean working hours/week (40).	Job Demands, Resources, Cynicism, Engagement, Commitment, Self-efficacy, Health.	Cynicism	Type A behaviour was linked with cynicism and engagement, job demands associated with cynicism, job resources positively associated with engagement, cynicism was associated with increased health complaints and reduced commitments and efficacy, and women reported less overtime, commitment and autonomy.	Longitudinal design for establishing causal relationships, integrating enhanced indicators for health and work performance.	Norway
5	Martinussen et al. (2007)	Quantitatives; Cross-sectional; Questionnaire	N=223, Male (173), Female (48), Married (76%), had children (48%), Average work experience (11.5 years), Mean working hours/week (39.5).	Job Demands, Resources, Burnout, Outcomes (Health, Work).	-	Older officers reported higher exhaustion, and work-family pressure as important predictors of all three burnout dimensions, burnout predicted work and health outcomes like psychosomatic complaints and satisfaction with life, job satisfaction, commitment and intention to leave the organization.	Inculcating models which include coping/protective factors and officers' perception of rewards, emotional stability and resilience as resources.	Norway
6	Wu (2009)	Quantitatives; Cross-sectional; Questionnaire	N=672; Male (654), Mean age (35).	Role conflicts, emotional exhaustion, health problems	-	Intrasender role conflict and its positive association with emotional exhaustion and health problems.	Burnout indicators, different role conflicts in measuring work stress.	Taiwan
7	Noblet et al. (2009)	Quantitatives; Cross-sectional; Questionnaire	N=2085; Male (81%); 30-49 years (72%); Work experience 20 years or more (39%).	Job control, job demands, support from work sources, well-being, job satisfaction, organizational commitment	-	Social support, and control, ensure the well-being, satisfaction and commitment of the employee, negative relationship between workload on well-being and satisfaction.	Moderator variables, Longitudinal design, effect of task classification (complex vs standard)	Australia

8	Chrisopoulos et al. (2010)	Quantitative; Longitudinal; Questionnaire	N=179; Male (161), Female (18); Mean age (43.4); Sergeant (49.7%), Senior constable (21.8%)	Job demands, resources, cognitive strain, emotional strain, physical strain	-	Match between demands and resources mitigates strain, a high level of resources in comparison to demands is harmful to well-being, matching of cognitive demands with cognitive resources enhances efficacy, and high levels of physical demands, and resources were associated with high levels of physical strain.	Focus on the psychological component of demands relates specifically to police tasks, police specific stressors for better buffering effects to reduce strain.	Australia
9	Hall et al. (2010)	Quantitative; Longitudinal; Questionnaire	N=257, Male (230), Female (27), Average age (42.6 years), Married (86%), Dependents (71%), Sergeant (43.6%), Senior constable (30%), Senior sergeant (12.1%)	Work-family conflict, emotional exhaustion, job demands.	Work-family conflict, Emotional exhaustion	The study confirms both mediation scenarios, increased demands lead to work-family conflicts, and emotional exhaustion and hinder recovery, and inclusion of resources in the model.	Reciprocal mediation relationships, effects of job demand spillover.	Victoria
10	Tuckey et al. (2012)	Quantitative; Cross-sectional; Questionnaire	N=716; Male (615), Female (101); Mean Age (41.9); Sergeants (348), Constables (368); Work experience (17.5 years)	Job demands, resources, harassment, role-specific or micro-level psychological variables	-	Lack of resources increases the odds of harassment of officers, and harassment at the workplace increases the officers' perception of threat in officer-offender interactions.	Longitudinal research, the role of power dynamics, the imbalance of power leading to harassment and eventually bullying at work, and multilevel effects of resourcing.	Australia
11	Smoktunowicz et al. (2015)	Quantitative; Cross-sectional; Questionnaire	N=625; Male (80%), Female (20%); Mean Age (36.6 years); Average work experience (12.83 years)	Job demands, burnout, job control, social support, counterproductive work behaviour (CWB)	Job burnout, control, social support.	Job demands are related to burnout when social support is low and there is high burnout, low social support relates to high instances of CWB, and social support moderated the relationship between job demands and burnout. Burnout mediated the job demands-CWB relationship when job control was high and social support was low.	Longitudinal research, organizational behaviour related to positive and negative outcomes to the individual and organization	Poland

12	Elgmark et al. (2017)	Quantitative; Cross-sectional; Questionnaire	N=4244; Male (74%), Female (26%); 30-34 years (29%); Work experiences, less than 10 years (77%); Majority worked in rotational shifts	Job demands, job control, support, exposure to threats, shift work, fatigue, and job satisfaction.	-	Job demands contribute significantly to fatigue while support to job satisfaction, and exposure to threats contribute positively to fatigue and negatively to job satisfaction.	Occupation-specific variables to the demand control support model, focussing on the link between psychosocial and physical aspects of police work.	Sweden
13	Hansson et al. (2017)	Quantitative; Cross-sectional; Questionnaire	N=714; Female (31%), Male (69%); Mean Age (42 years); Married (83%); Average work experience (15.5 years).	Job demands, control of social support, and general mental health.	-	Low social support and high job strain in female officers, low social support with active work and job strain is likely to cause psychological disturbance and poor mental health. Married women reported higher levels of social support.	Effect of role conflict on mental health and its role in the association of active work with psychological disturbance.	Sweden
14	Duxbury et al. (2018)	Quantitative; Cross-sectional; Questionnaire	Male (1169), Female (300); Average age_M (41.7 years), F(40.1 years); Rank_Constable_M (61%), F (72%); Work experience_M (14.8 years), F (14.1 years); Worked per week, M (44 hours), F (42).	Competing demands, outside work, non-supportive culture, work role overload, family role overload, and perceived stress.	-	Family role overload and work-role overload are important predictors of stress, female officers face similar stressors as they used to face in the 70s and 80s and these are more problematic for them as they have heavier demands outside of work.	Longitudinal research, Single police officers' work and family demands leading to overload and stress.	Canada
15	Turtle et al. (2018)	Quantitative; Cross-sectional; Questionnaire	N=1180; Male (91%), Mean age (39 years); Work experience average (14 years), all married.	Marital functioning, career demands, social and emotional spillover.	-	Career demands and social spillover are significant predictors of marital functioning.	Inclusion of other family systems (parent-child relation, sibling relations), mixed research specifically interviews or focus groups with children.	United States
16	Wolter et al. (2019)	Quantitative; Cross-sectional; Questionnaire	N=843; Male (609), Female (234); Age mean (40.9 years); Work experience mean (19.7 years); Field service (65.2%)	Job demands, resources, emotional exhaustion, well-being.	-	Job demands contribute significantly to emotional exhaustion, administrative stressors relate strongly to job demands, fair organizational climate, organizational goals and values promote well-being.	Significance of shared values in the police context, the effect (moderate or direct) of resources on emotional exhaustion/burnout concerning job demands, more factors to be included as job demands, resources in JD-R model according to a specific policing context.	Germany

17	Maran et al. (2020)	Quantitative; Cross-sectional; Questionnaire	N=police officers (112), health care professionals (286)	Secondary traumatic stress (STS), well-being and malaise at work, job demands, and job resources.	-	Officers suffer greater STS, workload, and work-family conflict in comparison to health care professionals, negative emotions and burnout as a consequence are suffered to a greater extent, work experience was not related to STS, work-family conflict provides context to STS.	A larger sample for more effective results, burnout syndrome and secondary traumatic stress using a person-centric approach applied in a police context, STS concerning the role (frontline work, serious crime investigations) of an officer in the organization, where an officer has to intervene, behaviour of STS suffered behaviour towards their children.	Italy
18	Baka (2020)	Quantitative; Cross-sectional; Questionnaire	N=7741; Male (83%), Female (17%); 31-40 years (50%), 41-50 years (23%), 25-30 years (21%); Positioned in crime prevention divisions (60%), criminal investigation (35%), support services (5%); Supervisory positions (14%), line officers (86%).	Job Demands, job control, social support, depression	Job control, social support	Job seniority is directly linked with organizational, and operational demands, depression, job control and lower social support, highest depression in the 45-50 age group, lowest in the 25-30 years, and depression higher in the case of female officers. Social support and job control moderated the negative effects of police job demands for organizational and not operational demands.	Longitudinal design for establishing causality between mental, and physical problems and job demands, and lack of resources. Effect of feedback, coaching, psychological climate as job resources.	Poland
19	Chen and Wu (2022)	Quantitative; Cross-sectional; Questionnaire	N=251; Male (217), Female (34); Age mean_31-40 (47.4)	Stress response, job demands, basic physiological needs, job autonomy.	Basic physiological needs, job autonomy.	Job demands improved the degree of satisfaction of basic physiological needs, job autonomy moderated between job demands and police stress response, and basic physiological needs partially mediate the influence of job demands on the stress response.	Relationship between job demands and stress response to broaden the scope of mental health, person-centric approach to understanding the basic physiological needs.	China

20	Oliver et al. (2023)	Quantitative; Cross-sectional; Questionnaire	N=852; Male (428), Female (413); Age mean (41.6 years); Work experience (4.15 years)	Work-related stress and well-being process, physical activity behaviour, police-specific stress.	-	Perceived job stress indirectly influenced the relationship between work demands and psychological well-being, work resources moderated the relationship between demand and perceived work stress and person characteristics between work demands and psychological well-being.	Longitudinal design, structural equation modelling to test complex relations between variables, qualitative study approach for greater clarity on the importance of physical activity and testing whether perceived work stress, work features and psychological well-being mutually affect each other or they have unidirectional causal effects.	Britain
21	Krause et al. (2023)	Quantitative; Cross-sectional; Questionnaire	N=712; 356 leaders and 356 followers were matched; Full-time officers	Job demands, resources and mental health outcomes	-	Police leaders deal with more quantitative demand, work privacy conflicts with more task-related, organizational resources with predictable but meaningful work and they had more influence and opportunities to develop a better feedback system, autonomy in breaks and holidays were related to job satisfaction and relevant for positive mental health among police leaders.	Longitudinal design specifically for police leaders, exhaustion and job engagement can be used as a mediator variable on health consequences, treating autonomy over breaks and holidays to be tested separately.	Germany
22	Drew et al. (2024)	Quantitative; Cross-sectional; Questionnaire	N=2669; Male (86%)	Job demands, burnout, psychological distress, commitment.	-	Organizational stressors are the strongest predictor of turnover intentions, a lower level of organizational commitment is associated with leaving the police profession, operational stress is the strong predictor of burnout through it, has the strongest indirect effect on turnover intention, trauma does not negatively impact the commitment of the personnel towards their profession as do the operational and organizational requirements of their job.	Longitudinal design, the inclusion of personnel from other regions will enhance the generalizability of findings, surveying officers who left the job, and investigation of responses on the lines of whether the personnel want to leave the particular policing agency or leave the policing profession altogether.	United States

23	Opielka and Staller (2024)	Quantitative; Cross-sectional; Questionnaire	N=666; Age_mean (43.5 years)	Working hours, job characteristics, psychological well-being.	-	Shift duty officers reported better mental well-being, less time overload, and perceived that they could complete their professional tasks more efficiently, officers on regular night shifts reported higher emotional stress in comparison to day duty officers owing to police service-specific activities.	Longitudinal design, diverse psychosocial work stressors across professions engaged in day and shift work, job characteristics specifically work schedules and its impact on mental health.	Germany
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Authors also suggest research on the imbalance of power, leading to harassment and sometimes bullying at the workplace due to a lack of social support. But there are instances where the social support provider is also, at the same time, the reporting officer who is responsible for increased demands and stress. The dynamics of such a relationship therefore require more research. Research on secondary traumatic research using a person-centric approach in a police work context is also recommended. Investigation of turnover intention responses from a wider sample of police personnel to examine whether the intent is to change the current agency/department or they want to leave the profession altogether.

### MANAGERIAL IMPLICATIONS

The research paper is an attempt to highlight, through a retrospective approach, the importance of job demands research on police personnel for academicians and practitioners, as the consequences of job demands have been considered as both a public concern and private trouble (Kenny & Cooper, 2003). The systematic review of literature provides areas that are addressed in job demands research in a policing context, as well as the areas that need further deliberation. The thematic clusters provide deliberations on work engagement, stressors, job design, and work-life balance in the case of police personnel who often have to work for sixteen hours at a stretch due to a shortage of manpower, uncertain law and order situations (Patel et al., 2019), as well as for other occupation groups in the first responder category. A bibliometric approach provides firm

foundations for advancing in a research area in a novel and meaningful way, gaining a one-stop overview, and identifying knowledge gaps (Donthu et al., 2021). The recent diffusion of the pandemic has considerably affected the working conditions, the knowledge, skills, and abilities (KSA) framework, leading to new and more complex job demands on police personnel. Hence, future research work can concentrate on the impact of public health emergencies like Covid-19 on law enforcement agencies.

## CONCLUSION

Police personnel represent an occupational group that, due to high job demands, is extremely vulnerable to stress (Violanti & Aron, 1994). Police have to deal with both criminals and victims of crime on a daily basis. The former requires a tight confrontation, while the latter requires an empathetic approach. As a consequence, police personnel engage in emotional labor daily. There have been studies on stress and mental health, but there are still important research gaps, especially concerning police personnel (Grawitch et al., 2010). No article has provided a holistic retrospection on the job demands domain of the police. To address this gap, the current study attempts to overview job demands research on police using a bibliometric method for the period 1983 to the middle of March 2024. Additionally, it incorporates a systematic review of literature. The former involves analyzing a corpus of 359 articles published in leading journals of the subject area, while the latter involves a review of 23 articles meeting our inclusion criteria.

The study highlights publication trends, the most productive and influential authors, and attempts to infer the intellectual structure of the domain. Using science mapping techniques such as co-citation analysis and bibliographic coupling, the study gathers the knowledge foundation and thematic structure of the domain by uncovering five specific areas of job demands research on police. Through co-occurrence analysis, the study also highlights the themes, patterns, and research direction in the job demands research on police personnel.

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# MAJORITY ACQUISITIONS VS MINORITY ACQUISITIONS: A PRE- AND POST- ACQUISITION FINANCIAL ANALYSIS OF INDIAN PHARMACEUTICAL COMPANIES

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## ABSTRACT

The purpose of the study is to analyze the financial performance of Indian Pharmaceutical Acquirers and compare the pre- and post-financial performance of acquirers conducting minority and majority acquisitions. The financial analysis was conducted on the data of 13 acquisition deals for the period between 2010 and 2019 by comparing the three-year pre- and post-acquisition periods until the year 2023 using the paired t-test methodology. The findings of the study revealed that there is no significant difference in the profitability and liquidity positions of the acquirers in the pre- and post-acquisition periods. Finally, the comparison between the financial performance of majority and minority acquisitions shows that the financial performance of acquirers deteriorates after the post-acquisition period, but the performance of majority acquisitions' acquirers is still better when compared to minority acquisitions.

**Keywords:** Minority acquisitions, majority acquisitions, India, paired t-test, financial performance, pharmaceutical industry.

## INTRODUCTION

Mergers and acquisitions are inorganic growth strategies widely used by companies across the world for growth and development (Gupta & Raman, 2022). In addition, due to today's competitive environment, they have been recognized as key strategic alliances and a firm's preferred dynamic strategy. Successful M&As expose firms to much-needed domestic and international strategies (Datta et al., 2020). It has been observed that corporate restructuring is an important part of finance, including changes within the corporate capital structure such as increasing debt, which leads to an increase in financial leverage. This type of corporate streamlining is very important and widely done as part of M&A financial

activities. There are mainly three types of M&A: horizontal integration, vertical integration, and conglomerates (Hossain, 2021). Recent researchers (Otsubo, 2021) have identified one more unique form of acquisitions known as partial, block, and minority acquisitions, where less than 50% of the target shares are acquired by the acquirers (Bostan & Spatareanu, 2018). Considering this new area of research in mergers and acquisitions, the present study explores the impact of minority acquisitions along with majority acquisitions on the financial performance of the acquirers.

In the past few years, M&A-related activities have increased significantly in terms of both volume and value, thereby increasing the number of studies on the mergers and acquisitions phenomenon. Reorganizations and M&A are very important for the growth of organizations (Gao & Kling, 2008), and so companies are opting for them. However, their success has always remained questionable. The success of M&A can be analyzed based on its motives and its realization in the future. There could be several motives for mergers and acquisitions, such as expansion to different geographical locations, diversification, or acquiring a customer or supplier. It could also be about reducing competition in an industry by entering into horizontal combination (Ladha, 2017). Regardless of any merger motive, it is important to assess the impact of M&A on the acquiring firm, which will decide the success and failure of any merger. Due to the huge cost involved in terms of time, money, and other resources, it is difficult for an acquiring firm to acquire, and therefore, the success and failure of M&A are crucial for the management of the acquiring firm. According to past studies exploring the said research area, focusing on

assessing the financial performance, particularly the accounting performance of the acquiring firms, helps to know the impact of M&A. Many studies with different conclusions have been done worldwide in this area. However, the success and failure of mergers and acquisitions still remain arguable among practitioners and academicians (Bhaskar et al., 2012).

The pharmaceutical industry in India is one of the leading industries in the country and has been growing and evolving at a fast pace over the last four decades. Globally, India is the third largest pharmaceutical producer in terms of volume and is ranked among the top 14 in value. It contributes around 1.72% to the country's GDP (Annual Report, 2020-21).<sup>1</sup> According to the Indian Brand Equity Foundation (2024), the pharmaceutical industry in India witnessed a compounded annual growth of 6-8%, supported by an 8% growth in the export segment along with 6% growth in domestic market consumption. This industry in India is expected to grow from US\$ 42 billion in 2021 to an estimated value of US\$ 65 billion in 2024 and is further projected to reach US\$ 130 billion by 2030. Mergers and acquisitions in the pharmaceutical sector help companies expand their operations, increase market share, and gain access to new products and technologies. Recent advancements in drugs and discoveries have increased competition in the pharmaceutical industry. Hence, M&A plays a vital role in gaining a competitive advantage by providing access to new technologies, markets, customers, products, and intellectual property.

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<sup>1</sup>Indian Brand Equity Foundation (2024). Indian Pharmaceutical Industry. Published by Ministry of commerce and industry. Government of India. Available from: <https://www.ibef.org/industry/pharmaceutical-india>

A huge amount of literature is available assessing the success and failure of restructuring activities in different sectors across the world, and there are many ways through which the impact of mergers can be assessed. But one of the most reliable ways is by analyzing the accounting performance, which is an important indicator to evaluate the performance of such restructuring activities. External investors value accounting disclosures by well-governed firms more because such firms are less likely to provide misleading information (Song, 2015). In order to evaluate the accounting performance in mergers, financial statements and the accounting performance of the companies are analyzed, and various accounting metrics are exported and compared, such as financial ratios, both prior to and after a merger, for a specific year or years (Aggarwal & Garg, 2019) (Mohanty, 2016) (Duggal, 2015) (Pervan et al., 2015) (Strasek & Gubensek, 2016) (Adhikari et al., 2023).

This research examines the underexplored area of finding the impact of minority acquisitions on the financial performance of acquirers of Indian pharmaceutical companies and compares the results of majority acquisitions with minority acquisitions. Unlike previous studies that predominantly focus on analyzing the impact of majority or complete acquisitions on the financial performance of acquirers, and showing mixed results.

### **Objectives of the study**

1. To study the growth of mergers and acquisitions literature in recent times in India.

2. To study the impact of minority and majority acquisitions on the financial performance indicators in the long term.
3. To compare the results of minority acquisition deals with majority acquisition deals.

### **LITERATURE REVIEW**

Since the 1990s, corporate restructuring deals have risen substantially in India during the post-liberalization era. This has been caused by increased competition from overseas players because of the opening of the economy, less bureaucratic interference in the process, making it easier to implement changes in corporate control, technological advancements that make processes transparent, and lower transaction costs across the board for businesses. M&A is the most common type of business restructuring. There are a number of reasons why businesses pursue M&A. The primary objective of any business is to have more market power, achieving competencies to reduce the risk of developing new products and services, improving proficiency through economies of scale and scope, and in some instances, transforming the competitive scope (Hitt et al., 2006).

Pre- and post-merger performance of merging entities has been the focus in a lot of M&A literature. Despite the large number of studies in the literature, the results related to its performance have remained inconclusive because of contradictions. According to some studies, mergers and acquisitions (M&A) are a useful strategy for inorganic growth and

boosting shareholder wealth. Others, however, have discovered that M&A reduces shareholders' wealth, resulting in a decline in the operating performance of the firm. The M&A literature is not only filled with contradictory results, but the performance metrics used in this research also differ significantly from one another.

The studies that have been conducted so far have made substantial use of both market-based and accounting-based indicators. Although market-based measures have been considered a good indicator to assess a firm's performance, accounting measures are the most preferred by top executives to analyze the long-term post-merger performance. According to a study based on 400 large mergers and acquisitions between 1995-2000 conducted by Kukalis (2007), the majority of CEOs surveyed have given their preference to accounting measures as compared to market measures for analyzing the post-merger performance. Investors, analysts, and researchers use accounting values for the firm's valuation (Habib & Azim, 2008), and the long-term potential and the capitalized synergy in M&A transactions can be seen by doing a fundamental analysis using ratios and comparative statement analysis (Kumar & Bansal, 2008). Earnings and Accounting Rate of Return are key metrics used widely to assess firm performance (Cheng et al., 2005; Stanton, 1987). The present study examined the success of mergers and acquisitions by using widely accepted accounting performance measures. The literature review is divided into two sections based on the studies concluding that M&A have a positive impact and negative impact on the performance of acquiring firms.

### **Positive Impact of mergers and acquisitions**

(Michail et al., 2021) conducted a study exploring the post-merger accounting performance of Greek listed companies during the span of 2009-2015, and the results of the study revealed statistically significant positive differences in the pre- and post-merger accounting performance. (Azhagaiah & Sathishkumar, 2014) investigated a sample of 39 companies that went into mergers in the period of 2006 to 2007 and conducted a 5-year pre- and post-analysis. The study concluded a positive impact of the transaction on acquiring firms after its implementation. In another study, (Al-Hroot, 2016) studied the economic performance of seven companies that entered merger agreements during 2000-2014. The study shows that the profits and liquidity improved, whereas corporate lending increased after the merger. (Ahmed & Ahmed, 2014) analyzed the effect of mergers on 12 manufacturing companies of Pakistan from 2000-2009 and found that the overall performance of the acquiring firm in terms of liquidity and capital structure improved, but profitability decreased after the merger. (Gupta & Raman, 2022) studied the financial performance of Agri-Food acquiring firms and concluded that the overall performance improved after mergers and acquisitions. (Kar et al., 2021) evaluated the impact of mergers and acquisitions on the corporate performance of the Indian IT sector, and the findings revealed a significant positive impact of domestic and cross-border M&As on the Return on Net Worth and Revenue of IT companies. There are a lot of studies done in the banking sector, showing varied results. According to (Trivedi, 2013), mergers and acquisitions are tools used by

banks to achieve growth in a shorter time span as well as provide qualitative synergistic benefits to banks. (Fraser & Zhang, 2009) analyzed a sample of US banks acquired by non-US banks during the year 1980-2001 and concluded with an improvement in target's performance. (Alhenawi & Stilwell, 2017) studied acquisitions in the USA during 1998 and 2010 and showed that M&A transactions create value in the longer run, and the gain is commensurate with the acquirer's historical performance and the target's pre-acquisition value.

#### 1. Negative Impact of Mergers and Acquisitions

(Pazarskis et al., 2022) investigated the post-merger accounting performance of the twenty-six companies listed on the Athens stock exchange. The results did not show any significant change in the financial performance of the companies post-mergers. (Gupta & Banarjee, 2017) examined the effects of mergers of Indian companies from 2006-2012 on acquiring firms by using various profitability and liquidity ratios for five years pre- and post-merger in seven different industries and found that the financial performance in terms of profitability and liquidity declined after the merger. (Mehrotra & Sahay, 2022) analyzed the financial performance of M&A deals in the manufacturing and service industry of India for the period of 2010-2014 and concluded that the acquirers did not have financial gains even after three years of the deal. (Adhikari et al., 2023) assessed the post M&A financial performance of the two commercial banks of Nepal using twelve accounting ratios and paired t-test

methodology and found mixed results for one bank and insignificant results for the other bank. (Ghosh, 2001) analyzed firms matching on the benchmark of performance and size but did not find any evidence related to the improvement in operating performance following acquisitions. (André et al., 2004) evaluated the performance of 267 mergers and acquisitions taken place in the span of 1980-2000 of Canadian firms in the long term and the findings show that the Canadian acquirers underperform in the post three-year period following acquisition. (Singh & Mogla, 2008) compared the pre- and post-merger operating performance of 56 merged companies during 1994 to 2002 and concluded that profitability deteriorates after the mergers. (Dixit, 2020) made a comparative analysis of the operating performance of acquirers doing partial and full acquisitions and the finding shows a decline in the operating performance of complete acquisitions.

After a thorough review of the previous studies, the authors find that most of the studies have analyzed the impact of complete or majority acquisitions on the financial performance of acquirers, but none of them have studied the impact of minority acquisitions on the financial performance of Indian pharmaceutical companies. However, in recent years, studies discussing the various aspects of partial or minority acquisitions (Akhigbe et al., 2007), (Chen, 2008), (Dang & Henry, 2016), (Ouimet, 2012) have been observed. Therefore, with increasing interest from researchers, the authors of the current study find it important to assess the financial

performance of minority acquisitions and compare the results with majority acquisitions, which is an unexplored area in the literature. Additionally, the authors argue that the financial performance of acquirers making majority acquisitions should be higher than the acquirers of minority acquisitions because majority acquisitions, due to their majority control over the target firm, help in deriving the full potential value of synergy, thereby having better financial performance than minority acquisitions.

So, the present study is a contribution to the literature in several ways. First, this study analyzed the financial performance of minority acquisitions along with majority acquisitions. Secondly, while most of the previous studies on minority or partial acquisitions focus on the performance of the target companies in the US, Canada, and Japan, this study finds the impact of majority and minority acquisitions on the financial performance of the acquirers of pharmaceutical companies in India. Third, the authors compared the financial performance of acquirers making majority and minority acquisitions.

## 2. Hypothesis

There is a significant difference in the profitability position of acquiring firms of majority acquisitions in the post-merger and acquisition period compared to the pre-merger acquisition period in the long term.

There is a significant difference in the liquidity position of acquiring firms of majority acquisitions in the post-merger and acquisition period compared to the pre-merger acquisition period in the long term.

There is a significant difference in the profitability position of acquiring firms of minority acquisitions in the post-merger and acquisition period compared to the pre-merger acquisition period in the long term.

There is a significant difference in the liquidity position of acquiring firms of minority acquisitions in the post-merger and acquisition period compared to the pre-merger acquisition period in the long term.

The financial performance of acquirers making majority acquisitions should be higher than that of the acquirers of minority acquisitions.

## 3. Research Methodology

The present study uses the Scopus database and CMIE Prowess IQ (Centre for Monitoring Indian Economy) for data extraction. For objective 1, the Scopus database was used by conducting a topic search in March 2024. A broader search strategy was utilized by conducting a topic search (combination of title, abstract, and keywords) with our search string. Table 1 summarizes the complete search strategy and data retrieval process.

For Objective 2, the data on mergers and acquisition deals during 2010-2019 in the Indian pharmaceutical industry has been retrieved from the CMIE Prowess IQ database. 13 M&A deals have been selected for the analysis using the following inclusion and exclusion criteria:

- Deals where the acquisition of shares is more than 50% are considered as majority acquisitions, and deals with less than 50% acquisition of shares are

considered as minority acquisitions. (Ouimet, 2012) (Nguyen et al., 2022)

- The deal status should be completed.
- Both the acquirer and acquiree should be Indian firms.
- The accounting data for the 3-year pre- and post-acquisition period should be available.

The study includes acquisitions only from 2010-2019 so that the financial performance can be analyzed for a long-term period (3-year pre and post) which extends up to 2023. The deal year has not been considered for the analysis, and financial performance is analyzed through accounting data collected from Money Control and the CMIE Prowess IQ database. The study uses 5 accounting variables for the financial performance analysis, broadly classified into 2 parameters:

- Profitability Position: Return on Assets, Return on Equity, Return on Capital Employed

- Liquidity Position: Current Ratio and Quick Ratio

Ratio analysis is a common method for assessing performance before and after mergers and acquisitions, and 13 M&A deals have been analyzed on the above-mentioned five variables, along with a paired t-test which is applied to test the significance of improvement in the profitability and liquidity position of the acquiring firm for the 3-year post-acquisition period.

#### 4. Results

Objective 1 states that there has been a growth in mergers and acquisitions literature in recent times. The number of studies year-wise and country-wise, along with the growth in the number of studies in India, has been presented graphically and in tables for the period of 2010-2024 under this section. Fig 1 shows an increasing trend in the year-wise number of studies, and as per table

**Table 1: Search strategy and data retrieval Process**

Date	Database	Search String
13/3/2024	Scopus	("Mergers" OR "M&A" OR "Mergers and Acquisitions")
Filters applied	Document Type: Article Language: English Time Period: 2010-2024	
Result	47254	
<b>Subject area filters from Scopus database applied</b>		
Filters Second stage	Scopus database: Business, Management and Accounting Economics, Econometrics and Finance	
Result	8340	
Filters Third stage	Country: India	
Result	379	

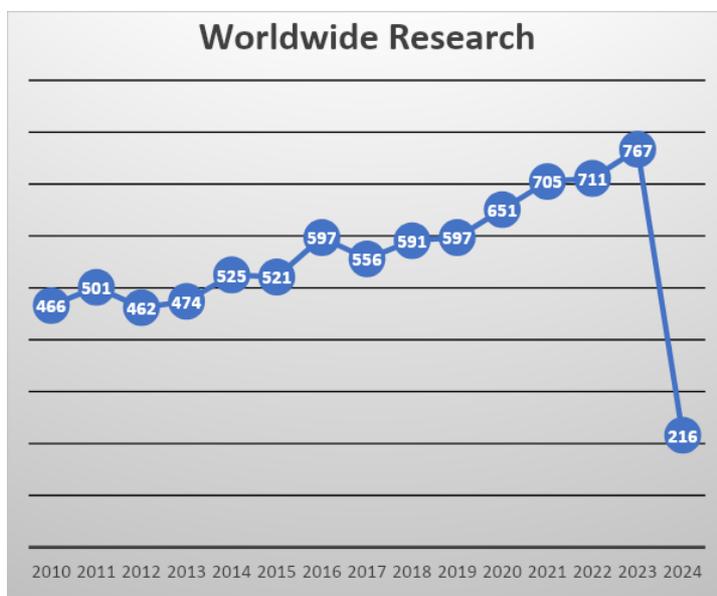
Source: Author's compilation

2, the number of articles in the year 2010 was 466, which has been increasing over time, showing the importance of the research area. In 2023, it has reached the highest number, which is 767. The authors have also conducted a country-wise research wherein the United States was the highest with 2729 studies, followed by the United Kingdom with 1027 studies. India ranks 7th with 379 studies, which is quite lower compared to the other top countries. Furthermore, it can be interpreted from figure 3 that there is a rising trend in M&A research in India since 2010, reaching its highest in 2023. Hence, it can be observed that there is significant growth in mergers and acquisitions literature from 2010-2024.

**Table 2: Number of articles published year-wise all over the world (2010-2024)**

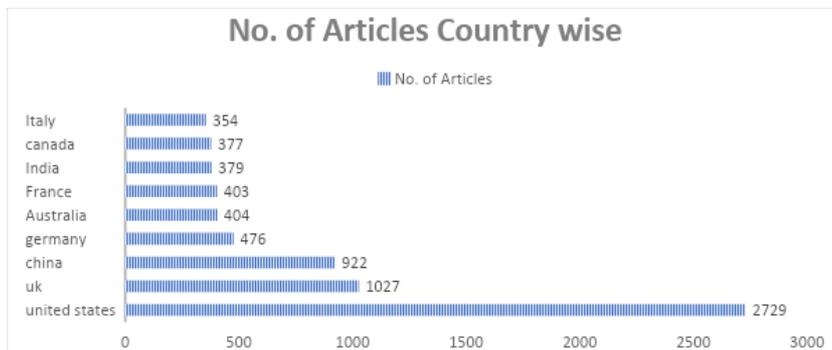
Year	No. of articles
2010	466
2011	501
2012	462
2013	474
2014	525
2015	521
2016	597
2017	556
2018	591
2019	597
2020	651
2021	705
2022	711
2023	767
2024	216
<b>Total</b>	<b>8340</b>

Source: Authors' compilation



**Fig 1: Graphical representation of year wise number of Articles published all over the world (2010-2024)**

Source: Authors' compilation



**Fig. 2: Number of Articles published in different countries**

Source: Authors' compilation



**Fig 3: Number of articles published in India (2010-2024)**

Source: Authors' compilation

Based on the Profitability and liquidity ratios, this paper is aimed for evaluating the financial performance of the sample divided into Majority and Minority Acquisitions.

**Results of Majority Acquisitions**

Table 3 shows the 3-year pre- and post-acquisition analysis of the firms that went into majority acquisitions. The findings of the same can be summarized as follows:

- Profitability Ratios:** The Return on Assets has decreased from 12.30 to 9.13 in the post M&A period. The mean change is negative, and the results are not statistically significant. The decrease depicts that Return on Assets has not improved in the post-acquisition period. Similarly, other profitability indicators; return on Equity and Return on Capital Employed have also decreased from 17.42 to 13.27 and 18.82

to 16.36, respectively. The p-value for the same is greater than 0.05, which shows that the results are not statistically significant. Hence, Hypothesis 1 is rejected.

- **Liquidity Ratios:** The current ratio has decreased from 2.13 to 1.96 since the mean of the ratios for both periods is positive, but the mean change is negative, thereby showing that the results are not statistically significant. Similarly, the results of the quick ratio also show a decline with a mean change of -0.08. Hence, resulting in insignificant statistical results. Thus, Hypothesis 2 is rejected.

## Results of Minority Acquisitions

### Minority Acquisition (3-year pre- and post-Acquisition)

Table 4 shows the pre- and post-acquisition analysis of 3-year pre- and post-acquisition of the firms went into minority acquisitions. The findings of the same can be summarized as follows:

- The ROA in table 4 shows a decrease in ROA from 25.23 to 7.10. The mean change is negative, and the results are not statistically significant. Similarly, the mean change of ROE and ROCE is also negative, and the results for the same are also insignificant. Hence, Hypothesis 3 is rejected.

**Table 3: Results of paired sample t-test for pre-and post-acquisition period of Minority acquisitions**

Majority Acquisition (3 year pre- and post-acquisition)					
Variables	Post mean	Pre mean	Mean Change	t-value	significance
ROA	9.1325	12.30125	-3.16875	1.288	0.239
ROE	13.27	17.4225	-4.1525	1.406	0.203
ROCE	16.365	18.82125	-2.45625	0.75	0.478
Current Ratio	1.9625	2.13	-0.1675	0.609	0.562
Quick Ratio	1.57375	1.65625	-0.0825	0.341	0.743

\*Significant at 0.05

**Table 4: Results of paired sample t-test for pre-and post-acquisition period of Minority acquisitions**

Minority Acquisition (3-year pre- and post-Acquisition)					
Variables	Post mean	Pre mean	Mean Change	t-value	significance
ROA	7.104	25.236	-18.132	0.922	0.409
ROE	10.368	31.386	-21.018	0.958	0.392
ROCE	10.57	29.418	-18.848	0.882	0.428
Current Ratio	2.976	3.674	-0.698	0.547	0.614
Quick Ratio	2.148	2.868	-0.72	0.586	0.59

\*Significant at 0.05

Source: Authors' calculations

- **Liquidity Ratios:** The current ratio has decreased from 3.67 to 2.97. Since the mean of ratios for both periods is positive, but the mean change is negative, the results are not statistically significant. Similarly, the results of the quick ratio also show a decline with a mean change of -0.72. Hence, resulting in insignificant statistical results. Thus, Hypothesis 4 is rejected.

Further, we have compared the results of majority acquisitions with minority acquisitions and considered only profitability ratios for 3-year pre and post analysis because profitability is an important factor that needs to be analysed to observe the impact of any strategy.

From the above table 5, it is indicated that the mean change of majority and minority acquisitions is negative and insignificant, as per the results of the paired t-test. However, if we compare the mean change values of ROA, ROE, and ROCE of majority acquisitions with the values of the same variables of minority acquisitions, it shows that the financial performance of the acquirers of majority acquisitions is better than the financial performance of minority acquisition acquirers.

Hence, hypothesis 5, which states that the financial performance of acquirers making majority acquisitions should be higher than the acquirers of minority acquisitions, is accepted.

## DISCUSSION

The study's results are being discussed in the following dimensions. The findings indicate that the financial performance in terms of ROA, ROE, ROCE, Current Ratio, and Quick Ratio does not have a significant change in the pre- and post-acquisition period for both majority and minority acquisitions. The results of the study are consistent with the results obtained by (Mehrotra & Sahay, 2022) (Pazarskis et al., 2022) (Pathak, 2016) (Long, 2015) where the acquirers did not find any significant financial gains for the companies' post-merger.

Further, the comparative analysis of the results of minority acquisitions with majority acquisitions shows that there is no significant difference in the pre- and post-acquisition performance of the acquirers. However, the financial performance of majority acquisition acquirers is higher than the acquirers of minority acquisitions. Hence, these results

**Table 5: Comparison of Results of Majority and Minority Acquisitions**

Variables	Majority Acquisitions (3 years pre- and post-acquisition)			Minority Acquisition (3 years pre- and post-acquisition)		
	Mean Change	t-value	significance	Mean Change	t-value	significance
ROA	-3.16875	1.288	0.239	-18.132	0.922	0.409
ROE	-4.1525	1.406	0.203	-21.018	0.958	0.392
ROCE	-2.45625	0.75	0.478	-18.848	0.882	0.428

\*Significant at 0.05

Source: Authors' calculations

are consistent with the study conducted by (Dixit, 2020) who concluded that neither the operating performance of the complete acquisition acquirers nor the partial acquirers improves after the acquisition.

### **Managerial Implications**

The findings of the study have significant implications for managers, investors, companies, and policymakers. We present the long-term financial performance of the Indian Pharmaceutical acquirers. The companies can learn from their previous success and failures. The managers have to make decisions related to merger and acquisition in such a manner that it creates a positive outcome for both the acquirer and acquiree. The results of the study can be a knowledgeable source of information for them for better decision-making. Further, the investors have to implement the best investment strategy, and the information provided by the study helps them to understand whether the acquisitions destroy or create long-term synergies. Lastly, the results of the study are also helpful for policymakers who formulate policies and regulations of M&A.

### **Limitations and Future Scope of the study**

The limitations of the study are that only publicly listed companies have been taken in the sample for a limited period of 2010-2019, and a 3-year pre and post-analysis has been conducted until the year 2023. Future research can extend to a longer period of 20 years with a 5-year pre and post-analysis. The studies can also include a mix of primary and secondary

data where survey responses could be collected from the acquiring and target companies for a better understanding of the M&A concepts of financial performance and various motives behind it. The present study has used 2 parameters, i.e., profitability and liquidity position, for financial performance analysis, but future researchers can include other parameters like solvency ratios, shareholders' wealth, stock prices, financial statement variables, and other micro- and macro-economic variables like GDP rate, exchange rate, etc., to have more clarity of results. Similar studies with the same or different methodology can also be done on the sample of cross-border acquisitions.

### **CONCLUSION**

Mergers and acquisitions are strategic decisions intended to improve the overall financial performance of companies and achieve synergies. The present study examines the growth rate of merger and acquisition literature in the past few years and analyzes the performance of acquiring firms in Majority and Minority Acquisitions during the post-M&A period. Paired t-test methodology is used to check the statistical significance of the results and compare the pre- and post-M&A period. The data for the period of 2010-2019 of Indian pharmaceutical companies has been taken, and a three-year pre- and three-year post-M&A window has been used to analyze the long-term effect of the merger and acquisition. The study uses two parameters (profitability and liquidity) to check the financial performance of the acquiring firms. The results demonstrate that there is no significant difference in the profitability and liquidity position of the

Majority and Minority acquirers in the three-year pre- and post-acquisition period. Furthermore, the authors also compare the results of Majority and Minority acquisition acquirers, assuming that the financial performance of majority acquisition acquirers is higher than that of the minority acquirers, as majority acquisitions are expected to generate the full potential value of synergies (Dixit, 2020). While comparing the results of profitability, the mean change value of both majority and minority acquirers is negative but still showing better performance in the case of majority acquisitions than minority acquisitions.

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# ANALYSIS ON CIRCULAR ECONOMY AND TECHNOLOGY INNOVATION TOWARDS SUSTAINABILITY IN THE MANUFACTURING SECTOR: A BIBLIOMETRIC ANALYSIS

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## ABSTRACT

There has been a growing recognition of the imperative to transition towards more sustainable practices in the manufacturing sector. Aiming towards sustainable practices, the concepts of circular economy and technological innovation offer promising avenues for achieving sustainability goals. In this context, the aim is to examine the evolving research landscape concerning the integration of circular economy principles and technological innovation toward sustainability in the manufacturing sector. To achieve this objective, bibliometrics were conducted using R-Studio. A dataset of scholarly publications from Scopus and Web of Science was used for bibliometrics and analyzed. To analyze the key bibliographic data such as publication titles, authors, publication years, journal/conference names, keywords, abstracts, citation counts, etc., were extracted from the Scopus and Web of Science databases. This study, with the help

of R-Studio/Biblioshiny, summarizes the data in the form of main information of the data, most relevant sources, sources production over time, word cloud, and co-occurrence network in the form of tables and figures as well. The findings of the study reveal a growing interest in integrating circular economy and sustainability with 360 documents from both databases. The key themes identified in this study are Sustainable Development, Performance, Management, Sustainability, and Framework. The main limitation of the study is that it focuses only on two databases and suggests future research with a more analytical and broader dataset. This study is most relevant for research scholars by helping them identify key research areas to explore and for organizations and governments as well by suggesting which areas to focus on more.

**Keywords:** Circular economy, technology innovation, sustainability, manufacturing sector, bibliometric analysis.

## INTRODUCTION

### Background information

The global manufacturing sector has experienced remarkable growth and development in recent decades, driving economic progress, technological innovation, and societal advancement. However, this expanded progress also brings huge costs to our environment, with widespread environmental degradation, resource depletion, and social inequality. It is clearly evident that many sustainability programs are organized all around the world for a better future for us and the next generations. According to today's environmental conditions, there is a strong need to make the manufacturing process more sustainable around the globe.

By keeping environmental degradation, resource scarcity, and social inequity in mind, it is necessary to change the understanding and methods of industrial production to attain the sustainable development goal for society. The conventional methods of production and consumption, i.e. extraction of raw materials, manufacturing processes, and waste disposal, are now increasingly recognized as unsustainable over the long period. So there is a need to emphasize more on circular and sustainable practices, resource efficiency, waste reduction, and environmental management to tackle the limitations of old manufacturing methods.

The term Circular Economy has gained widespread attention in recent decades and has its roots in various schools of thought and culture, including “Cradle to Cradle” and

“Biomimicry.” The idea of a circular economy has become increasingly popular and supported by government officials, especially in China and the European Union. This approach, with the help of sustainable production practices, tries to minimize environmental impact and create a closed-loop system for maximum utilization of resources. By shifting from a linear model of production and consumption to a circular one, CE seeks to achieve sustainable economic growth while preserving natural resources and reducing ecological footprints (EU Commission, 2014; Murray et al., 2015). This innovative economic model aims to be restorative and regenerative by design, with key objectives focused on eliminating waste, replenishing natural capital, and generating economic value through the effective utilization, rather than consumption, of resources (Torres-Giner, 2023). The Circular Economy has emerged as a promising framework for achieving sustainability in the manufacturing sector. At its core, a circular economy seeks to mimic the regenerative processes found in nature, where waste is minimized, and resources are reused, recycled, and restored in a closed-loop system. By rethinking product design, material flows, and supply chain management, the circular economy offers a pathway toward a more sustainable and resilient manufacturing ecosystem.

The interdependent connection between industry and the environment significantly influences the performance of industrial enterprises. As environmental concerns escalate, the impact on industrial operations becomes increasingly pronounced, exerting mounting pressure on business performance

(Lieder & Rashid, 2016). Moreover, technological innovation has been instrumental in propelling the shift towards sustainable manufacturing methods. Progress in materials science, digitalization, automation, and renewable energy has opened up fresh avenues for enhancing efficiency, curbing waste, and reducing environmental carbon footprints. Technologies such as additive manufacturing (3D printing), Internet of Things (IoT) sensors, and artificial intelligence (AI) are revolutionizing production processes, enabling greater flexibility, customization, and resource optimization.

CE preserves the environment by reducing the consumption of natural resources (Centobelli et al., 2020), eliminating waste, preventing the depletion of resources, and relying on material loops (Prieto-Sandoval et al., 2018). The amalgamation of Circular Economy principles with technological innovation presents substantial opportunities to elevate sustainability within the manufacturing sector. By leveraging technology-driven solutions such as smart manufacturing, predictive maintenance, and the integration of renewable energy, businesses can streamline resource usage, boost operational efficiency, and reduce their carbon footprint. Furthermore, the commitment to sustainability in manufacturing isn't just about environmental responsibility; it's also an economic imperative. With rising consumer and regulatory expectations for ethically sourced, environmentally conscious, and socially responsible products, manufacturers prioritizing sustainability are poised to enhance their competitive advantage in the global market.

## Research Question

What are the key trends in research on the circular economy and technology innovation in the manufacturing sector?

## Motivator or importance of the study

The manufacturing sector significantly impacts the environment through resource consumption and waste generation. As such, there is an increasing need to explore sustainable practices that can mitigate these effects.

The rapid advancement of technology presents new opportunities for enhancing sustainability within the manufacturing sector. Innovations such as digitalization, automation, and green technologies are pivotal in developing sustainable manufacturing processes.

A bibliometric analysis can reveal the research landscape's evolution, including identifying key trends, influential publications, and emerging research gaps.

## LITERATURE REVIEW

### Circular Economy and Sustainability

A comprehensive catalogue of 15 business sustainability movements encompasses various strategies and approaches designed to promote environmental responsibility and economic viability. These movements include recycling, waste minimization, cleaner production, zero-emission, zero-growth economy, green economy, triple bottom line, life-cycle assessment, sustainable consumption, corporate social responsibility,

blue economy, share value creation, industrial ecology, and Circular Economy (CE) (Tóth, 2019). The Circular Economy (CE) is an economic paradigm that shifts away from the traditional ‘end-of-life’ concept, instead prioritizing the reduction, reuse, recycling, and recovery of materials throughout the entirety of production, distribution, and consumption processes (Kirchherr et al., 2017). Sustainability emerged as an overarching concept covering CE, with “Recycle” being the most frequently addressed imperative, followed by “Remanufacture,” “Recover,” “Reduce,” and “Repair.” While CE publications in the maritime industry have increased since 2018, there is limited evidence of CE principles emerging in seaports (Razmjooei et al., 2024). In the realm of circular economy approaches, scholars and industry experts have developed various R-imperatives or R-frameworks to guide implementation. These frameworks include the 3Rs (Ghisellini et al., 2016; Kirchherr et al., 2017), 4Rs, and 6Rs (Sihvonen & Ritola, 2015), as well as more comprehensive models like the 9Rs (Potting et al., 2017) and the 10Rs (Reike et al., 2018). The circular economy interacts with various environmental protection concepts, including sustainable development (Millar et al., 2019), climate change mitigation (Chizaryfard et al., 2020), green growth, zero waste, and the minimization of environmental impact (Zink & Geyer, 2017; Korhonen et al., 2018). It has a significant impact on sectors such as infrastructure (Kucukvar et al., 2021; Ki et al., 2021a), industry (Koop et al.,

2021), mining (Smol et al., 2020; Upadhyay et al., 2021), recycling (Ki et al., 2021b), and renewable energy (Farooq et al., 2021). Moreover, the circular economy requires a societal shift toward new ways of thinking and Interventions (Skene, 2022). However, some scholars suggest that instead of merely reducing production and consumption, the circular economy might sometimes lead to an increase in these activities. This phenomenon is referred to as the circular economy rebound (Zink & Geyer, 2017; Makov & Font Vivanco, 2018).

### **Manufacturing Sector and Sustainability**

(De Angelis (2018) employs the natural resource-based view and agency theory to explore circularity approaches and the integration of digitalization technologies in Sustainable Manufacturing (SM) operations and processes. According to the natural resource-based view, three critical capabilities—pollution prevention, product monitoring, and sustainable development—are identified as key drivers for achieving competitive advantage. Agency theory suggests that circular business models can enhance recycling and asset reuse through effective monitoring and incentives. Furthermore, digital technologies like the Internet of Things (IoT) are instrumental in asset tracking, significantly improving efficiency (Lahti et al., 2018).

The term “sustainability” was initially coined in 1980 within the World Conservation Strategy. However, it wasn’t until the release of *Our Common Future* (WCED, 1987)

that sustainability gained widespread acknowledgment, particularly in tandem with the perspective of development, giving rise to the term “sustainable development.” Victor (1991) defines sustainable development as attaining the highest extent of progress feasible without exhausting a nation’s capital assets, primarily consisting of its natural resource base. Attaining a sustainable ecological footprint per capita, especially in nations with very high human development, is feasible through a 40% reduction in the ecological footprint, a goal attainable with existing knowledge and technologies (WWF, 2012; IEA, 2012). Increasing the proportion of renewable energy in the energy mix to at least 27% by 2030 is deemed both achievable and realistic. The rapid growth in renewable energy deployment, along with the ample technical potential and opportunities for further integration, suggests that this threshold is within reach (IPCC, 2011). However, achieving this target will require supportive policies and measures to stimulate the transition to renewable energy sources (Holden et al., 2014). Sustainable development seeks to surpass traditional concepts of economic advancement and societal welfare by adopting a more comprehensive approach. It involves tackling a diverse array of interlinked issues, including energy, urbanization, poverty reduction, hunger, and the advancement of environmentally sound economic growth (Bonnedahl et al., 2022; Filho et al., 2023). The pivotal roles of green finance and corporate governance in China’s sustainable development objectives are underscored, with green monetary policy exhibiting superior efficacy when compared to green fiscal policy (Zhao & Xing, 2024).

## **Technology Innovation and Sustainability**

Hicks (1932) was the pioneer in introducing the concept of technology effects, suggesting that fluctuations in product prices drive firms to prioritize innovation. Innovation is a key driver of socio-economic development, and it is primarily technological advancements that yield profitability (Dai, M., 2012). Command-controlled regulations have the most positive impact, while market-incentivized regulations offer flexibility and greater potential for promoting green development. Though green technology innovation improves sustainability, the impact of green product innovation is minimal, indicating an area for improvement (Wang, M., 2022). It is essential to differentiate between the types of green technology innovation, such as green product innovation and process innovation (Clark, K., 1998). While changes in production processes can foster new product innovations, technological advancements do not always result in product innovation (Shao, S., et.al., 2022).

## **Research Gap**

Insufficient focus on sector-specific challenges and opportunities for implementing CE and technological innovations in the manufacturing sector. Lack of quantitative metrics and comprehensive bibliometric analysis linking CE and technological innovation with measurable sustainability outcomes in manufacturing. Underexploration of the role of emerging technologies (such as AI, IoT, blockchain, etc.) in enabling CE practices and sustainable manufacturing.

## RESEARCH METHODOLOGY

### Objective

To examine the evolving landscape of research concerning the integration of circular economy principles and technological innovation towards sustainability in the manufacturing sector.

### Research Design

This study utilized bibliometric analysis to examine the progression of Circular Economy (CE) research within the context of sustainability in the manufacturing industry. Specifically, it investigated the interconnection between CE and sustainability, tracked the development of CE within studies on Sustainable Manufacturing (SM), and outlined the present status of CE R-imperatives within manufacturing industry research. By employing bibliometric analysis as a quantitative method, the study efficiently identified collaboration patterns, research clusters, and areas of knowledge deficiency. Furthermore, it elucidated the intellectual framework of the investigated domain along with its evolving trends (Donthu et al., 2021). For bibliometric analysis, data is abstracted from Scopus and Web of Science using “circular economy, technology

innovation, sustainability, and manufacturing sector” as keywords. The important observation is that, by using these keywords collectively, no result is shown. The result is abstracted using two keywords one by one in inverted commas, which is shown in Table 1.

Table: 1 summarizes the number of documents found on Scopus and Web of Science for various keyword combinations. The keywords are Circular Economy, Technology Innovation, Manufacturing Sector, and Sustainability. A significant amount of research is found on the intersection of Circular Economy and Sustainability, with 241 documents in Scopus and 119 in Web of Science. In contrast, only 12 documents in Scopus and 4 in Web of Science explore the connection between Technology Innovation and Sustainability. The combination of Manufacturing Sector and Sustainability is scarcely researched, with just 2 documents in Scopus. For the intersection of Technology Innovation and Circular Economy, there are 2 documents in Scopus and 1 in Web of Science. The lack of data for the combinations of Circular Economy and Manufacturing Sector, and Technology Innovation and Manufacturing Sector, indicates potential gaps in the research for these specific areas. Overall, the table highlights

**Table 1:**

Keywords	No. of documents from Scopus	No. of documents from Web of Science
Circular economy and manufacturing sector	-	-
Circular economy and sustainability	241	119
Technology innovation and manufacturing sector	-	-
Technology innovation and sustainability	12	4
Manufacturing sector and sustainability	2	-
Technology innovation and circular economy	2	1

a stronger research emphasis on sustainability within the circular economy framework, while other intersections involving technology and specific sectors remain less explored.

## RESULTS

After extracting the data, the total number of documents from Scopus and Web of Science is 255 and 124 respectively and analyzed with the help of R Studio and biblioshiny. The information abstracted from these two databases includes main information, most relevant sources, sources production over time, word cloud, and co-occurrence network. These results will help in determining the future directions for research and trying to fill the gap. The analyzed results are shown below:

### Main Information

**Table: 2 Source: Biblioshiny**

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2017:2024
Sources (Journals, Books, etc)	79
Documents	124
Annual Growth Rate %	31.13
Document Average Age	2.16
Average citations per doc	51.18
References	10821
DOCUMENT CONTENTS	
Keywords Plus (ID)	591
Author's Keywords (DE)	485
AUTHORS	

Description	Results
MAIN INFORMATION ABOUT DATA	
Authors	553
Authors of single-authored docs	7
AUTHORS COLLABORATION	
Single-authored docs	7
Co-Authors per Doc	4.59
International co-authorships %	37.1
DOCUMENT TYPES	
article	80
article; early access	2
article; proceedings paper	1
book review	1
editorial material	8
review	31
review; early access	1
Timespan	2007:2024
Sources (Journals, Books, etc)	183
Documents	255
Annual Growth Rate %	23.86
Document Average Age	2.38
Average citations per doc	34.78
References	0
DOCUMENT CONTENTS	
Keywords Plus (ID)	1673
Author's Keywords (DE)	874
AUTHORS	
Authors	996
Authors of single-authored docs	22
AUTHORS COLLABORATION	
Single-authored docs	24
Co-Authors per Doc	4.1
International co-authorships %	30.59
DOCUMENT TYPES	

Description	Results
MAIN INFORMATION ABOUT DATA	
article	121
article article	1
article conference paper	1
book	7
book chapter	33
conference paper	32
conference review	2
editorial	6
erratum	10
note	2
retracted	1
review	39

Table: 2 interprets all the main information, that a researcher or analyst wants to know to carry research and for analysis; like number of documents, type of document, document content, average growth rate, authors, author collaboration, time span etc.; this information is abstracted from both the databases and this is shown in a single table to make the reader easy to compare as well both the databases.

**Most relevant sources**

Web of Science Scopus

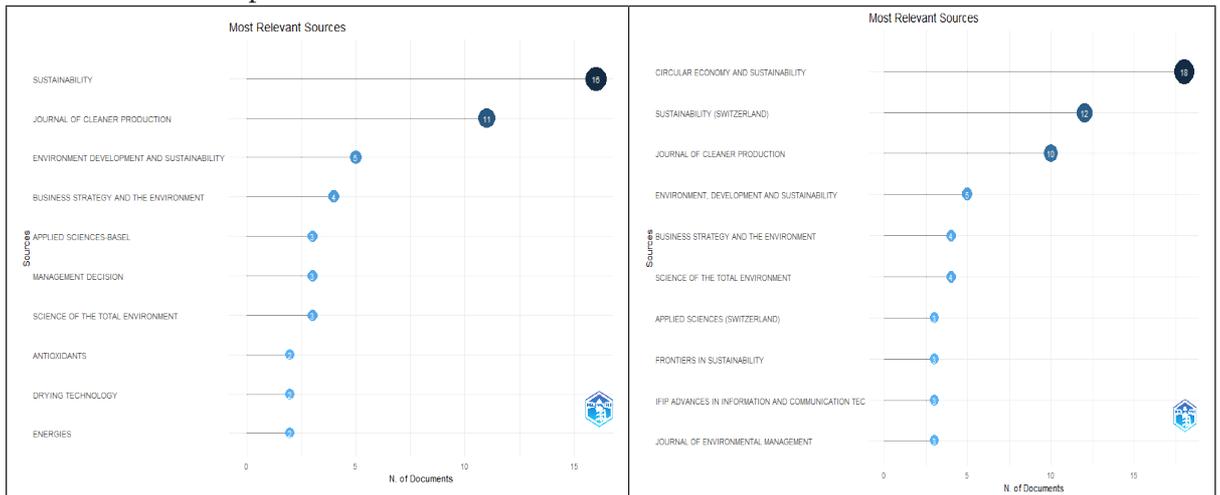
**Table 3: Source: Biblioshiny**

Sources	Articles
SUSTAINABILITY	16
JOURNAL OF CLEANER PRODUCTION	11
ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY	5

Sources	Articles
BUSINESS STRATEGY AND THE ENVIRONMENT	4
APPLIED SCIENCES-BASEL MANAGEMENT DECISION	3
SCIENCE OF THE TOTAL ENVIRONMENT	3
ANTIOXIDANTS	2
DRYING TECHNOLOGY	2
ENERGIES	2
CIRCULAR ECONOMY AND SUSTAINABILITY	18
SUSTAINABILITY (SWITZERLAND)	12
JOURNAL OF CLEANER PRODUCTION	10
ENVIRONMENT, DEVELOPMENT AND SUSTAINABILITY	5
BUSINESS STRATEGY AND THE ENVIRONMENT	4
SCIENCE OF THE TOTAL ENVIRONMENT	4
APPLIED SCIENCES (SWITZERLAND)	3
FRONTIERS IN SUSTAINABILITY	3
IFIP ADVANCES IN INFORMATION AND COMMUNICATION TECHNOLOGY	3
JOURNAL OF ENVIRONMENTAL MANAGEMENT	3

Table: 3 summaries the information regarding the most relevant sources of both the databases and this is shown in descending order to make it easily understandable; which journal is contributing highest in their field and make it easy for researchers and scholars to easily set targets for publications and to find most relevant journal for their research.

**Most relevant sources**  
Web of Science Scopus



Source: Biblioshiny (figure:1)

From Figure: 1, it is interpreted that four journals are common in this field these are: Journal of Cleaner Production, Business Strategy and Environment, Environment, Development and Sustainability and Management Decision.

The most relevant source is from the Web of Science with 16 documents i.e. Sustainability and from Scopus its Circular Economy and Sustainability with 18 documents. Sources Production over time

**Table:4 Source: Biblioshiny**

Year	SUSTAIN-ABILITY	JOURNAL OF CLEANER PRODUC-TION	ENVIRONMENT DEVELOPMENT AND SUSTAIN-ABILITY	BUSINESS STRATEGY AND THE ENVIRON-MENT	APPLIED SCIENC-ES-BASEL	MANAGE-MENT DECI-SION	SCIENCE OF THE TOTAL ENVIRON-MENT
2017	0	1	0	0	0	0	0
2018	0	1	1	1	0	0	0
2019	1	5	1	1	0	1	1
2020	1	6	1	1	0	1	1
2021	6	10	1	2	1	1	1
2022	10	10	1	2	2	2	2
2023	13	11	1	4	3	3	3
2024	16	11	5	4	3	3	3

Table 4 shows the frequency or number of documents generated by the most relevant or active sources in its field per year of Web of Science. This indicates that the frequency of documents published per year is increasing, but few of them have a constant frequency compared to last year and may increase as the year is not finished yet because the data is abstracted in the middle of the year. This suggests that work on these keywords began in 2017.

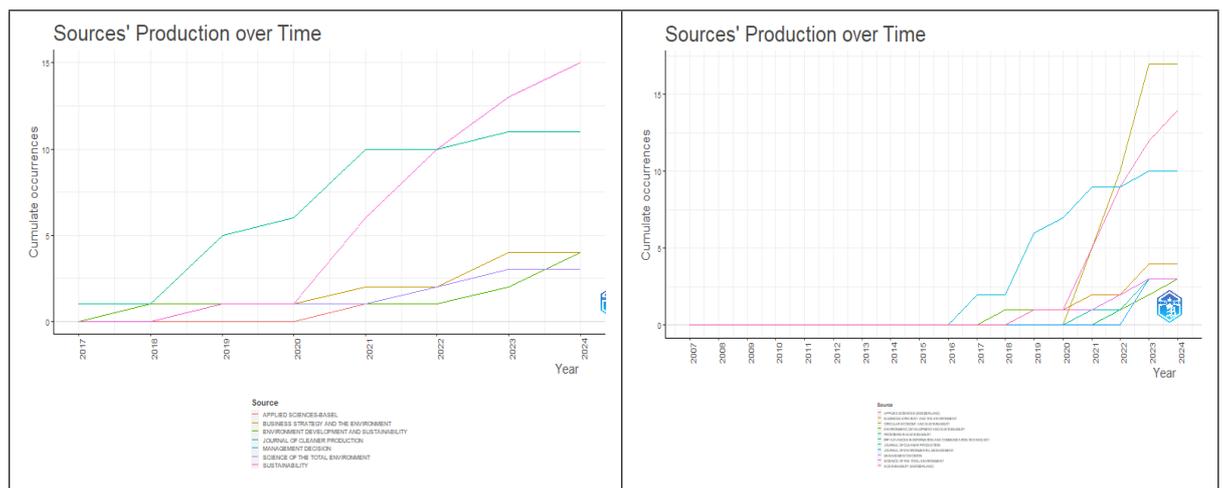
Sources Production over time

Table: 5 shows the data abstracted from Scopus and the publication started in the year 2017. The frequency of the published documents is increasing per year. And few journals started working in this field in later stages like in 2021 or 2019; these journals are Circular Economy and Sustainability (Switzerland) respectively. Circular Economy and Sustainability started its publication in the year 2021, and publishing documents at a very high and increasing rate.

**Table 5: Source: Biblioshiny**

Year	CIRCULAR ECONOMY AND SUSTAINABILITY	SUSTAINABILITY (SWITZERLAND)	JOURNAL OF CLEANER PRODUCTION	ENVIRONMENT, DEVELOPMENT AND SUSTAINABILITY	BUSINESS STRATEGY AND THE ENVIRONMENT	SCIENCE OF THE TOTAL ENVIRONMENT
2017	0	0	2	0	0	0
2018	0	0	2	1	1	0
2019	0	1	6	1	1	1
2020	0	1	7	1	1	1
2021	5	5	9	1	2	1
2022	10	8	9	1	2	2
2023	17	11	10	1	4	3
2024	18	14	10	5	4	4

Source production over time  
Web of Science Scopus



Source: Biblioshiny (figure: 2)



recycling	32
sustainability	32
waste management	16
life cycle	14
environmental impact	13
biomass	12
article	11
agriculture	10
carbon	10
economic and social effects	10
tensile strength	10
wastewater treatment	10
decision making	9
greenhouse gases	9
cellulose	7
climate change	7
economics	7
innovation	7

Table 6 shows the top 20 keywords of a word cloud, indicating the frequency of the keywords in the word cloud. The higher the frequency, the greater the prominence of the word in the word cloud. This table suggests which keywords are commonly used by researchers in their studies and which words they can use to find and fill research gaps. Additionally, this information interprets that the frequency of the keywords suggests which database is working more in which field, and accordingly, it is helpful for future research references in their field or areas of interest.

### Co-occurrence network

In the co-occurrence table, the “Node” column lists the different terms or concepts within the

network. These represent the entities whose relationships are being analyzed. The “Cluster” column indicates the grouping or community to which each node belongs. Nodes in the same cluster are more closely related to each other than to nodes in other clusters. Betweenness centrality measures the extent to which a node lies on the shortest paths between other nodes. A high betweenness score suggests that the node acts as a bridge or connector within the network, facilitating communication between different parts. Closeness centrality indicates how quickly a node can reach all other nodes in the network. It is calculated as the inverse of the average length of the shortest paths to all other nodes. A higher closeness value suggests that a node is more centrally located. PageRank evaluates the importance of a node based on the number and quality of links pointing to it. A higher PageRank value suggests greater influence or importance within the network.

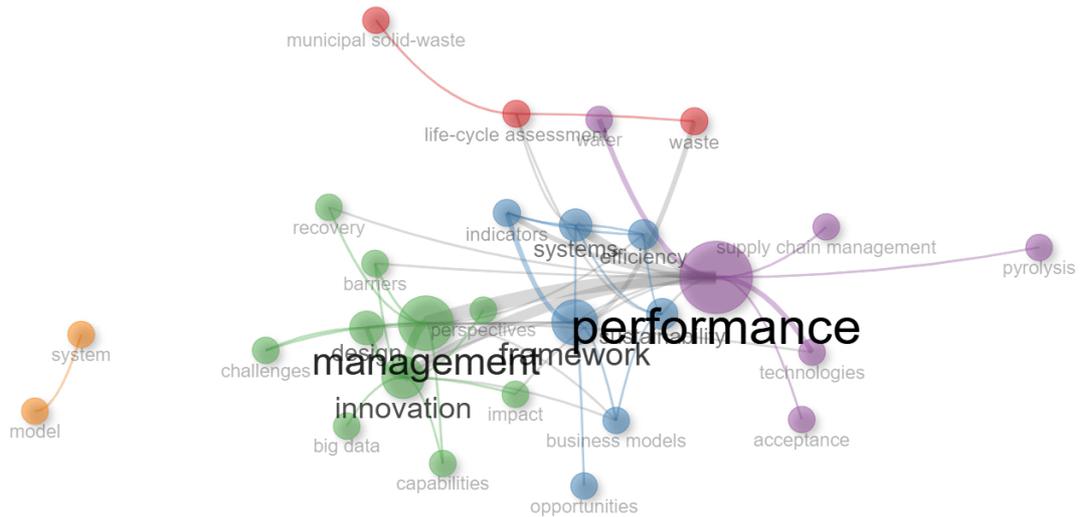
Web of Science

Table 7 indicates that there are five clusters in total, with cluster 3 having the maximum number of nodes and cluster 5 having the lowest number of nodes. In cluster 1, “Life-cycle assessment” has the highest betweenness and PageRank within this cluster, suggesting it is a key term in this group. In cluster 2, “Framework” stands out with high betweenness, closeness, and PageRank, indicating its central importance in this cluster. In cluster 3, “innovation” has the highest betweenness and PageRank, signifying its influential role. In cluster 4, “Performance” has the highest scores across all three metrics, making it a highly central and influential node. In cluster 5, there are only two nodes, “model” and “system,” both

showing maximum closeness centrality (a value of 1), indicating they are crucial connectors in the network, even though they have low betweenness and PageRank scores.

**Table 7: Source: Biblioshiny**

Node	Cluster	Betweenness	Closeness	PageRank
life-cycle assessment	1	25.595122	0.01515152	0.03696818
waste	1	5.43190109	0.01639344	0.0226765
municipal solid-waste	1	0	0.01111111	0.01321288
framework	2	57.0979127	0.02380952	0.07422448
sustainability	2	14.7011481	0.01960784	0.03823287
systems	2	25.3769956	0.02083333	0.0508158
efficiency	2	2.42360599	0.02	0.04280985
business models	2	3.76167958	0.01960784	0.03067621
indicators	2	0.76496674	0.01960784	0.0364551
opportunities	2	0	0.01515152	0.01166622
management	3	51.9547313	0.02380952	0.09613762
innovation	3	67.179441	0.02325581	0.09496008
design	3	3.67684332	0.01851852	0.03506996
recovery	3	0	0.01818182	0.01767633
challenges	3	0	0.01538462	0.01803458
barriers	3	0	0.01923077	0.02413361
impact	3	0	0.01851852	0.01808051
capabilities	3	0	0.01612903	0.01786754
perspectives	3	0	0.01492537	0.01181443
big data	3	0	0.01492537	0.01181443
performance	4	151.035653	0.02777778	0.15480897
water	4	0	0.01666667	0.01475626
technologies	4	0	0.01818182	0.02080937
pyrolysis	4	0	0.01666667	0.01162322
supply chain management	4	0	0.01666667	0.01162322
acceptance	4	0	0.01666667	0.01162322
model	5	0	1	0.03571429
system	5	0	1	0.03571429



This figure shows the result of data from the Web of Science

Source: biblioshiny (figure: 4)

Figure 4 interprets that the largest nodes in the center of the network likely represent the most important or frequently occurring terms. For example, “Performance” appears prominently suggesting it is a key term in the dataset. Different colored clusters indicate thematic groupings. For example, there might be a cluster focused on management concepts, another on frameworks, and others on more specialized topics. The edges connecting nodes between different clusters show the relationships or co-occurrences of terms across different themes.

### Scopus

Table 8 interprets that cluster 2 has the highest number of nodes and cluster 5 has

the lowest number of nodes. In cluster 1, “Sustainability” has the highest betweenness, closeness, and PageRank in the cluster, indicating it is a critical connector and influential node. In cluster 2, “sustainable development” has very high betweenness, closeness, and PageRank scores, highlighting its central and influential roles. This cluster contains many terms related to environmental and economic considerations. In cluster 3, “Metabolism” has notable betweenness, indicating it acts as an important connector within its cluster. In cluster 4, nodes generally have lower centrality metrics, suggesting they may be more specialized or peripheral in the overall network. In cluster 5, “Valorization” stands out with relatively high betweenness and PageRank, indicating its relevance in connecting different concepts related to this cluster.

**Table 8: Source: Biblioshiny**

Node	Cluster	Betweenness	Closeness	PageRank
recycling	1	11.8203846	0.01298701	0.04271981
sustainability	1	77.923422	0.01408451	0.06704341
waste management	1	7.48396869	0.01204819	0.02534515
biomass	1	24.1160581	0.01298701	0.03337537
article	1	2.90167232	0.01204819	0.02951368
agriculture	1	0.02941176	0.01111111	0.0112646
carbon	1	1.25747747	0.01190476	0.01950165
tensile strength	1	0.46693122	0.01123596	0.01300549
wastewater treatment	1	0.09836066	0.01149425	0.01301955
greenhouse gases	1	2.28902389	0.01190476	0.02255159
economics	1	0.27901316	0.01149425	0.01655104
innovation	1	0	0.01086957	0.00974076
phosphorus	1	0	0.01075269	0.00738641
adsorption	1	0.28888889	0.01111111	0.01023601
china	1	0	0.01052632	0.00610764
economic analysis	1	0	0.01098901	0.00794852
environmental economics	1	0	0.01123596	0.01263523
environmental sustainability	1	1.19714022	0.01176471	0.01777475
municipal solid waste	1	0	0.01086957	0.00795263
sustainable development	2	598.049077	0.01960784	0.19016668
circular economy	2	257.940011	0.01754386	0.13362272
life cycle	2	1.57679041	0.01190476	0.02608334
environmental impact	2	0.665085	0.01149425	0.02108598
economic and social effects	2	0.16752545	0.01136364	0.01895594
decision making	2	0	0.01098901	0.01394755
climate change	2	0.05309735	0.01098901	0.01287113
product design	2	0	0.01098901	0.01284714
supply chains	2	0.38529746	0.01136364	0.01516682
alkalinity	2	0	0.00970874	0.00489968
environmental management	2	0	0.01111111	0.00972863
lignin	2	0.33936316	0.01098901	0.01050158
literature reviews	2	0	0.01075269	0.01027974
systematic literature review	2	0	0.01086957	0.01104522
business models	2	0	0.01075269	0.00789483



others on more specialized topics. The edges connecting nodes between different clusters show the relationships or co-occurrences of terms across different themes.

## DISCUSSION

The research focuses on analyzing the evolution of circular economy studies within the context of sustainability, particularly in the manufacturing sector. It emphasizes the importance of comprehending the interplay among circular economy, technological innovation, and sustainability to promote durable practices within the manufacturing industry. This analysis reveals an interesting fact about the occurrence of certain keywords across both databases. “Circular economy and sustainability” are the most researched topics, while other combinations like technology innovation and the manufacturing sector showed fewer results. This suggests further research on the intersection of circular economy, technology innovation, and manufacturing sustainability to fill the gap and also help in attaining SDGs like SDG 9 and SDG 11. The findings of this bibliometric analysis provide valuable information for researchers interested in circular economy, technology innovation, and sustainability in the manufacturing sector. This suggests an opportunity for further exploration and development of integrated frameworks that utilize technological advancements to enhance circular economy practices. The analysis of both datasets indicates that major themes such as sustainable development, circular economy, performance, management, and framework lead the

research areas. However, this study addresses a notable gap specifically, the integration of technological innovation with circular economy principles in the manufacturing sector. This gap acts as a valuable research area for scholars trying to develop comprehensive frameworks integrating advanced technologies to achieve sustainability goals.

Green Technological innovations such as the Internet of Things (IoT), artificial intelligence (AI), and additive manufacturing (3D printing) play a major role in the transformation of lean manufacturing to the circular economy. Keywords like sustainability, waste management, sustainable development, circular economy, efficiency, recycle, recovery, etc., are the most influential according to this analysis. Furthermore, studying these keywords also helps policymakers and organizations to achieve their sustainability goals and work for the environment and society as well. It's the responsibility of every organization to work for the three P's (People, Planet, Profit), and this can be possible with the integration of technology innovation and circular economy in the manufacturing sector. Nowadays, consumers are also focusing on the environment and trying to purchase eco-friendly products, so those manufacturers that prioritize sustainability can enhance their competitive advantage and work for the three P's. These practices help improve brand image, customer loyalty, and compliance with regulations, which can lead to increased market share and profitability. This study emphasizes the importance of integrating circular economy principles with technological innovation to promote sustainability in the manufacturing sector.

## Implications

The findings offer actionable insights for managers and policymakers in the manufacturing sector. From strategic planning and innovation management to supply chain optimization and corporate social responsibility initiatives, managers can leverage the insights to drive organizational change and foster sustainable practices. Implementing a circular economy and sustainable manufacturing practices results in significant cost savings through efficient resource utilization, waste reduction, and energy conservation, improving profitability and contributing to environmental preservation and social well-being. Rethinking supply chain management to incorporate circular principles improves supply chain resilience and reduces dependency on finite resources. Companies can develop closed-loop systems that enhance material flow and reduce the environmental impact. The findings of this study are helpful for research scholars as well. With this, they can find the gap and the most influential keyword in their area of interest in the study, i.e., related to sustainability.

## Limitations and Future Research Direction

The main limitation of this study is that it focuses only on the two databases, i.e. Scopus and Web of Science. While extracting the data from databases, no screening was done because the number of publications was low. Further research can be done in this area using more analytical tools, and an empirical study should also be conducted in the manufacturing sector

by taking “circular economy and technology innovation” into consideration.

## CONCLUSION

The study illuminates the dynamic landscape of the circular economy, technology innovation, and sustainability research within the manufacturing sector. It highlights the increasing attention and scholarly interest in these interconnected fields, reflecting a growing recognition of their importance for achieving sustainable development goals. The analysis identifies emerging trends and research priorities, such as the embedding of circular economy principles into manufacturing processes, the role of technology innovation in driving sustainability, and the importance of collaborative approaches to address complex sustainability challenges. Despite the progress made in understanding the circular economy and technology innovation in the context of sustainability, the analysis also reveals certain knowledge gaps and areas requiring further exploration. This includes the need for more research on specific intersections, such as the integration of digital technologies in circular economy practices or the impact of regulatory frameworks on sustainable manufacturing. The analysis highlights the importance of interdisciplinary collaboration and knowledge sharing in advancing research and practice in the circular economy, technological innovation, and sustainability. By fostering partnerships between academia, industry, and government agencies, stakeholders can collectively address sustainability challenges and accelerate the

transition towards a circular and sustainable manufacturing sector. This bibliometric analysis shows that technology innovation and the manufacturing sector both lack research work towards sustainability and, according to today's requirements, it's important to work towards sustainability for any country and organization, as well as for a better future and the healthy lives of our young ones.

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# DIGITAL TRANSFORMATION OF ONLINE LEARNING TOOLS ADOPTED BY HIGHER EDUCATION INSTITUTIONS IN HARYANA DURING THE PANDEMIC

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## ABSTRACT

The COVID-19 pandemic has precipitated unprecedented changes across various sectors, with education being one of the most significantly impacted. As higher education institutions swiftly transitioned from traditional in-person teaching methods to online platforms, the need to assess and understand this digital transformation has become critical. This research paper explores the adoption of online learning tools by higher education institutions in Haryana during the pandemic, employing a qualitative research methodology to gain deeper insights into the experiences, challenges, and outcomes associated with this shift.

Utilizing a self-administered questionnaire, the study captures the perspectives of 200 teachers from higher education institutions across Haryana. The questionnaire is designed to probe various facets of the digital transition,

including the selection of tools, the effectiveness of online teaching methodologies, the challenges faced by educators in engaging students, and the overall impact on the educational process. Responses will be analyzed to identify patterns and themes that shed light on the effectiveness of the digital tools and strategies implemented during the pandemic.

The study aims to contribute to the broader discourse on digital education by providing empirical evidence on the successes and obstacles encountered by educators during this forced digital shift. By highlighting specific tools and practices that have either facilitated or hindered effective teaching or learning, the research seeks to offer valuable insights for policymakers, educational leaders, and technology providers. This, in turn, could guide future decisions on the integration of technology in education, ensuring that digital

platforms not only supplement but enhance the learning experience.

Moreover, the research will explore the sustainability of these digital practices post-pandemic, examining whether the emergency measures can evolve into long-term educational strategies. The findings are expected to provide a comprehensive overview of digital education's trajectory during a critical period, contributing to a strategic framework for leveraging technology in enhancing the resilience and quality of higher education in the face of future challenges.

**Keywords:** Digital Transformation Learning Tools in Higher Education Institutions (HEIs) in Haryana.

## INTRODUCTION

The COVID-19 pandemic has dramatically accelerated the adoption of digital technologies in higher education, forcing institutions around the globe to transition rapidly from traditional classroom settings to online learning environments. In Haryana, this shift has been particularly significant, with higher education institutions confronting both the opportunities and challenges presented by this sudden transformation. The adoption of various online learning tools has become a focal point for educational research, as it encapsulates the challenges of digital integration in an emergency context and its impacts on pedagogical outcomes. This study focuses on the digital transformation in higher education institutions in Haryana during the pandemic, examining the effectiveness of the online tools and methodologies adopted. By

employing a qualitative approach through a self-administered questionnaire distributed among 200 teachers, the research aims to capture a comprehensive view of the educators' experiences, the pedagogical challenges encountered, and the overall efficacy of digital learning. This introduction sets the stage for a detailed exploration into how these digital tools have reshaped the educational landscape, highlighting the need for policies and practices that support effective online teaching and learning. The study's insights are intended to inform future decisions by educational leaders and policymakers, ensuring that the integration of technology not only addresses immediate challenges but also enhances the long-term resilience and quality of education in the face of potential future disruptions.

### Relevance to Higher Education in Haryana

The relevance of studying the digital transformation of higher education in Haryana during the COVID-19 pandemic lies in the region's unique demographic and technological landscape. Haryana, a significant contributor to India's educational and technological sectors, faced a distinct set of challenges and opportunities when transitioning to online learning. Prior to the pandemic, while urban areas of Haryana boasted relatively high levels of technological adoption and internet connectivity, the rural areas were not as well-equipped, leading to a pronounced digital divide. The sudden necessity to shift to online platforms tested the resilience and adaptability of higher education institutions across this diverse state. Educational leaders were compelled to rapidly implement digital solutions, often improvising

to accommodate a varied student body in terms of technological accessibility and digital literacy. This transition is particularly relevant in Haryana, where the mix of rapidly growing tech hubs and traditional educational practices created a unique laboratory for studying the impact of digital tools on education. The pandemic magnified existing inequalities and forced institutions to innovate and rethink pedagogical strategies. Thus, examining how these institutions navigated the crisis, managed continuity in education, and planned for an uncertain future can provide valuable insights not only for local policymakers and educational administrators but also for global education systems facing similar challenges. The experience of Haryana's higher education sector during the pandemic highlights crucial lessons in leveraging technology to bridge educational gaps, enhancing digital literacy, and preparing for future disruptions, making it a vital area of study.

### **Importance of Digital Transformation**

The importance of digital transformation in the context of higher education has been dramatically underscored by the COVID-19 pandemic, which acted as a catalyst for an unprecedented shift towards online learning platforms across the globe. In higher education, digital transformation is not merely about substituting physical classrooms with virtual ones; it involves a comprehensive rethinking of teaching methodologies, learning processes, and administrative operations to enhance educational accessibility, efficiency, and quality. This transformation is crucial for several reasons. Firstly, it broadens the reach of educational offerings, allowing institutions

to extend their resources beyond traditional geographic limitations and make education more accessible to a diverse student body, including those from remote or underserved regions. Secondly, digital tools and technologies, such as learning management systems, artificial intelligence, and data analytics, provide educators with innovative ways to deliver content, assess performance, and personalize learning experiences at scale, which can lead to improved educational outcomes. Furthermore, digital literacy itself is a critical skill in the modern workforce, and integrating technology into everyday learning prepares students for the digital-centric jobs of the future.

Additionally, the resilience of educational institutions during disruptions, be they pandemics, natural disasters, or social unrest, is significantly enhanced by having robust digital infrastructures in place that can adapt and continue to function under a variety of conditions. Lastly, digital transformation encourages a culture of continuous innovation within institutions, promoting regular updates to curricula and teaching practices and fostering an environment that is responsive to the evolving demands of society and industry. Thus, the digital transformation of higher education is not just a response to a temporary crisis but a strategic evolution that aligns with broader educational and economic trends.

### **Technological Preparedness**

Technological preparedness in higher education institutions, particularly in a diverse state like Haryana, is a critical factor in their ability to respond effectively to the abrupt demand for

online learning platforms brought about by the COVID-19 pandemic. Prior to the pandemic, the level of readiness varied significantly across institutions, with those in urban areas generally better equipped with the necessary infrastructure, such as high-speed internet access and digital learning management systems. Conversely, institutions in rural areas often struggled due to limited connectivity and a lack of robust technological tools, which posed significant challenges when the need to transition to online learning became urgent.

The disparity in technological preparedness not only influenced the immediate response capabilities of these institutions but also impacted the overall effectiveness of the digital transition. Those with advanced IT departments and prior experience with online courses were able to pivot more smoothly, maintaining continuity of teaching and learning with less disruption. On the other hand, institutions that lacked this preparedness faced steep learning curves and delays in implementation, which could affect the educational outcomes of their students. The situation highlighted the importance of strategic investments in technology and training in educational settings, not just as a crisis response but as a fundamental component of educational planning and infrastructure. The pandemic underscored the need for all institutions, regardless of their previous level of technological adoption, to assess and upgrade their digital readiness as a critical step towards ensuring educational resilience and quality in the face of future challenges. This preparedness is not only about having the right tools but also about cultivating the digital literacy of both educators and students to leverage these tools

effectively, fostering an environment where technology enhances learning and operational efficiency.

### **Student Accessibility and Engagement**

Student accessibility and engagement in digital learning environments, particularly during the COVID-19 pandemic, emerged as pivotal factors in the effectiveness of the educational process in higher education institutions in Haryana. With the sudden shift to online platforms, disparities in access to reliable internet and appropriate digital devices significantly influenced students' ability to participate in online classes. In Haryana, where economic and geographic disparities are pronounced, the challenge was not only providing the hardware but also ensuring that all students had sufficient internet bandwidth and digital literacy to engage with the new modes of learning. Institutions faced the dual task of deploying digital tools that were user-friendly and could run on minimal technical specifications while also implementing support systems to assist students facing accessibility issues. Engagement, another critical aspect, was challenged by the impersonal nature of online interactions and the difficulty of replicating hands-on, interactive learning experiences in virtual classrooms. Teachers had to innovate with pedagogical strategies that could hold student attention and foster interactive participation. Techniques such as synchronous (real-time) and asynchronous (task-based, at one's own pace) learning, interactive discussion forums, and virtual group projects were employed to enhance

engagement. The psychological impact of isolation was also significant, with institutions needing to provide more than just academic support to maintain student engagement; emotional and motivational support became just as crucial. This scenario highlighted the essential need for educational institutions to develop comprehensive strategies that address not only the technological aspects of online learning but also the human factors that influence student engagement and accessibility, ensuring that learning remains inclusive and effective regardless of external circumstances.

### **Evaluation of Learning Tools**

The evaluation of learning tools during the rapid shift to online education in Haryana amid the COVID-19 pandemic required a multi-faceted approach to ensure that these tools met educational needs effectively. Higher education institutions embarked on assessing a wide array of digital platforms and tools based on several critical criteria, including user-friendliness, technical reliability, and the ability to facilitate interactive and engaging learning experiences. This process involved not only technical assessments but also pedagogical evaluations to determine how well these tools aligned with the curriculum needs and learning objectives of various courses. Feedback from both students and educators played a crucial role in this evaluation process, providing insights into the practical usability and effectiveness of these tools in a real-world educational context. Institutions prioritized tools that supported a range of functions, such as video conferencing for live classes, robust discussion forums for asynchronous communication, and

secure platforms for assessments and exams. Additionally, compatibility with multiple devices and operating systems was essential to accommodate the diverse technology access among students. The evaluation also considered the scalability of tools to handle varying class sizes and the inclusion of accessibility features to support students with disabilities. Ultimately, the effectiveness of learning tools was measured not just by their technical performance but by their impact on learning outcomes and student satisfaction. This comprehensive evaluation helped institutions not only adapt to immediate challenges but also plan for a future where blended and fully online modalities might become more prevalent, aiming to create a more resilient and flexible educational environment. This process highlighted the necessity for ongoing review and adaptation of technology in education, ensuring that learning tools evolve in tandem with pedagogical goals and technological advancements.

### **Objectives**

1. Evaluate the Effectiveness of Online Learning Tools and Methodologies
2. To study the effect of digital tools on teaching and learning practices
3. To study the effectiveness of various online tools on digital learning

### **LITERATURE REVIEW**

Kumar et al. (2020) studied “Outcome of Online Teaching-Learning over Traditional Education during the Covid-19 Pandemic” and stated that the purpose of this research is

to determine how the COVID-19 epidemic affected online education in India's higher education institutions. Problems, including inadequate training and resources, were uncovered via an online survey. The overarching goal of this study is to provide policymakers and academic institutions with the data they need to design better online education programs that foster the growth of young scholars and increase their employability.

Harman Preet Singh (2021) studied "Personalized and Adaptive Learning on Student Learning Performance: A TOE (Technology Organization Environment) Framework for Saudi Arabia" and stated that this research shows that a DT-PAL (Digital technology-enabled personalized and adaptive learning) student learning framework at the institutional level can be built using the TOE model. It also shows that this framework has the ability to improve students' performance. The concept posits that curriculum simplification, gender equality, increased professionalism, improved teaching approaches, and student creativity may all result from digital technology-enabled adaptive and individualized learning. With this information, Saudi Arabia and other nations may advance their education systems and achieve their digital transformation objectives set forth by their National Transformation Programs.

Mahajan and Gulati (2017) underscore the transformative potential of cloud computing in enhancing accessibility, scalability, and cost-efficiency within academic resource management, particularly in libraries. While their focus centers on library administration, the principles extend to other institutional domains, notably online learning resources.

The pandemic-induced pivot to remote education has prompted global postsecondary institutions to implement learning management systems, video conferencing tools, and other digital assets. In Haryana, leveraging digital technology has surmounted pandemic challenges, revolutionized traditional pedagogical landscapes, and fostered innovative educational methodologies.

(Bhardwaj & Rathee, 2021) in the paper titled "Virtual Flipped Classroom: An Approach Transforming Online Learning in Indian Higher Education" and said that virtual flipped classrooms are one of the digital techniques that have emerged in response to the COVID-19 epidemic. Research involving fifty Master of Education (M.Ed.) students at Maharshi Dayanand University in Rohtak indicated that the virtual flipped classroom significantly improved their learning results. By highlighting the benefits of both online and in-person instruction, the results hope to inspire educators to embrace technology and open up new avenues for student learning.

(Bharej & Billus, n.d.), in the paper titled "Quality Enhancement in Teaching-Learning and Evaluation of HEIs during Covid Scenario - with Reference to Sanatan Dharma College, Ambala Cantt" and said that focusing on its ongoing attempts to preserve higher education quality, this research article examines the online teaching and learning system used by Sanatan Dharma College, Ambala Cantt during the COVID-19 epidemic. To emphasize the most employable educational materials, it employs quantitative and qualitative methods.

The study on mobile applications in education by Sunitha and Elina (2020) provides insight into the expanding significance of digital learning tools in contemporary pedagogy. The investigation of mobile applications highlights how they might improve student and teacher accessibility, engagement, and individualized learning experiences. The implementation of digital technologies has been crucial in Haryana's higher education institutions during the epidemic, as it has enabled remote teaching and learning and altered conventional educational paradigms. Prakash et al., 2021, in the research paper "Pandemic of Covid-19, Lockdown and its Impact on Indian Education System," said that education has a key role in human evolution, adapting to new technology, and social demands. Education is still going strong in the face of the COVID-19 epidemic, which has killed millions of people and left many more without jobs, thanks to new tools and approaches in the classroom. The effects of COVID-19 on the Indian education system are examined in this study, with special emphasis on the pros and cons of online education.

The investigation of mobile application development for Android platforms by Chawla, Aggarwal, and Aggarwal (2016) provides insights into the nexus between technology and education. Pupils may access instructional materials anywhere, at any time, using mobile digital education, which opens up new possibilities for ubiquitous learning. Mobile applications have become essential tools for providing online learning content throughout the epidemic, helping Haryana's higher education institutions to successfully engage students and adjust to distant teaching.

Aslam et al. (2021) study examined how the COVID-19 lockdown affected higher education, with a particular focus on Library and Information Science (LIS) students in India. Based on a survey methodology conducted at 19 Central Universities, the results showed that online courses, mostly offered by Zoom, were widely adopted. Prominent obstacles, like insufficient internet connectivity, were noted, highlighting the critical function of webinars in transforming teaching methods in the LIS field.

The study of ICT in higher education by Dixit and Raheja (2020) demonstrates the complex array of problems, difficulties, and solutions in India. Haryana's higher education institutions had to quickly adopt digital transformation because of the major challenges they encountered during the epidemic. In light of these extraordinary conditions, the incorporation of online learning resources became essential for maintaining educational continuity and meeting the changing demands of both teachers and students.

Chatterjee et al., 2023, studied "Information and Communication Technologies in Education: A Framework for Transforming the Indian Education System through Smart Learning" and said that the all-around development of a developed country depends on its educational system's use of digital tools. Modernizing its education system, India has promoted "Smart learning," an approach based on information and communication technologies. In this research, we look at how information and communication technologies may help build a digital world and how they

might improve education for the future. Analyzing reports, research works, and expert views, the study employs descriptive research, qualitative methodologies, and thematic and content analysis. Educational policymakers and scholars in the future of India might use the findings as a reference. The study by Malik and Rana (2018) highlights the critical role that cloud computing plays in e-learning ecosystems by looking at it as the foundation of educational platforms. Cloud-based solutions offer scalable infrastructure that makes it easier to deliver interactive tests, multimedia information, and collaboration tools necessary for online learning. During the epidemic, this technology architecture facilitates easy access to instructional resources, improving the flexibility and effectiveness of e-learning settings in Haryana's higher education institutions.

The study conducted during the COVID-19 epidemic by Bansal et al. (2021) examined the transformative influence of digital technology in e-learning. It concentrated on implementing online learning tools, including WhatsApp, AnyDesk, Zoom, and Microsoft Teams, in the face of widespread lockdowns and school closures. Studies have highlighted issues with data security and transmission performance, especially in cloud computing settings intended to improve the safe and effective delivery of educational content. Incorporating encrypted and compressed data communication protocols was intended to decrease packet loss and minimize delays, improving the overall resilience of e-learning systems throughout the epidemic.

(Singh & Rana, 2023) studied "Revitalizing E-Governance in Haryana: Embracing Digital Transformation Post-Pandemic" and said that Governments at all levels in Haryana have embraced technology in response to the COVID-19 pandemic's effects on the state's e-governance infrastructure. The significance of e-governance efforts is underscored by the transition to a cashless society. To maintain excellent governance, encourage contactless interactions, and progress the Digital India program, the Haryana government must devise a plan to speed up digital transformation and public involvement, making appropriate use of technology.

Arora and Yadav (2020) outline the complex terrain of ICT activities in higher education, concentrating on the educational environment of Haryana. Their academic discussion captures the complex development of virtual learning resources throughout the epidemic and illuminates the revolutionary path taken by universities. By carefully combining theoretical ideas with empirical data, the writers navigate the complexity of this paradigm shift to explain the many facets of digital transformation. The scholarly discourse of Aggarwal (2014) delves deeply into the transformative potential of digital education by navigating the complex domain of e-learning in the context of mobile ad hoc networks. Examining how mobile technology and pedagogical paradigms work together harmoniously, the author sheds light on how online learning tools have changed education. By means of a thorough analysis of mobile ad hoc networks, Aggarwal outlines the changing features of digital education,

emphasizing its critical function in supporting dynamic educational environments.

In Rana and Malik's (2022) research, the literature analysis clarifies the many ways in which the COVID-19 pandemic has affected the educational environment, with an emphasis on how online learning tools have changed in Haryana's Higher Education Institutions (HEIs). Using a thorough synthesis of previous research, the study emphasizes how important it is for HEIs to quickly transition to digital modalities in the midst of the epidemic, pointing out both the benefits and problems that come with this revolutionary change. Regression analysis and correlation coefficients were two of the statistical techniques used in the article to identify the complex link between COVID-19 and the development of the educational system.

In Maiti, Sharma, and Pandey's comparative analysis from 2022, the stark differences in higher education quality between Chhattisgarh's public and private universities were highlighted. These differences were made worse by the use of technological instruments in pedagogy. The study found that whereas private colleges were skilled at running their online programs, government universities had many challenges, such as restricted access to necessary equipment and poor internet connectivity, which were made worse in tribal regions. In the end, the study emphasized the need for deliberate initiatives to close the educational gap by noting the many problems associated with online learning, including poor infrastructure, limited funding, and inconsistent teacher quality.

Using information from government initiatives and the National Education Policy (NEP) of 2020, the literature review based on Papnoie and Ravi's (2023) study offers a thorough examination of the digital transformation of online learning tools within Higher Education Institutions (HEIs) in Haryana during the pandemic. This study delves deeply into the crucial role that government interventions play in encouraging the use of online education platforms. It also clarifies the policies, regulations, and financing mechanisms that are intended to improve the digital infrastructure and pedagogical practices in higher education institutions. The study utilized both descriptive statistics and thematic analysis as statistical methods to explicate the complex dynamics of the digital revolution in the context of education.

Uppal and Rana's (2023) study elucidate the increased prevalence of digital learning in Indian schools, emphasizing Haryana's HEIs during the pandemic. It meticulously examines online learning technology adoption, obstacles, and impacts on pedagogy and student engagement, employing trend and qualitative content analysis. Government initiatives, including digital infrastructure development, e-learning policies, and programs like SWAYAM and the National Digital Library, aim to democratize access to quality education across socioeconomic strata.

The literature study that is taken from the research of Sarkar and Syamsunder (2022) offers a comprehensive analysis of how the COVID-19 pandemic has affected efforts related to training and development. It provides

insightful information about how online learning resources have evolved digitally within Haryana's Higher Education Institutions (HEIs). By utilizing statistical techniques such as regression analysis and ANOVA, the research thoroughly clarifies the complex dynamics influencing how the pandemic affects training paradigms. Aspects including the use of remote learning, improvements to the technology infrastructure, and pedagogical modifications are examined in light of the pandemic's unparalleled disruptions. The rapid transition from traditional to online education in India, brought about by the COVID-19 epidemic, was critically studied by Nawale (2021), who also highlighted the substantial obstacles that both instructors and students experienced in sustaining the quality of e-learning. The study highlighted the differences between the pandemic-induced ad hoc emergency remote teaching that lacked necessary infrastructure and voluntary participation, and the established online education frameworks like those offered by IGNOU. Despite significant challenges, such as psychological strain and inadequate technology, the study highlighted fresh avenues for educational innovation and the need for a quick transition to the new digital paradigm.

The study conducted by Chauhan et al. (2021) examined the desire of full-time business school students and teachers in India and Italy to continue using digital classroom approaches instead of traditional ones during the COVID-19 epidemic. Using Smart PLS 3 software, the study analyzed survey data from 396 students and 130 faculty members, integrating the Expectation Confirmation Model (ECM) and Task-Technology Fit (TTF). The results showed

that task-technology fit, perceived utility, and satisfaction all had a substantial impact on students' intentions to continue using technology. Italian students were more likely to prioritize task-technology fit than Indian students, who were more concerned with technological mastery. Teachers in both nations showed that the correlation between task-technology fit and inclination to continue was relatively less.

Singh, Gopal, and Kiran (2022) meticulously analyzed the transformative impact of digitalization on the teaching-learning process at Sanatan Dharma College, Ambala Cantt, highlighting the profound reliance on ICT advancements during the pandemic. Their study underscored the increased relevance and utilization of digital platforms such as SWAYAM, National Digital Library of India, and CEC, which facilitated continued educational engagement despite lockdowns. By integrating ICT tools with conventional methods, the college effectively addressed the diverse needs of learners, thereby enhancing the quality of education and adapting to the 'new normal' in higher education.

Sahu and Samantaray (2022) conducted a thorough assessment of the digital revolution of education in India, focusing on rural areas. They highlighted the critical role that technology plays in improving educational outcomes. The study emphasized the government's efforts to provide instructors and pupils with cutting-edge technology tools and online resources, highlighting the possibilities and difficulties that rural India may face in adjusting to these technological improvements. Despite these challenges, the study outlined a promising path for digitizing rural education with the goal of

preparing rural students for the demands of future technology.

The literature study derived from Wadhwa's (2013) research emphasizes how important it is for Higher Educational Management Institutes (HEMIs) to have full 360-degree training and development systems. It clarifies how important these kinds of solutions are in helping Higher Education Institutions (HEIs) in Haryana during the epidemic to digitize their online learning resources. In her study, Wadhwa promotes the incorporation of a variety of training techniques and pedagogical strategies, highlighting the importance of these approaches in helping teachers and students develop their ability to adapt and become technologically proficient.

The deployment of ICT-based learning tools in Indian higher education during the COVID-19 epidemic was carefully examined by Singh et al. (2022). They also conducted a comparative examination of the widely supported 'SWAYAM' platform against other international e-learning platforms. The study's findings indicated notable differences in characteristics including distribution channels, target markets, and user population, suggesting that 'SWAYAM' needs to be significantly improved in order to compete globally. The thorough SWOC analysis included insightful information about the advantages, disadvantages, opportunities, and difficulties related to these e-learning portals. It also offered tactical suggestions for the creation of policies that would satisfy stakeholders and spur innovation in education.

Bello and Hamam's (2020) literature analysis delves into the complexities of

information and communication technology (ICT) adoption in Nigerian tertiary education regulations. It provides insightful information on the larger context of digital transformation. It examines the complex dynamics affecting the adoption of ICT techniques and technologies, outlining the opportunities and obstacles that come with the process. The study by Bello and Hamam emphasizes the role that institutional policies and regulatory frameworks play in determining how ICT adoption develops, emphasizing the necessity of all-encompassing approaches to enable seamless integration into the higher education environment. The literature review derived from Krishna and Sekharaiah's (2015) study explores the complex domain of security aspects related to online social network users, providing important insights into the protective mechanisms of the digital world. It examines the wide range of instruments and procedures used to guarantee the availability, confidentiality, and integrity of user information on online social networking sites. In their study, Krishna and Sekharaiah highlight the need for strong security frameworks and explain how they may reduce vulnerabilities and maintain user confidence in the face of changing cyber threats.

Yadav and Soni's (2022) study's literature analysis delves into a fascinating investigation of the ways in which technology interacts with social dynamics, with a special emphasis on the ways in which technology contributes to societal peace and harmony. It deftly examines the plethora of digital tools that are employed to strengthen social ties, foster communication, and diffuse conflicts, providing a new outlook on the transformational power of technology in

promoting communal well-being. This study raises important questions about how digital platforms might help communities develop empathy, understanding, and resilience. It also signals the beginning of a new age in which technology plays a key role in promoting social harmony and cohesiveness.

Shukla and Singh (2022) scrutinized the utilization and perception of electronic resources by faculty in private universities within Delhi NCR during the COVID-19 pandemic. Their study highlighted the significant reliance on e-resources and online learning tools facilitated by university libraries, which were essential in maintaining the continuity of education amid widespread institutional closures. The research underscored the need for robust library support and tailored e-resource development to enhance faculty teaching and research experiences in the digital transformation era.

A comprehensive literature analysis was carried out by Duggal, et, al, (2021) to investigate the state of schooling in India during the COVID-19 epidemic. They emphasized the move to digital teaching techniques and disclosed government initiatives to set up free online learning environments. But there were also major obstacles, like differences in internet accessibility and poor infrastructure. The study's findings were intended to contribute to the growing conversation about online education during international emergencies by educating educators and higher education institutions on how to restructure pedagogical practices to better prepare for future crises. Sharma and Choudhary (2022) carried out a thorough analysis of the revolutionary effects of ICT on education, which were especially

expedited by the COVID-19 epidemic and required an immediate transition to digital learning modalities. The study highlighted the ways in which educational institutions have adapted to online and blended learning settings, underscoring the important role that electronic resources play in improving the quality of education and the development of skills. The report also stressed how well the paper aligns with India's New Education Policy (NEP) 2020, which promotes significant ICT integration changes for comprehensive and excellence-driven educational experiences.

During the COVID-19 epidemic, Kumar et al. (2023) investigated instructors' attitudes on the adoption of e-learning in Indian higher education institutions, concentrating on factors including perceived utility, institutional support, and teacher-student interaction. The results, which were obtained through the use of PLS-SEM and online questionnaires, emphasized the critical role that teachers' attitudes and levels of satisfaction with online instruction are shaped by perceived usefulness and institutional support. By providing thorough insights into the factors impacting instructors' intention to continue using online teaching approaches in the face of educational disruptions, the study adds to the body of literature.

The literature review that resulted from the research conducted by Gupta and Gupta (2011) explores the practical implications of Information Technology (IT) in the context of management education, providing insight into the relevance and practical applicability of IT. It examines a range of IT resources and approaches used in management education,

explaining how they improve the delivery of instruction, enable experiential learning, and develop managerial skills. The study by Gupta and Gupta is a groundbreaking investigation of the complex relationship between IT and management education, emphasizing the transformational power of this relationship in preparing future leaders with the knowledge and abilities needed to successfully navigate a world that is becoming more and more digital.

The literature study that was taken from the research of Raman and Kaushik (2016) performs a thorough investigation of contemporary cybersecurity technologies and approaches, providing a thorough evaluation of their applicability and effectiveness. It explores a wide range of innovative methods and tools used to protect networks and digital assets, explaining how they help to reduce cyber threats and guarantee data integrity. The work of Raman and Kaushik is regarded as a foundational work in the industry, offering insightful information on how cybersecurity methods are changing and opening the door to greater resilience in a world that is becoming more linked. A thorough evaluation of online versus traditional teaching-learning was carried out by Kumar et al. (2020) in multiple Indian higher education institutions during the COVID-19 pandemic. Their quantitative survey demonstrated the critical role that online education plays, even in the face of obstacles like limited resources and inadequate preparation for ICT-based learning. In order to improve online learning outcomes and students' employability in a post-pandemic environment, the study underlined the

necessity of customized training programs for instructors and students.

The study conducted by Maheshwari et al. (2021) carefully explained the substantial shift in higher education brought about by the introduction of e-learning, which was greatly accelerated by the COVID-19 epidemic. This study highlighted the emerging trend of moving away from traditional pedagogical frameworks and towards virtual, learner-centric paradigms. It also revealed that e-learning has received generally positive feedback from both educators and students because of its many benefits, including increased mobility, content richness, and feasibility. However, the investigation also revealed significant obstacles, such as poor infrastructure, the digital divide in rural areas, and cybersecurity issues, which call for proactive steps to remove these barriers and maintain productive teacher-student relationships.

The Malik and Rana (2020) study's literature review provides a comprehensive analysis of the benefits and drawbacks of e-learning deployment in higher education. It explores the several platforms and technologies used in e-learning settings in detail, explaining how they might improve the accessibility, adaptability, and interactivity of instruction. Informed by a comprehensive knowledge of the complex consequences of adopting e-learning, Malik and Rana's study makes a significant addition to the conversation and helps higher education institutions make strategic decisions throughout the epidemic.

Gupta and Pal's (2021) study on COVID-19's impact on Indian higher education,

focusing on the University of Delhi, reveals significant challenges in transitioning to online instruction across seventeen departments. Urban and rural student disparities, unpreparedness for work placements, and administrative hurdles due to reliance on paper-based systems emerged. Nonetheless, the university community's resilience underscores potential future advancements in digital educational technologies.

In their research chapter, Gusai, et al, (2023) offered a thorough examination, examining the dramatic transition during the COVID-19 epidemic from traditional schooling to e-learning and distance learning. Their study covered the potential and problems faced by teachers and students around the globe, emphasising how quickly digital platforms like Tencent Classroom and Byju's are being adopted. Disparities in digital access, especially in rural regions, remained a serious concern despite the explosion of online resources. The chapter recognised the continuing value of in-person connection in education while highlighting the transformative potential of online learning.

The literature study, which is based on Bhat's 2009 ground-breaking work, explores how Information and Communication Technology (ICT) has the power to drastically alter India's educational system. It carefully looks at the range of instruments and approaches used to use ICT to improve outreach, quality, and accessibility in education, and it clarifies the various ways that it affects Haryana's higher education institutions in the middle of the epidemic. Bhat's work is a ground-breaking

analysis of the tactical use of ICT tools, explaining how they may drive digital change in the classroom and create inclusive learning environments that are responsive to the needs of the modern world.

Shukla's (2023) research perceptively explores digital technology's transformative potential in education, analyzing tools, methodologies, and models reshaping teaching, organization, and student engagement in Haryana's HEIs during the pandemic. This foundational work provides a comprehensive examination of digital adoption impacts, informing strategic plans that foster resilient and progressive educational environments, significantly contributing to academic discourse.

The study of literature that resulted from Kumar et al.'s (2021) thorough inquiry explores the complex world of blended learning techniques and tools, providing a thorough examination of their suitability and effectiveness in Haryana's Higher Education Institutions (HEIs) during the epidemic. It carefully examines a wide range of instructional strategies, technology tools, and pedagogical techniques used in blended learning settings, explaining how they contribute to individualized, dynamic, and interesting learning experiences. The study by Kumar et al. stands out as a foundational addition to the academic conversation because it offers priceless insights into the complex dynamics of blended learning adoption, guiding strategic actions meant to improve student outcomes and resilience in the face of unprecedented upheavals.

The literature evaluation that resulted from the empirical inquiry conducted by Anthony et al. (2019) explores the complex ways in which blended learning might improve teaching and learning effectiveness in higher education institutions. It carefully examines a wide range of instruments, approaches, and teaching strategies used in blended learning settings, explaining their complex effects on student participation, learning outcomes, and knowledge acquisition. The paper by Anthony et al. stands out as a foundational contribution to the academic conversation because it offers insightful information about the complex dynamics of blended learning adoption. This information can then be used to inform strategic initiatives that aim to maximize educational opportunities in the context of higher education's constant change.

## RESEARCH METHODS

This quantitative study investigates the digital transformation of online learning tools in Higher Education Institutions (HEIs) across Haryana during the pandemic. Employing

a cross-sectional design, data are collected from 200 participants representing diverse HEIs in the region. A purposive sampling approach is utilized to ensure a comprehensive understanding of digital transformation efforts. The study relies on a structured questionnaire developed from existing literature and expert input to gather insights into the extent and nature of digital transformation initiatives in HEIs amidst the pandemic.

### Reliability Analysis

The case processing summary reveals that all 200 cases in the study were valid, with none excluded. Utilizing listwise deletion, cases with missing data across all variables were excluded from analysis, ensuring the completeness of the dataset. Regarding reliability, Cronbach's Alpha, a measure of internal consistency, was calculated at 0.949, suggesting high reliability. This analysis involved 14 items, indicating the likely use of a questionnaire or scale with multiple components. Overall, these findings indicate a well-processed dataset with strong reliability, providing a robust foundation for drawing conclusions from the study's results.

**Table 1:**

<b>Case Processing Summary</b>			
		<b>N</b>	<b>%</b>
<b>Cases</b>	<b>Valid</b>	200	100.0
	<b>Excluded</b>	0	.0
	<b>Total</b>	200	100.0
a. Listwise deletion based on all variables in the procedure.			
<b>Reliability Statistics</b>			
<b>Cronbach's Alpha</b>		<b>N of Items</b>	
.949		14	

## DATA ANALYSIS AND RESULTS

### Demographic Analysis:

The data presents the distribution of gender and age among participants in the study. Regarding gender, 58% of the participants identified as male, while 42% identified as female. This indicates a slight male majority within the sample. In terms of age, the majority of participants fall within the 18-30 age bracket, comprising 44% of the sample. Participants aged 30-40 represent 35% of the sample, while those aged 41-60 account for 21%. Overall, the data reflects a diverse representation in terms of both gender and age groups among the participants.

The data outlines the distribution of participants across academic departments and their years of teaching experience. In terms of academic departments, the highest frequency is observed in Humanities, accounting for 37% of the participants. Sciences, Engineering and Technology, and Social Sciences each represent 21% of the participants, indicating a relatively balanced distribution across these fields.

Regarding years of teaching experience, participants with 1-5 years of experience constitute the largest group, making up 37% of the sample. Those with 6-10 years, 11-15 years, and more than 15 years of teaching experience each represent 21% of the participants. This distribution suggests a diverse range of teaching experience

**Table 2:**

Gender				
	Frequency	Percent	Valid Percent	Cumulative Percent
Male	116	58.0	58.0	58.0
Female	84	42.0	42.0	100.0
Age				
	Frequency	Percent	Valid Percent	Cumulative Percent
18-30	88	44.0	44.0	44.0
30-40	70	35.0	35.0	79.0
41-60	42	21.0	21.0	100.0

**Table 3:**

Academic Department				
	Frequency	Percent	Valid Percent	Cumulative Percent
Humanities	74	37.0	37.0	37.0
Sciences	42	21.0	21.0	58.0
Engineering and Technology	42	21.0	21.0	79.0
Social Sciences	42	21.0	21.0	100.0
Years of Teaching Experience				
	Frequency	Percent	Valid Percent	Cumulative Percent
1-5 years	74	37.0	37.0	37.0
6-10 years	42	21.0	21.0	58.0
11-15 years	42	21.0	21.0	79.0
More than 15 years	42	21.0	21.0	100.0

levels among the participants, contributing to a comprehensive representation across different academic disciplines and experience levels.

The data illustrates perceptions regarding the impact and usability of digital learning tools utilized during the pandemic. Regarding the overall quality enhancement of teaching and learning, 35% of respondents agreed that the tools positively affected quality, while 14% strongly agreed. Conversely, 22.5% strongly disagreed and 14.5% disagreed with this notion, indicating some dissenting opinions.

Regarding ease of navigation and use, 36% of respondents agreed that the tools were easy to navigate and use, while another 14% strongly agreed. However, 15% strongly disagreed and 21% disagreed with this statement, suggesting a higher proportion of respondents expressing challenges with tool usability. Overall, the data reflects a range of perceptions regarding the

impact and usability of digital learning tools during the pandemic, with a notable proportion of respondents expressing positive sentiments but also indicating areas for improvement.

For student engagement, 35% of respondents agreed that the digital tools effectively facilitated engagement, with an additional 14% strongly agreeing. Conversely, 22.5% strongly disagreed and 14.5% disagreed with this statement, indicating mixed opinions on the effectiveness of the tools in promoting engagement.

Regarding the enhancement of teaching and learning quality, 28% of respondents agreed that the tools had a positive impact, while 14.5% strongly agreed. However, 22.5% strongly disagreed and 21% disagreed with this notion, suggesting a higher proportion of dissenting opinions regarding the tools' efficacy in improving overall teaching and learning

**Table 4:**

<b>The digital tools I used improved the overall quality of teaching and learning.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	45	22.5	22.5	22.5
<b>Disagree</b>	29	14.5	14.5	37.0
<b>Neutral</b>	28	14.0	14.0	51.0
<b>Agree</b>	70	35.0	35.0	86.0
<b>Strongly Agree</b>	28	14.0	14.0	100.0
<b>The digital learning tools I used during the pandemic were easy to navigate and use.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	30	15.0	15.0	15.0
<b>Disagree</b>	42	21.0	21.0	36.0
<b>Neutral</b>	28	14.0	14.0	50.0
<b>Agree</b>	72	36.0	36.0	86.0
<b>Strongly Agree</b>	28	14.0	14.0	100.0

quality. Overall, the data reflects a diverse range of perspectives on the effectiveness and impact of digital tools in the educational setting during the pandemic.

**Table 5:**

<b>The digital tools I used effectively facilitated student engagement during online classes.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	45	22.5	22.5	22.5
<b>Disagree</b>	29	14.5	14.5	37.0
<b>Neutral</b>	28	14.0	14.0	51.0
<b>Agree</b>	70	35.0	35.0	86.0
<b>Strongly Agree</b>	28	14.0	14.0	100.0
<b>The digital tools I used improved the overall quality of teaching and learning.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	45	22.5	22.5	22.5
<b>Disagree</b>	42	21.0	21.0	43.5
<b>Neutral</b>	28	14.0	14.0	57.5
<b>Agree</b>	56	28.0	28.0	85.5
<b>Strongly Agree</b>	29	14.5	14.5	100.0

**Table 6:**

<b>Using digital tools for online teaching presented significant technical challenges.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	60	30.0	30.0	30.0
<b>Disagree</b>	42	21.0	21.0	51.0
<b>Neutral</b>	28	14.0	14.0	65.0
<b>Agree</b>	56	28.0	28.0	93.0
<b>Strongly Agree</b>	14	7.0	7.0	100.0
<b>The adoption of digital tools provided new opportunities for innovative teaching methods.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	45	22.5	22.5	22.5
<b>Disagree</b>	43	21.5	21.5	44.0
<b>Neutral</b>	14	7.0	7.0	51.0
<b>Agree</b>	70	35.0	35.0	86.0
<b>Strongly Agree</b>	28	14.0	14.0	100.0

Regarding technical challenges, 30% of respondents strongly disagreed that significant technical challenges were present, while 28% agreed, and 21% disagreed. Meanwhile, 14% held a neutral stance, and 7% strongly agreed with the statement, suggesting a mixed range of experiences regarding technical hurdles.

In terms of opportunities for innovative teaching methods, 35% of respondents agreed that the adoption of digital tools provided new opportunities, with an additional 14% strongly agreeing. Conversely, 22.5% strongly disagreed and 21.5% disagreed with this statement, indicating differing perspectives on the extent to which digital tools facilitate innovative teaching approaches.

In terms of usability, 28% of respondents found the tools easy to navigate and use, with an additional 28% agreeing with this statement. Conversely, 22% disagreed and 15% strongly

disagreed, indicating a notable proportion of participants expressing challenges with tool usability. Additionally, 7% strongly agreed with the statement, suggesting a smaller yet positive sentiment regarding tool usability.

Regarding student engagement, 36% of respondents agreed that the digital tools effectively facilitated engagement, while 14% strongly agreed. Conversely, 21% disagreed and 15% strongly disagreed, indicating a mix of opinions on the effectiveness of the tools in promoting student engagement. Additionally, 14% held a neutral stance on this matter.

Concerning confidence in integration, 36% of respondents agreed that they felt confident in their ability to integrate digital tools into teaching practices, while 14% strongly agreed. Conversely, 21% disagreed and 15% strongly disagreed, indicating varying levels of

**Table 7: The digital learning tools I used during the pandemic were easy to navigate and use.**

<b>The digital learning tools I used during the pandemic were easy to navigate and use.</b>				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	30	15.0	15.0	15.0
Disagree	44	22.0	22.0	37.0
Neutral	56	28.0	28.0	65.0
Agree	56	28.0	28.0	93.0
Strongly Agree	14	7.0	7.0	100.0
<b>The digital tools I used effectively facilitated student engagement during online classes.</b>				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	30	15.0	15.0	15.0
Disagree	42	21.0	21.0	36.0
Neutral	28	14.0	14.0	50.0
Agree	72	36.0	36.0	86.0
Strongly Agree	28	14.0	14.0	100.0

**Table 8:**

<b>I felt confident in my ability to integrate digital tools into my teaching practices.</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	30	15.0	15.0	15.0
<b>Disagree</b>	42	21.0	21.0	36.0
<b>Neutral</b>	28	14.0	14.0	50.0
<b>Agree</b>	72	36.0	36.0	86.0
<b>Strongly Agree</b>	28	14.0	14.0	100.0

<b>The digital tools provided sufficient flexibility to adapt to different teaching styles and course formats</b>				
	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Strongly Disagree</b>	45	22.5	22.5	22.5
<b>Disagree</b>	42	21.0	21.0	43.5
<b>Neutral</b>	28	14.0	14.0	57.5
<b>Agree</b>	56	28.0	28.0	85.5
<b>Strongly Agree</b>	29	14.5	14.5	100.0

confidence among participants. Additionally, 14% held a neutral stance on this matter.

Regarding flexibility, 28% of respondents agreed that the digital tools provided sufficient flexibility to adapt to different teaching styles and course formats, with an additional 14.5% strongly agreeing. However, 22.5% strongly disagreed and 21% disagreed with this statement, suggesting a notable proportion of participants expressing challenges with tool flexibility. Additionally, 14% held a neutral stance on this matter.

## DISCUSSION

The data provides valuable insights into educators' perceptions regarding the integration and effectiveness of digital tools in online teaching practices during the pandemic. It is

notable that while a significant proportion of respondents expressed confidence in their ability to integrate digital tools into their teaching practices, there were also dissenting opinions, with a considerable number indicating either a lack of confidence or neutrality on the matter. This suggests a need for further support and training to enhance educators' digital literacy and confidence in utilizing these tools effectively.

Similarly, the data highlights mixed perceptions regarding the usability and effectiveness of digital tools in facilitating student engagement and adapting to different teaching styles and course formats. While a substantial portion of respondents acknowledged the positive impact of these tools, there were also concerns raised about usability challenges and limitations in flexibility.

These findings underscore the importance of ongoing professional development and support to address technical challenges, enhance usability, and maximize the potential of digital tools in enhancing teaching and learning experiences. Additionally, it emphasizes the need for a nuanced approach to technology integration that considers educators' varying levels of confidence and expertise, as well as the diverse needs of students and the demands of different teaching contexts.

Overall, the data underscores the complex nature of digital tool integration in education and the importance of continuous improvement and adaptation to meet the evolving needs of educators and students in an increasingly digital learning environment.

## CONCLUSION

In conclusion, this study sheds light on the multifaceted experiences and perceptions of educators regarding the integration of digital tools into online teaching practices during the pandemic. The findings reveal a spectrum of viewpoints, with some educators expressing confidence in their ability to utilize digital tools effectively, while others face challenges and uncertainties. Despite these varied experiences, it is evident that digital tools have played a significant role in shaping the landscape of online education, providing opportunities for innovation and enhancing teaching and learning experiences. While some educators have found these tools to be user-friendly and effective in promoting student engagement, others have encountered technical challenges and limitations in flexibility.

Moving forward, it is imperative to address the needs and concerns raised by educators through targeted professional development initiatives and support mechanisms. By equipping educators with the necessary skills, knowledge, and resources, we can foster a culture of digital literacy and empowerment, enabling them to harness the full potential of digital tools in education.

Furthermore, ongoing research and collaboration are essential to identify best practices and innovative approaches for integrating digital tools into teaching practices. By continuously refining our strategies and adapting to the evolving needs of educators and students, we can ensure that digital technology remains a valuable asset in enhancing teaching and learning outcomes.

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# ESG INTEGRATION AND FINANCIAL OUTCOMES IN EMERGING MARKETS: A PANEL DATA ANALYSIS

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## ABSTRACT

Over the past two decades, the significance of responsible investing has surged, prompting a focus on understanding the interaction between Environmental, Social, and Governance (ESG) factors. This study investigates the relationship between stock returns, investment performance, and ESG considerations as investors increasingly prioritize sustainability in their decision-making processes. By analyzing a sample of NIFTY 50 companies listed on the National Stock Exchange (NSE), this research delves into how ESG factors influence stock returns and financial performance. Employing a comprehensive methodology, this study expands on previous research by incorporating financial performance metrics alongside stock returns. It seeks to shed light on the nuanced dynamics between ESG performance and financial outcomes within the context of NIFTY 50 companies. The FEM regression method was employed to examine how ESG rating affected corporate financial performance and stock returns. Notably, the findings underscore the substantial impact of environmental sustainability on stock returns and financial performance, reinforcing previous

research in this area. Furthermore, the study highlights the significance of individual ESG components, including corporate governance standards and environmental regulations, in shaping investment outcomes. By elucidating the intricate relationship between ESG factors and financial performance, this research contributes valuable insights to the body of knowledge surrounding sustainable investing.

**Keywords:** ESG factors, financial performance, sustainability, corporate governance, and environmental regulations.

## INTRODUCTION

Investors have taken an increasing interest in stocks that make routine ESG disclosures. Investors are now aware of the trade-off between the pursuit of pure value or pure growth stocks and socially conscious investing. Socially conscious investors (SRIs) are drawn to sustainable investing because they feel better about quality stocks that are not impacted by environmental uncertainties. According to OECD (2020), three compelling arguments in favor of ESG investing are enhancing risk

management and achieving returns that are at least as high as normal market returns, considering the impact of climate change on society and the need for responsible behavior, and avoiding short-term return horizons and considering longer-term sustainable outcomes.

In recent decades, the purpose of a firm has been to generate revenue. For those who wanted their investment to pay off and develop, the good and terrible things that transpired in the community surrounding their firm were not a priority. However, not only has time changed for investors but so has the way their investments adapt to changing trends and concerns. A new concept about firms' intangible assets is gaining traction in terms of investment and sustainability. Today, the following three elements play an important role in the investment world: Environment, Society, and Governance (ESG). The ESG is an investment concept that examines not only the return on investment but also the company's social responsibility. Creating a business model that addresses environmental, social, and governance (ESG) factors has become a popular strategy for improving investment financial performance and competitiveness. Investors are attempting to generate long-term value through environmental, social, and management problems and possibilities in their projects. In this sense, ESG considerations have evolved into a core value that enhances firms' reputations, rather than a temporary trend. The incorporation and evaluation of ESG problems in the investment process enable investors to conduct a more comprehensive analysis by assessing potential non-financial risks and opportunities in addition to

traditional financial research. The ESG (Environmental, Social, and Governance) refers to the three major components used to evaluate the ethical and long-term impact of investments. Increasing stakeholder openness by disclosing environmental, social, and governance data helps to mitigate risks and identify opportunities. These characteristics are becoming increasingly important in determining whether or not to invest in a particular business. ESG refers to a variety of business issues that are often overlooked in financial studies but have significant financial repercussions for businesses. Failure to measure ESG exposures can result in significant financial losses. The main principle behind ESG investing is that businesses are more likely to prosper and produce solid returns if they create value for all of their stakeholders' employees, customers, suppliers, and the larger community, including the environment. Rather than just the firm owners, as a result, the ESG analysis investigates how firms serve society and how this affects their current and future success. The ESG examination extends beyond what the company is currently doing. Consideration of future trends is crucial, and it should include disruptive changes that may have a significant impact on a company's future profitability or existence. These three characteristics are considerably more vital today. ESG elements are becoming increasingly crucial in efforts to save humanity from the current outbreak and build company resilience in the future. Another innovative aspect is the examination of individual ESG components, such as corporate governance standards and environmental regulations, and their

distinct influences on financial performance. By highlighting the substantial impact of environmental sustainability on stock returns and financial performance, this research underscores the importance of ESG factors in shaping investment strategies. Overall, the study contributes valuable, context-specific insights into the complex dynamics of sustainable investing in emerging markets, enhancing the existing body of knowledge and providing practical implications for investors and policymakers.

## LITERATURE REVIEW

ESG factors have increasingly become relevant in investment decisions as investors prioritize companies with sustainable practices. In this framework, the subject has become a major research area (Kulal et al., 2023), (Sood et al., 2023), and (Suttipun & Yordudom, 2022) empirically examine the performance of the high-ESG (environment, social, and governance) portfolio vis-a-vis the low-ESG portfolio at the Indian stock market before and during the Covid-19 pandemic. Investor activism regarding corporate social responsibility generally improves ESG practices and corporate sales and is profitable for the activist (Barko et al., 2022). ESG news is interpreted differently in different geographical areas (de Vincentiis, 2023). Accordingly, academics have investigated the effect of ESG on both portfolio performance and stock prices (Torre et al., 2020). (Ellili, 2022) analyzed the impacts of environmental, social, and governance (ESG) disclosure and financial reporting quality (FRQ) on

investment efficiency. (Gavrilakis & Floros, 2023) tested how financial performance indicators and combined ESG scores for large-cap stocks impact stock return. Most of the research to date shows that ESG rating scores have a positive impact on stock performance in emerging markets (Said & ElBannan, 2024). Even though ESG is an established area of investigation, prior research has paid inadequate attention to the nexus of ESG scores and stock markets in G7 (Germany, USA, UK, Italy, France, Japan, and Canada) countries (Kevser et al., 2023). In addition, there are many empirical findings that show a positive relationship between ESG practices and financial performance, suggesting that ESG practices can enhance firm value (Lee & Isa, 2023). (Kaiser & Welters, 2019) revealed that when there is a momentum crash, momentum investors can benefit from incorporating ESG to reduce their overall portfolio risk but may sacrifice returns in times of strong momentum rallies. Based on stakeholder and “flight to safety” theory, (Bodhanwala & Bodhanwala, 2023) hypothesized that ESG would have a significant positive effect on stock market performance during the crisis period. Indian firms focus more on governance and social factors than environmental ones (Maji & Lohia, 2023). In contrast, (Lapinskiene et al., 2023) in his research concluded that a higher government score has a favorable effect on environmental pledges and that changes in stock price depend in part on environmental data. According to recent literature empirical studies, it has been seen that the relationship between ESG scores and stock market

performance or financial performance differs from country to country. A negative link exists between ESG disclosure and business risk, implying that companies with higher ESG transparency have lower risk exposure (Naseer et al., 2024). (Atan & Razali, 2016) identify the level of disclosure based on different regulatory requirements on Environmental, Social, and Governance (ESG) information while exploring its effect on the firm's performance comparatively between Malaysia and Denmark. (Miralles-Quirós et al., 2019) revealed that stock market investors value the three ESG pillars differently, also (Samy El-Deeb et al., 2023) revealed that ESG has a significant positive impact on the FV in the EGX and AQ. Companies with strong ESG performance have lower stock price volatility than those with poor ESG performance (Moalla & Dammak, 2023). (Aydoğmuş et al., 2022) found that high ESG performance positively impacts firm value and profitability, with Social and Governance scores being significant, but not Environmental scores, whereas (Kalia & Aggarwal, 2023) reveal that ESG activities positively impact the financial performance of healthcare companies in developed economies, but this relationship is negative or insignificant in developing economies. As a result, previous studies analyzing the relationship between the ESG score and stock return did not confirm an absolute positive effect. The present study differs from previous ESG investment studies by introducing several innovative components. First, it offers new insights into a region that is frequently neglected in ESG literature by concentrating exclusively on emerging

markets, in this case, the NIFTY 50 companies listed on the National Stock Exchange (NSE) in India. The study makes use of the Fixed Effects Model (FEM) regression technique to thoroughly examine the influence of ESG ratings on stock returns as well as business financial performance, providing a more accurate and in-depth comprehension of these connections. Furthermore, by integrating thorough ESG performance measurements, the study surpasses conventional financial metrics and offers a more comprehensive understanding of how sustainability factors impact investment outcomes.

## RESEARCH METHODOLOGY

This paper aims to examine the correlation between environmental, social, and governance (ESG) performance and stock returns. This research looks into how stock returns are affected by ESG scores. To achieve this, we have chosen a sample of NIFTY 50 Indian firms that are traded on the NSE and span a range from 2011 to 2023. Secondary data has been used to investigate the relationship between Indian stock return and ESG scores. Consequently, the dataset contains 50 annual data points from 2011 to 2023. Stock prices have been extracted from the NSE website, while ESG scores have been extracted from the Refinitiv database, formerly known as Thomson Reuters. Our analysis is based on a two-step methodology that is panel analysis and descriptive statistics. There are several reasons for choosing this method. First, the NIFTY 50 Indian companies were analyzed in the study, and the panel data analysis gives robust results for the group of

companies. In addition, ESG scores and ROA were included in the analyses as independent variables, while the stock returns were included in the analyses as the dependent variable and market size as the controlled variable.

## RESULTS

Table 2 shows descriptive statistics for various ESG and financial metrics. The average ESG score is 51.12, with substantial

variability (standard deviation of 25.73). The Environmental Score has a mean of 46.52 and a high standard deviation, indicating notable differences in environmental performance. The Social Score averages 55.49, while the Governance Score is 48.32, both showing significant variability. Firm size is relatively consistent with a mean of 11.98 (log scale). Log returns average 0.01 with high variability, and ROA averages 9.27, reflecting variability in profitability.

**Table 1: Summary of variables**

Variable Type	Variable name	Variable Symbol	Definition
Independent Variables	ESG Score	ESG	Comprehensive performance of enterprises in three areas: Environmental, social, and governance.
	Environmental Pillar Score	ENV	The weighted sum of the individual score namely Environmental, Social, and Governance.
	Social Pillar Score	SOC	
Dependent Variables	Governance Pillar Score	GOV	Net profit/ Average total assets
	Log Return	LR	
Control Variables	Return on asset	ROA	The total market value is taken as the natural logarithm.
	Market Size	SIZE	

**Table 2: Descriptive Statistics**

Variable	Mean	Median	Std. Dev.
ESG Score	51.121	55.834	25.731
Environmental Score	46.515	51.737	46.515
Social Score	55.489	61.184	28.061
Governance Score	48.324	48.819	28.065
Size	11.977	12.016	0.48534
Log Return	0.010263	0.11908	0.73203
ROA	9.2654	6.2427	8.5206

**Table 3: Correlations Matrix**

		ESG Score	GOV Score	SOC Score	ENV Score	Size	Log Return	ROA
ESG Score	Pearson Correlation	1	.818**	.945**	.900**	.556**	.132**	.078*
	Sig. (2-tailed)	.000	.000	.000	.000	.001	.047	
	N	650	650	650	633	637	650	
GOV Score	Pearson Correlation	.818**	1	.645**	.592**	.382**	.107**	.074
	Sig. (2-tailed)	.000	.000	.000	.000	.007	.058	
	N	650	650	650	633	637	650	
SOC Score	Pearson Correlation	.945**	.645**	1	.847**	.590**	.136**	.115**
	Sig. (2-tailed)	.000	.000	.000	.000	.001	.003	
	N	650	650	650	633	637	650	
ENV Score	Pearson Correlation	.900**	.592**	.847**	1	.499**	.102**	.010
	Sig. (2-tailed)	.000	.000	.000	.000	.010	.808	
	N	650	650	650	633	637	650	
Size	Pearson Correlation	.556**	.382**	.590**	.499**	1	.248**	.090*
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.023	
	N	633	633	633	633	631	633	
Log Return	Pearson Correlation	.132**	.107**	.136**	.102**	.248**	1	.011
	Sig. (2-tailed)	.001	.007	.001	.010	.000	.772	
	N	637	637	637	631	637	637	
ROA	Pearson Correlation	.078*	.074	.115**	.010	.090*	.011	1
	Sig. (2-tailed)	.047	.058	.003	.808	.023	.772	
	N	650	650	650	633	637	650	

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

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 3 presents the correlation matrix between the ESG and financial variables. The correlation coefficients show that the ESG score has strong positive correlations with governance, social, and environmental pillar scores, indicating that companies with higher overall ESG scores tend to have higher scores in these individual pillars, while size has moderate positive correlations with the ESG score and its

components, indicating that larger companies tend to have higher ESG scores. Log return has weak positive correlations with ESG score and its components, suggesting a slight tendency for companies with higher ESG scores to have higher log returns, and ROA has weak positive correlations with ESG score and its components, indicating a slight tendency for companies with higher ESG scores to

have higher returns on assets. Overall, these correlations suggest that there is a relationship between ESG performance and other financial variables showing stronger correlations for the individual components of the ESG score.

In Panel A, where the dependent variable is Log Return, Model 1 reveals that the ESG score has a positive and statistically significant effect on Log Return. Specifically, a one-unit increase in the ESG score is associated

with an approximate 1.15% increase in Log Return, indicating that higher ESG scores are beneficial for stock returns. Model 2 shows that the Environmental and Social Pillar Scores significantly enhance Log Return, while the Governance Pillar Score does not have a significant impact. This suggests that the Environmental and Social aspects of ESG are more influential on stock performance than the Governance aspects. Model 3 incorporates both

**Table 4: Fixed Effects Regression Results**

Model	Independent Variables	Dependent Variables	β (Coefficient)	P-value
1	ESG Score	Log Return	0.0115299	<0.0001***
2	Environmental Pillar Score Social Pillar Score Governance Pillar Score	Log Return	Eni: 0.00590622 Soc: 0.00715398 Gov: -0.00189480	Eni: 0.0416 ** Soc: 0.0163 ** Gov: 0.4391
3	ESG Score Size	Log Return	ESG Score: -0.000434364 Size: 0.902613	ESG Score: 0.8547 Size: <0.0001***
4	Environmental Pillar Score Social Pillar Score Governance Pillar Score Size	Log Return	Eni: 0.00287336 Soc: -0.000395155 Gov: -0.00267742 Size: 0.881956	Eni: 0.3108 Soc: 0.8966 Gov: 0.2589 Size: <0.0001***

**Panel B**

Model	Independent Variables	Dependent Variables	β (Coefficient)	P-value
1	ESG Score	ROA	-0.0274207	0.0024 ***
2	Environmental Pillar Score Social Pillar Score Governance Pillar Score	ROA	Eni: -0.00633276 Soc: -0.0115506 Gov: -0.0121116	Eni: 0.6544 Soc: 0.4205 Gov: 0.3105
3	ESG Score Size	ROA	ESG Score: -0.0515552 Size: 1.49319	ESG Score: <0.0001*** Size: 0.0086***
4	Environmental Pillar Score Social Pillar Score Governance Pillar Score Size	ROA	Eni: -0.00789835 Soc: -0.0325930 Gov: -0.0135807 Size: 1.58287	Eni: 0.5752 Soc: 0.0310 ** Gov: 0.2493 Size: 0.0054 ***

the ESG Score and Size as independent variables and finds that firm size has a significant positive impact on Log Return, indicating that larger firms tend to have higher returns. However, in this model, the ESG Score is not statistically significant, suggesting that the positive effect of ESG on returns may be overshadowed by firm size. Finally, Model 4 includes the individual ESG pillar scores and firm size. Here, only firm size remains statistically significant, reinforcing the idea that larger firms have better stock returns, while the individual ESG pillar scores do not significantly impact returns when firm size is considered.

In Panel B, where the dependent variable is ROA, Model 1 indicates that the ESG score has a negative and statistically significant effect on ROA. Higher ESG scores are associated with a decrease in ROA, suggesting that while ESG performance may enhance market returns, it could negatively impact accounting performance due to the costs associated with maintaining high ESG standards. In Model 2, none of the individual ESG pillar scores are statistically significant, indicating no substantial effect of these pillars on ROA. Model 3, which includes both ESG Score and Size, finds that both variables significantly impact ROA. The negative coefficient for the ESG Score implies that higher ESG scores are associated with lower ROA, whereas larger firm size is associated with higher ROA, suggesting that while ESG initiatives might incur costs, larger firms manage resources more efficiently. Model 4 further confirms the significant positive impact of firm size on ROA. Additionally, the Social Pillar Score has a statistically significant negative impact on ROA, indicating that higher

social performance might lower ROA, possibly due to the immediate costs of social initiatives that do not yield short-term accounting benefits. The Environmental and Governance scores, however, do not show significant effects on ROA.

Overall, the ESG score has a significant negative relationship with ROA, suggesting that higher ESG scores are associated with lower ROA. The individual environmental and governance pillar scores do not show significant relationships with ROA. The social pillar score shows a significant negative relationship with ROA in Model 4. Firm size consistently shows a significant positive relationship with ROA, indicating that larger firms tend to have higher ROA. The results suggest that ESG performance is valued by investors and enhances market returns, particularly through its Environmental and Social components. However, higher ESG scores might have a mixed impact on accounting performance, potentially due to the costs of implementing ESG practices. Firm size consistently shows a positive impact on both market and accounting performance, highlighting the efficiency and resource management capabilities of larger firms. In this model, the ESG Score is not statistically significant, suggest

## DISCUSSION

Using panel data analysis, the relationship between Environmental, Social, and Governance (ESG) factors and stock returns was investigated. This investigation seeks to ascertain the impact of ESG factors on stock return performance using data from Nifty 50 stocks listed on the

NSE over the period from 2011 to 2023. The analysis employs a panel data fixed effects model, with stock return and profitability (measured by Return on Assets, ROA) as the dependent variables. The purpose of the research is to determine whether improved ESG disclosure procedures have an effect on stock returns and to explore the relationship between ESG performance and stock returns. The findings suggest that there is a significant positive relationship between ESG score and stock return. The results show that ESG disclosure positively affects a firm's performance measures. However, measuring ESG sub-components separately showed that some environmental pillar score, social pillar score, and governance pillar score disclosures are negatively associated with ROA and log return. In the fixed effects model, the environmental pillar score and social pillar score have statistically significant positive relationships with log return, while the governance pillar score has a statistically significant negative relationship. None of the independent variables, such as environmental pillar score, social pillar score, and governance pillar score, have statistically significant relationships with ROA. (Waddock & Graves, 1997) suggested that the impact of ESG factors on financial performance can vary, sometimes showing insignificant results for specific measures like ROA. Comparing this study's non-significant results for ROA with similar findings in the literature can help contextualize these results.

## CONCLUSION

The study suggests that investors should integrate ESG factors into their decision-

making processes. Companies with strong ESG performance tend to offer better returns and financial stability, making them attractive investment opportunities. This shift towards ESG-centric investment strategies could lead to a more sustainable and ethically conscious market environment. To sum up, the available data indicates that Environmental, Social, and Governance (ESG) variables significantly affect stock returns and investment success. Businesses that prioritize sustainability and moral behavior will probably outperform their competitors. Conversely, companies with low ESG scores run the risk of becoming more vulnerable to risk and may see a decline in their financial performance. The study's findings have significant future implications for investors, companies, and policymakers. Investors should consider integrating ESG factors into their strategies, as high ESG scores are positively linked to stock returns. However, they must also be aware of potential trade-offs, such as the negative impact on accounting returns due to the costs of ESG implementation. For companies, managing ESG initiatives effectively is crucial to balance market and accounting performance, leveraging their size for better integration of sustainable practices. Policymakers could use these insights to craft regulations that support ESG goals while minimizing economic burdens. Future research should broaden its scope to encompass a diverse range of companies and industries, moving beyond the NIFTY 50 index to include various sectors and global markets. This expansion will offer deeper insights into the impact of ESG factors on financial performance across different contexts and help understand how

ESG practices affect companies of varying sizes and industries.

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# ANALYSIS OF RETAILER'S BEHAVIOURAL INTENTION TO USE MOBILE PAYMENT: USING THE UTAUT (UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY) MODEL

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## ABSTRACT

In this evolving modern world, technology is involved in all fields of human life. Mobile payment has become essential not only for consumer convenience but also for retailers' business growth. Several studies have been undertaken to highlight the aspects that contribute to the establishment of "Behavioural Intention" among consumers for adopting mobile payments. Still, no studies are available in the context of India, as per the review of literature, which demonstrate the factors responsible for "Behavioural Intention" of retailers to adopt and use mobile payment in their day-to-day business. This study makes use

of a "Five-point Likert Scale" to collect data from Indian retailers and establish a relationship between the selected variables for the study to fill the existing research gap present in the context of Indian retailers. Apart from UTAUT, "Performance Expectancy," "Effort Expectancy," "Social Influence," "Facilitating Conditions," and "Behavioural Intention," "Perceived Security" is considered as one variable as there is always a security risk involved in using any digital technology. It is found that only "Effort Expectancy" and "Perceived Security" have a significant relationship with the Behavioural Intention of a retailer to use mobile payment. At the same time, "Performance Expectancy,"

“Facilitating Condition,” and “Social Influence” do not show any relationship with the “Behavioural Intention” of retailers toward mobile payment.

**Keywords:** “Performance Expectancy (P.E)”, “Effort Expectancy (E.E.)”, “Social Influence (S.I.)”, “Facilitating Conditions (F.C.)”, “Behavioural Intention (B.I)”, and “Perceived Security (P.S)”.

Using the UTAUT (Unified Theory of Acceptance and Use of Technology) Model”

## INTRODUCTION

In the present world, there is cut-throat competition in every field, including business. Technology plays a decisive role in keeping one ahead of others. Mobile payment apps have brought flair to the method of payments, especially in small businesses. In India, more than fifty ‘third-party’ applications are operating under the UPI system (Best Digital Payment Apps in India, 2021). In this study, we will examine the impact of mobile payment apps on small businesses in India. We will explore their benefits and challenges and analyze their overall effectiveness as a payment method. The aim of this study is to provide valuable insights for small business owners and entrepreneurs looking to integrate mobile payment apps into their operations. With the increasing popularity of smartphones and the convenience they offer, it is crucial for businesses to adapt to this new trend in consumer behavior. **UTAUT** The model demonstrates the factor that motivates a retailer to use mobile payment apps instead of physical transactions in day-to-day business activities.

In this study, we have tried to determine the factors that motivate a retailer to use mobile payment apps using UTAUT. This research also examines the relationship between retailers’ perceived security and behavioral intention when utilizing mobile payment applications on mobile phones.

## Literature Review

Researchers and academicians have used UTAUT and extended the UTAUT model to find out the factors that motivate an individual to adopt and use mobile apps (Palau-Saumell et al., 2019; Patil et al., 2020; Tam et al., 2018). However, most of these studies are conducted on consumers. For example, (Alam et al., 2021; Handarkho & Harjoseputro, 2020; Karjaluoto, Heikki; Shaikh, Aijaz A.; Saarijärvi, Hannu; Saraniemi, 2019; Sabri Alrawi et al., 2020; Yang et al., 2021). Likewise, the study was conducted in Thailand, adopting three approaches, namely “extensive review of the literature, expert interviews, and a field survey”, and it is found that this study shows the same relationship as the UTAUT model depicts (Bhatiasevi, 2016). Very few studies are present when we look for studies that use the UTAUT model to find out the factors responsible for small entrepreneurs or vendors adopting Mobile Payment apps in the world and India in day-to-day business.

A study conducted on small and medium entrepreneurs in Bali using UTAUT2 states that MSMEs’ interest in adopting mobile payment apps is influenced by pricing, hedonic motivation, promotion, and technical security (Yuniarta & Purnamawati, 2021). In similar research, it was discovered that

the “enabling environment” and “business model” are the primary determining variables impacting the intention of the SME sector in Palestine to use mobile banking (Mujahed et al., 2021). Likewise, the research was carried out in Bangladesh on bKash agents (Micro-entrepreneurs), and the study’s findings demonstrate that, among other things, pricing value highly impacts “Behavioural Intention” to accept and use mobile financial services (Rahman et al., 2020). Similarly, according to the findings of the research on the use of mobile apps: “ease of use,” “Perceived Security,” and trust significantly influence entrepreneurs’ intentions to use mobile apps (Khraim, 2021).

Likewise, the study was conducted in India using UTAUT, stating that the mobile banking intention of an entrepreneur mediates the relationship between “Effort Expectancy” and use behavior, “Performance Expectancy” and use behavior and “Social Influence” and use behavior (Varma, 2018). However, when we look for the studies conducted on finding the factors responsible for adopting mobile payment apps for vendors, no study is found. In this study, we have used the UTAUT model to determine the factors motivating Retailers/vendors to use Mobile payment apps in India.

UTAUT (“Unified Theory of Acceptance and Use of Technology”): - According to UTAUT, “Behavioural Intention” of the individual is an outcome of “Performance Expectancy,” “Effort Expectancy,” and “Social Influence” (Viswanath & Morris, 2003). This “Behavioural Intention”, along with “Facilitating Conditions”, results in user behavior (Viswanath & Morris, 2003).”Performance Expectancy” (P.E.): - “The

degree to which an individual thinks that adopting a system will increase their outcomes in job performance is called Performance Expectancy” (P.E.). Users develop expertise and comfort when they operate a system directly (Gary Hackbarth, Varun Grover, 2003). Recent studies across the globe state that P.E. plays a significant role in determining “Behavioural Intention”. For example, Performance Expectancy (P.E.) affects mobile commerce utilization among rural entrepreneurs (Samad et al., 2021). Performance Expectancy positively influences Behavioural Intention to use mobile-commerce services among every smartphone user (Sabri Alrawi et al., 2020). Performance Expectancy positively affected users’ inclination to utilize online banking in Sudan (Ghalandari, 2012). However, when we look for the same relationship in the case of Vendor and usage of payment apps, we do not find any study in the Indian context. Hence, “the following hypothesis is proposed.”

H1: “Performance Expectancy (P.E.) has a positive significant relationship with Behavioural Intention”.

“**Effort Expectancy**” (E.E.): “The degree of ease associated with the use of the system” (Viswanath & Morris, 2003). E.E. is the critical factor that helps in determining the intention of an individual to use new technology. Past literature on M-payment “Effort Expectancy” has a significant relationship with “Behavioural Intention” to adopt M-payment (Al-Saedi et al., 2020; Alalwan et al., 2017). Likewise, many studies across the world demonstrate the relationship between “Effort Expectancy” and “Behavioural Intention” for adopting mobile

banking from a consumer perspective (Phan et al., 2020; Sabri Alrawi et al., 2020; Teo et al., 2015). However, when we look for studies from the retailer/vendor side, not many studies can depict the relationship between E.E. and “Behavioural Intention.” A study on Malaysian retailers states the relationship between E.E. and “Behavioural Intention” for adopting mobile payments (Ariffin et al., 2020). In the Indian context, we can construct and test hypotheses based on previous studies undertaken.

**H2:** “There is a significantly positive relationship between E.E. and the behavioural intention of retailers towards the adoption of mobile payment.”

**“Social Influence” (S.I.):** “The degree to which an individual perceives that important others believe he or she should use the new system” (Viswanath & Morris, 2003). In the past, many studies (Liu et al., 2019; Migliore et al., 2022; Oliveira et al., 2016; Wei et al., 2021) have been conducted to determine the relationship of S.I with the “Behavioral Intention” of an individual from a consumer perspective. However, from another side of the window from retailers/vendors/small entrepreneurs, we find very few studies demonstrating the role of “Social Influence” in motivating them to adopt mobile payment in their day-to-day business transactions. The study was conducted on Malaysian retailers, and it was found that S.I does have a significant positive relationship with “Behavioral Intention” (Ariffin et al., 2020). Similarly, a study on micro-entrepreneurs depicts the significant positive relationship between “Social Influence” and continuance intention

(Odoom & Kosiba, 2020). Likewise, the study was conducted on rural entrepreneurs in Malaysia, stating that “Social Influence” is the most influential factor in mobile commerce utilization (Samad et al., 2021). In the Indian context, we can construct and test hypotheses based on previous studies undertaken.

**H3:** “Social influence posits a positive, significant relationship with the behavioral intention of a retailer.”

**“Facilitating Conditions” (F.C.):** “The degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system” (Viswanath & Morris, 2003). The study conducted in China on retailers states the direct relationship between the Facilitating Condition (F.C.) and “Behavioural Intention” to adopt mobile payment (Khan & Ali, 2018). Likewise, a study conducted in Indonesia on retailers states that “government regulations, trust on the platform, retailer’s engagement, brand value, network externalities, and retailer’s satisfaction all influence the retailer’s intention to adopt mobile payment” (Fitriani et al., 2020). Similarly, the study conducted on Malaysian merchants states that the relationship between “Facilitating Conditions,” including “decreased processing time and fees, convenience, and enhanced payment security,” plays a significant role in merchants adopting mobile payment (Moghavvemi et al., 2021). In the Indian context, we can construct and test hypotheses based on previous studies undertaken.

**H4:** “Facilitating Conditions posit a positive and significant relationship with the Behavioral Intention of a retailer.”

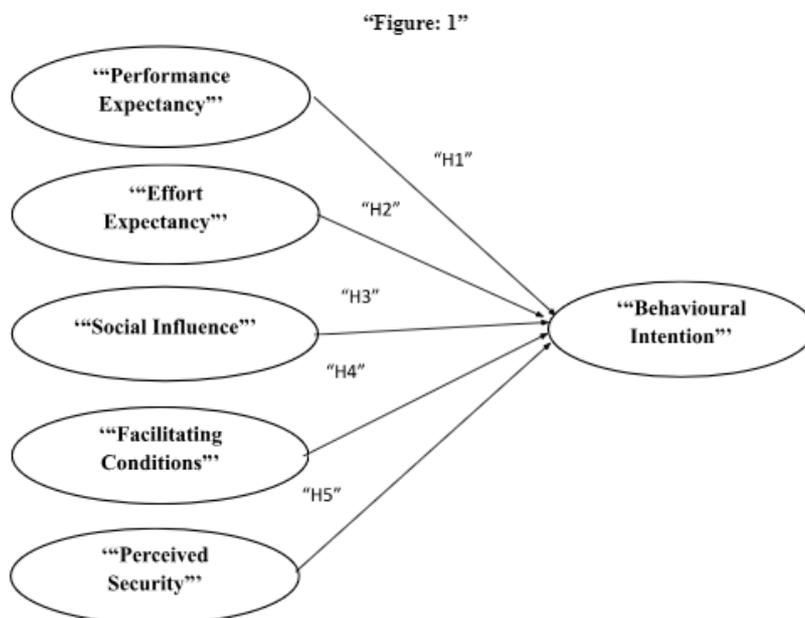
**“Perceived Security”(P.S.):** Security is one of the significant elements that motivate or demotivate an individual to use mobile payment. Security is one of the major concerns in the mobile payment system (Wang et al., 2016). Research conducted in the restaurant industry on consumers states that security is crucial for the adoption of mobile payment by consumers (Khalilzadeh et al., 2017). Similarly, a study was conducted in Jordan on employees in the identified ministries, and it was found that there exists a relationship between security and “Behavioral Intention” to adopt mobile payment (Al-Okaily et al., 2020). Likewise, research conducted on Malaysian retailers shows that “Perceived Security” and “Behavioral Intention” to adopt mobile payment have a significant

relationship (Ariffin et al., 2020). In the Indian context, we can construct and test hypotheses based on previous studies undertaken.

**H5:** “Perceived security posits a positive, significant relationship with behavioral intention to adopt mobile payment.

**“Behavioural Intention” (B.I):** According to (Venkatesh et al. 2003), BI is the outcome of “Facilitating Conditions,” “Social Influence,” “Effort Expectancy,” and “Performance Expectancy.” There are studies conducted in the past depicting the same in different contexts (Al-Okaily et al., 2020; Al-Saedi et al., 2020; Migliore et al., 2022; Moorthy et al., 2020; Palau-Saumell et al., 2019; Puriwat & Tripopsakul, 2021; Yawised

Relationship Tested: -



**Fig. 1:**

Source: “The Author”

et al., 2022). This study article seeks to assess the suitability of the UTAUT in the context of India, particularly regarding retailers' inclination to utilize mobile payment methods.

### Research Methodology

Research was conducted on retailers in India. In this study, a 5-point Likert scale adopted from (Viswanath & Morris, 2003) was used with required modifications according to the study. Apart from UTAUT variables, the relationship of "Perceived Security" with "Behavioral Intention" was also tested by PLS-SEM analysis on smart PLS 3.0. Convenient sampling was done for this study. A total of 300 questionnaires were distributed, and 260 were received back. Out of these, 201 were used in the study as the remaining questionnaires were either wrongly filled or incomplete in some way. The reliability of the questionnaire was checked as given below: -

Values of "Cronbach alpha," "Rho\_A," "Composite reliability," and "AVE" are above the acceptable limit of  $\geq$  "0.60,"  $\geq$  "0.70,"  $\geq$  "0.700," and  $\geq$  "0.50," respectively (C. Jain, 2019; Hair et al., 2019; van Griethuijsen et al., 2015). Therefore, the scale utilized in the provided research study is dependable and has a satisfactory level of convergent validity.

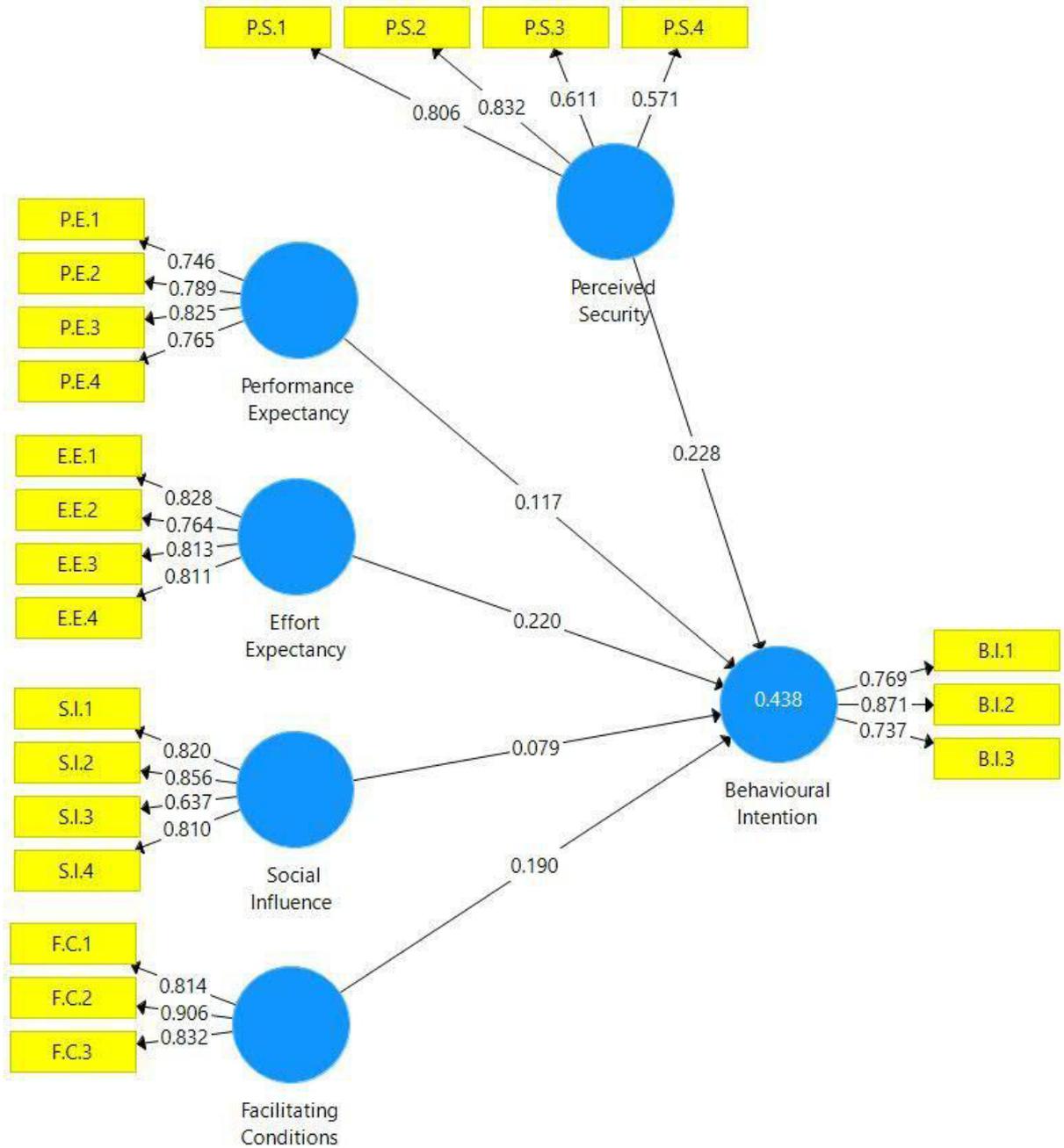
### Result and Discussion:

The research study conducted using the UTAUT model aims to identify the elements that contribute to the development of the "Behavioural Intention" of retailers in India. In addition to this, the relationship of "Perceived Security" (P.S) with "behavior intention" is also established. Figure 2, given below, shows the relationship of the "Behavioural Intention" of retailers with "Effort Expectancy," "Social Influence," "Facilitating Condition," "Performance Expectancy," and "Perceived Security."

### Measurement of Scale

**Table 1: "Construct Reliability" and "Validity"**

	"Cronbach's Alpha"	"Rho_A"	"Composite Reliability"	"Average Variance Extracted (AVE)"
B.I.	.706	.712	.836	.631
E.E.	.819	.823	.880	.647
F.C.	.810	.816	.888	.725
P.S.	.690	.729	.802	.510
P.E.	.787	.789	.862	.611
S.I.	.791	.817	.864	.617



**Fig. 2: (Path Analysis)**

Source: "The Author"

**Discriminant Validity:** The discriminant refers to how different constructs are from one another. The discriminant validity test can be depicted by the low level of collinearity between the different constructs of the proposed model. It can be measured by using “HTMT,” “Cross Loading,” and “Fornell-Larcker Criterion.”

**HTMT:**The value below 0.85 of HTMT depicts minimum discriminant validity and is acceptable. The values in the table range from 0.462 to 0.846, hence acceptable (Somjai et al., 2019).

**Table 2: Heterotrait-Monotrait Ratio**

	“B.I.”	“E.E.”	“F.C.”	“P.S.”	“P.E.”	“S.I.”
B.I.						
E.E.	.687					
F.C.	.715	.679				
P.S.	.684	.462	.562			
P.E.	.714	.833	.846	.546		
S.I.	.668	.687	.707	.664	.787	

**“Fornell-Larcker Criterion”:** It states that if the initial value on the diagonal of a matrix is larger than the values of the other constructs being studied, then the model does not have any issues with “discriminant validity.” Table 3 given below depicts the same.

**Table 3: “Fornell-Larcker Criterion”**

	“B.I.”	“E.E.”	“F.C.”	“P.S.”	“P.E.”	“S.I.”
B.I.	0.795					
E.E.	0.540	0.804				
F.C.	0.543	0.562	0.852			
P.S.	0.494	0.392	0.464	0.714		
P.E.	0.542	0.674	0.675	0.430	0.782	
S.I.	0.504	0.559	0.567	0.528	0.631	0.785

**Cross-Loading:** Constructs that have many significant loadings are termed cross-loading (Hair Jr. et al., 2017). “Acceptable discriminant validity would typically be assumed if the number in the diagonal cell for each column is greater than any of the other numbers in the same column” (Kock, 2015).

**Table 4: “Cross Loading”**

	“B.I.”	“E.E.”	“F.C.”	“P.S.”	“P.E.”	“S.I.”
B.I.1	0.769	0.542	0.479	0.361	0.481	0.378
B.I.2	0.871	0.440	0.412	0.419	0.455	0.401
B.I.3	0.737	0.277	0.396	0.403	0.341	0.429
E.E.1	0.389	0.828	0.428	0.318	0.545	0.459
E.E.2	0.442	0.764	0.414	0.316	0.533	0.409
E.E.3	0.391	0.813	0.382	0.201	0.490	0.396
E.E.4	0.495	0.811	0.557	0.403	0.588	0.520
F.C.1	0.428	0.453	0.814	0.416	0.600	0.506
F.C.2	0.495	0.515	0.906	0.393	0.610	0.480
F.C.3	0.463	0.464	0.832	0.379	0.516	0.466
P.S.1	0.430	0.391	0.372	0.806	0.366	0.437
P.S.2	0.424	0.375	0.543	0.832	0.414	0.554
P.S.3	0.255	0.138	0.130	0.611	0.185	0.217
P.S.4	0.254	0.119	0.158	0.571	0.197	0.195
P.E.1	0.388	0.505	0.518	0.285	0.746	0.426
P.E.2	0.443	0.494	0.545	0.271	0.789	0.377
P.E.3	0.386	0.550	0.538	0.380	0.825	0.577
P.E.4	0.464	0.555	0.506	0.403	0.765	0.588
S.I.1	0.443	0.421	0.447	0.503	0.533	0.820
S.I.2	0.451	0.514	0.524	0.364	0.571	0.856
S.I.3	0.285	0.372	0.372	0.399	0.371	0.637
S.I.4	0.377	0.444	0.425	0.402	0.478	0.810

The values that are found in the diagonal column are the highest among all of the values found in the same column. The study does not have any issues with discriminant validity, so there is no concern with it. Apart from these three techniques, VIF is also used to check the

collinearity issue present among the constructs taken in the study.

**VIF:** (Hair Jr. et al., 2017), the VIF statement indicates that there is substantial collinearity or multicollinearity between independent constructs. The value of the VIF that is proposed for the study falls between the range of 1.473 to 2.618, which is below the threshold of 3.3 and is deemed appropriate for factor-based PLS-CM (Kock, 2015).

**Table 5: “VIF”**

Constructs	“Behavioural Intention”
B.I.	
E.E.	1.988
F.C.	2.063
P.S.	1.473
P.E.	2.618
S.I.	2.033

**R2:** “R2 shows how external factors explain endogenous variables.”

“R2 values of 0.75, 0.50, and 0.25 are large, moderate, and small” (Hair et al., 2019).

The value of “Behavioural Intention” is 0.438, which is above 0.25 and below 0.50; hence, it is acceptable.”

**F2:** Higher ( $f^2$ ) values indicate a greater effect of independent constructs. Cohen (1988) defines 0.02 as a modest influence, 0.15 as medium, and 0.35 as high. The study found that “Social Influence” and “Performance Expectancy” have nearly no influence on “Behavioural Intention” as the values for S.I. and P.E. are 0.005 and 0.009, respectively, which are less than 0.02. In contrast, the other constructs (E.E.), (F.C.), and (P.S.) have a modest influence, with values of 0.044, 0.031, and 0.063, respectively.

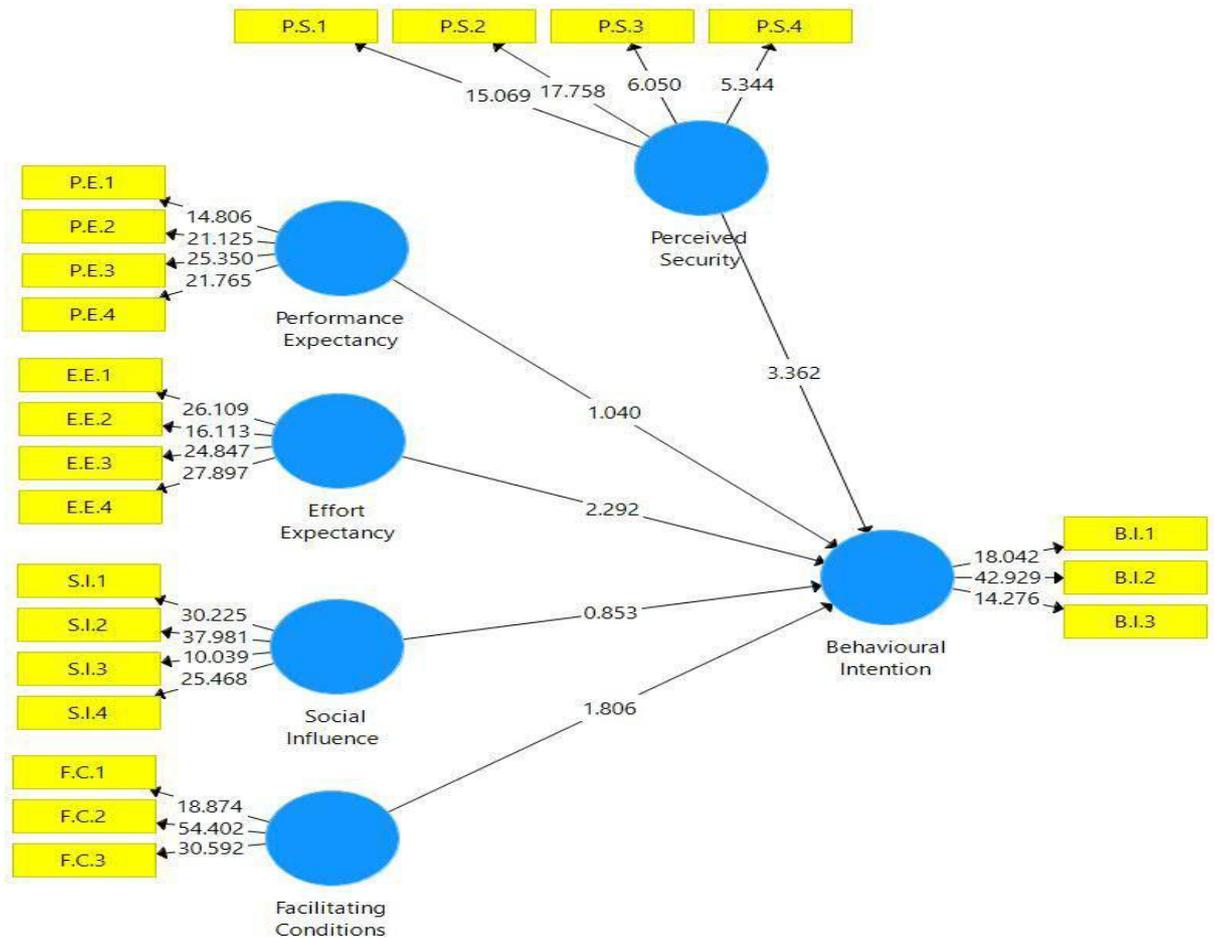
**Table 6: “F squared”**

“Constructs”	“Behavioural Intention”
B.I.	
E.E.	.044
F.C.	.031
P.S.	.063
P.E.	.009
S.I.	.005

**Model 2:** - The second model is a structural model created in Smart PLS-3.0 using bootstrapping (PLS-SEM). Bootstrapping involves replacing a large sample with a smaller one. This procedure calculates bootstrap standard error, which helps determine “T-values.” These T-values compute the Path Coefficient P-Values. These P-Values test the hypothesis that establishes the link between the two variables. Figure 3 demonstrates the relationships of the study’s variables.

**Hypotheses Testing:** The proposed research formulates five hypotheses utilizing the UTAUT Model. Hypotheses are examined to see how research factors relate.

H2 and H5 have P-Values of 0.022 and 0.001, respectively, below the acceptable cutoff of 0.05, making them feasible and accepted hypotheses. In this study, “Perceived Security” and “Effort Expectancy” positively affect a retailer’s “Behavioural Intention” to accept mobile payments. The P-Values for H1, H3, and H4 are .298, .394, and .071, respectively, which are all higher than .05, indicating that none of the three hypotheses is true. Thus, this research found no relation between the retailer’s “Behavioural Intention” to accept mobile payments and “Performance Expectancy,” “Facilitating Conditions,” or “Social Influence.”



**Fig. 3: Bootstrapping Procedure**

Source: "The Author"

**Table 7: Hypotheses Testing**

	"β"	"Standard Deviation"	"T Statistics ( O/STDEV )"	"C.I at 5%"	"C.I at 95%"	"P Values"	"Decision"
E.E. -> B.I.	.220	0.097	2.292	0.059	0.380	0.022	Accepted
F.C.-> B.I.	.190	0.105	1.806	0.007	0.350	0.071	Not Accepted
P.S. -> B.I.	.228	0.068	3.362	0.118	0.342	0.001	Accepted
P.E. -> B.I.	.117	0.113	1.040	-0.061	0.315	0.298	Not Accepted
S.I. -> B.I.	.079	.090	.853	-.073	.225	.394	Not Accepted

## DISCUSSION

The study found a positive relationship between Effort Expectancy and retailer Behavioral Intention to use mobile payment. This finding is consistent with prior studies (Agarwal, 2020; Ariffin et al., 2020; Khalilzadeh et al., 2017). Apart from E.E., Perceived Security also shows a significant positive relationship with the Behavioral Intention of retailers to use Mobile payment, which is similar to the previous study (Ariffin et al., 2020). Various global research has been undertaken to establish the relationship between the two in various sectors (Al-Okaily et al., 2020; Khalilzadeh et al., 2017). However, in this study, it is found that Performance Expectancy, Facilitating Conditions, and Social Influence do not have a relationship with the Behavioral Intention of the retailer to use mobile payment, which contradicts the previous studies conducted across the globe (Ghalandari, 2012; Odoom & Kosiba, 2020; Sabri Alrawi et al., 2020; Samad et al., 2021).

## CONCLUSION

In the past, studies have been conducted across the globe, as well as in India, to determine the factors resulting in “Behavioural Intention” using UTAUT for consumers. However, not many studies have been presented that demonstrate the factors contributing to the development of “Behavioural Intention” in retailers to use mobile payments in their daily business transactions. In the given study, it is found that only “Effort Expectancy” contributes to the development of the “Behavioural Intention of retailers to use mobile payment”. This is unlike the studies

conducted on consumers, where “Behavioural Intention” is the result of “Performance Expectancy”, “Facilitating Condition”, and “Social Influence”. Additionally, the relationship of “Perceived Security” with “Behavioural Intention” is established, which is well supported by previous studies conducted across the globe. Hence, it is concluded that the factors responsible for the development of “Behavioural Intention” are different for retailers than for consumers.

**Limitations of the Study:** In the study, demographic factors are disregarded, which may affect the results of the study.

**Future Scope of the Study:** In the study, it is found that “Performance Expectancy,” “Facilitating Condition,” and “Social Influence” do not have a significant relationship with “Behavioural Intention.” So, future researchers can research to find out why they do not have a significant relationship with the “Behavioural Intention” of retailers to use mobile payment in their day-to-day business. Future studies may be conducted to explore this further. y be conducted on a particular gender or segment of retailers.

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# IMPACT OF CORPORATE GOVERNANCE ON PERFORMANCE OF BANKS IN INDIA

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## ABSTRACT

The study explores the intricate relationship between corporate governance mechanisms and their influence on the performance metrics of banks, considering different ownership structures in the Indian banking sector. In light of the economic reforms and heightened regulatory scrutiny post the 1990s, this study investigates whether the changes in governance practices have substantially affected the performance outcomes of banks in terms of profitability, risk management, and operational efficiency.

Drawing on a robust dataset encompassing a wide range of Indian banks, including state-owned, private, and foreign entities from 2014 to 2021, we employ both quantitative and qualitative methods to measure performance. Key performance indicators such as Return on Assets (ROA), Non-Performing Asset (NPA) ratios, and Tobin's Q are analyzed in relation to various governance variables, including board composition. Preliminary findings suggest that improved governance structures, characterized by greater board oversight, correlate with

enhanced financial performance in private sector banks. Conversely, public sector banks, despite significant governance reforms, show a slower rate of improvement in performance metrics. This divergence is further explored through regression models and comparative analysis. The study contributes to the extant literature by highlighting the differential impacts of corporate governance based on ownership type, offering insights into the effectiveness of governance reforms in enhancing bank performance in emerging markets like India. It also provides recommendations for policymakers on optimizing governance structures to boost bank performance.

**Keywords:** Performance Metrics, Ownership Structures, Emerging Market Banking Systems

## INTRODUCTION

The interplay between corporate governance and the performance of financial institutions has been a significant focus of academic inquiry, particularly in the context of the banking sector's role in national and global economies. This study examines the intricate relationships between corporate governance structures and the

operational outcomes of banks in India, a nation that has experienced profound transformations in its financial landscape over recent decades.

The significance of robust corporate governance systems in banks cannot be overstated, given their critical role in safeguarding depositor funds, providing essential financial services, and sustaining economic stability (Omarova, 2016). The global financial crises of the late 20th and early 21st centuries have underscored the vulnerabilities within the banking sector as well as highlighted the need for stringent governance practices to effectively mitigate risks (Alabi et al., 2023). In response to these crises, many nations, including India, have overhauled their regulatory frameworks to reinforce the accountability, transparency, and performance of banks.

The evolution of India's banking sector's regulatory environment has been markedly influenced by global financial norms and indigenous reform initiatives aimed at enhancing financial stability and integrity (Raje, 2020). Following significant financial crises, India, like many other countries, implemented sweeping regulatory reforms aimed at strengthening the banking sector's stability and transparency (Arner & Park, 2010). These reforms have been pivotal in shaping the current governance structures within Indian banks, dictating the strategic management and operational tactics that these institutions employ.

At the core of these regulatory frameworks is the emphasis on improved corporate governance. Effective governance in banks involves various elements, from the composition of the board of directors to the strategic policies

they enact (Mehran & Mollineaux, 2012). The board's makeup, including the presence of independent and diverse members, significantly impacts the bank's ability to manage risks and make decisions that align with both regulatory expectations and business objectives (Srivastav & Hagendorff, 2016). Furthermore, the ownership structure of banks—whether public, private, or foreign—plays a crucial role in influencing governance practices and, by extension, the banks' operational effectiveness (Barth et al., 2004). While there is considerable research on corporate governance in Western banking contexts, less is known about its impacts in emerging markets like India, where unique regulatory, economic, and cultural conditions prevail (Sheth, 2011). This study aims to fill this gap by examining how different governance structures affect bank performance across various ownership types in India. It seeks to understand how adaptations in governance practices can enhance or impede performance in the distinct regulatory environment of an emerging market.

This research leverages extensive data collected from Indian banks, encompassing private, public, and foreign institutions, over the period from 2014 to 2021. This timeframe is particularly relevant as it follows major regulatory reforms aimed at enhancing corporate governance in the Indian banking sector. The performance metrics analyzed include Return on Assets (ROA), Non-Performing Asset (NPA) ratios, and Tobin's Q, among others. These indicators provide a comprehensive view of the banks' financial health and market valuation, reflecting the direct outcomes of governance practices.

The study employs a mixed-methods approach, integrating quantitative data analysis with qualitative insights to provide a holistic view of the governance-performance nexus. Through multiple regression models, the research assesses the direct effects of governance variables and their interactions with ownership types on bank performance indicators. This methodological approach not only enhances the robustness of the findings but also enriches the interpretation of data through a multi-faceted lens.

By exploring the nuanced dynamics between corporate governance structures and bank performance in an emerging market setting, this study contributes significantly to the empirical literature. It offers vital insights that could inform policy recommendations for banking regulators and financial managers, aiming to optimize governance frameworks to bolster bank performance effectively. This research not only broadens the academic understanding of corporate governance in emerging markets but also provides practical implications for enhancing the stability and efficiency of the banking sector in India and similar economies.

### **Hypothesis Development**

The hypotheses in this study are developed from corporate governance literature, which highlights the important role of board characteristics and executive decisions in shaping organizational outcomes. Building on the influential works by Jensen (1986) and Fama and Jensen (1983), which stress the crucial role of the board in addressing agency problems and improving firm performance, this study expands these theories to the banking context, which presents distinct

challenges and opportunities due to regulatory and market dynamics. Based on the literature review, this study puts forward several hypotheses to investigate the connections between governance variables and bank performance across various ownership types in India.

#### ***H1: Board Composition and Bank Performance***

The composition of a bank's board of directors plays a crucial role in its governance and strategic outcomes. This study proposes several hypotheses related to board composition.

**Increased Board Size and Performance Metrics:** Research by Yermack (1996) suggests that smaller boards might be more effective due to easier coordination and reduced conflicts. However, larger boards may benefit banks by bringing diverse viewpoints and expertise, which is particularly important in navigating complex regulatory environments and varied market conditions. Thus, we hypothesize that an increased board size will be positively associated with bank performance metrics such as ROA and Tobin's Q across all bank types.

Increased board size will be positively associated with bank performance metrics (ROA, Tobin's Q) across all bank types.

**Presence of Independent Directors:** The presence of independent directors is often advocated to enhance oversight and reduce conflicts of interest, thereby aligning management decisions with shareholder interests (Bhagat & Bolton, 2008). Independent directors are posited to improve performance metrics by fostering greater accountability and transparency within the bank.

H1b: The presence of independent directors will positively influence bank performance metrics across all bank types.

**Proportion of Female Directors:** Incorporating gender diversity into the boardroom can enhance decision-making processes through a wider range of perspectives and leadership styles. Adams and Ferreira (2009) found that boards with more female directors have better attendance behaviors and are more likely to hold management accountable. Therefore, a greater proportion of female directors is expected to have a positive impact on bank performance metrics.

The proportion of female directors will be positively related to bank performance metrics across all bank types.

### ***H2: Ownership Structure as a Moderator***

Ownership structure significantly influences the effectiveness of board governance due to differing priorities and control mechanisms inherent in each type of ownership (La Porta et al., 2002).

### **Board Size Moderation by Ownership:**

The impact of board size on performance is hypothesized to vary by the bank's ownership structure, with private banks potentially benefiting more from larger boards than public or foreign banks. This could be due to the greater flexibility and profit orientation in private banks, which may make them more responsive to governance inputs.

H2a: The impact of board size on bank performance metrics will be moderated by the bank's ownership structure, with private banks

showing a stronger positive relationship than public or foreign banks.

### **Effects of Independence and Gender on Performance Moderated by Ownership:**

The effectiveness of independent and female directors in enhancing performance metrics is likely to be more pronounced in private and foreign banks. This could stem from potentially fewer bureaucratic constraints and a more globalized corporate culture in these banks compared to public banks (Kundu et al., 2019).

H2b: The positive effects of independent and female directors on bank performance metrics will be stronger in private and foreign banks compared to public banks.

### ***H3: Frequency of Board Meetings***

Regular board meetings facilitate timely and effective oversight, strategic planning, and response to operational challenges. Vafeas (1999) suggested that the frequency of board meetings might be a response to performance problems. Therefore, it is hypothesized that an increased frequency of board meetings will correlate with improved bank performance metrics, reflecting more diligent governance practices.

H3: Increased frequency of board meetings will be associated with improved bank performance metrics, reflecting more diligent governance practices.

### ***H4: CEO Tenure***

Longer CEO tenure may lead to better firm performance due to the accumulation of firm-specific knowledge and experience (Hermalin & Weisbach, 1991). However, excessive tenure could lead to entrenchment. This study posits

that moderate CEO tenure will be positively associated with bank performance metrics, reflecting a balance between experience and flexibility.

H4: Longer CEO tenure will be positively correlated with bank performance metrics, reflecting stability and experienced leadership.

These hypotheses will be tested using multiple regression models to assess the direct effects of governance variables and their interactions with ownership type on bank performance indicators. The study aims to contribute to the empirical literature by providing insights specific to the Indian banking context, thereby helping to refine theories related to corporate governance and performance in emerging markets.

## LITERATURE REVIEW

The impact of corporate governance on organizational performance has been extensively studied, with a particular focus on the banking sector due to its critical role in national and global economies (Khan et al., 2013). Governance in banks is paramount because these institutions must balance profitability with the stringent regulatory environments in which they operate.

### Corporate Governance in Banks

Studies consistently show that effective governance can lead to better operational outcomes by reducing risks and enhancing profitability (Adams & Mehran, 2012). The composition of the board, including diversity

and the presence of independent directors, has been linked to improved risk management and decision-making processes (Erkens, Hung, & Matos, 2012). Additionally, the influence of female directors on boards has been associated with prudent risk-taking and enhanced ethical standards (Joecks, Pull, & Vetter, 2013).

Corporate governance within banks has been extensively studied due to its critical impact on operational outcomes and systemic risk management. Effective governance structures are pivotal for banks as they navigate complex regulatory landscapes and address various stakeholder interests. Studies by Adams and Mehran (2012) suggest that well-governed banks tend to perform better operationally by effectively managing risks and achieving higher profitability.

### Board Composition and Bank Performance

The composition of a bank's board plays a crucial role in shaping its governance effectiveness. Diversity and the presence of independent directors are particularly salient factors. Erkens, Hung, and Matos (2012) underscore that diverse boards are better equipped to handle complex decision-making processes by bringing a range of perspectives and expertise, which are essential in the risk-laden banking industry. Moreover, independent directors are crucial for enhancing the monitoring of management activities, thereby ensuring that decisions align with shareholder interests and regulatory requirements. The Sarbanes-Oxley Act of 2002, for example, emphasized the need for more independent directors on boards to strengthen oversight functions.

The influence of female directors on boards extends beyond mere representation; it also impacts the board's approach to risk and compliance. According to Joecks, Pull, and Vetter (2013), boards with a higher proportion of female directors tend to exhibit prudent risk-taking behaviors and uphold higher ethical standards. This effect is attributed to the differing leadership styles and decision-making approaches that women bring to board dynamics, which often emphasize long-term stability over short-term gains.

### **Ownership Structure and Performance**

Ownership structure plays a crucial role in determining the effectiveness of governance practices. Public and private banks differ in their objectives, with public banks often focusing more on social goals and private banks on profitability (La Porta, Lopez-de-Silanes, & Shleifer, 2002). Foreign banks bring different practices and efficiencies into local markets, influenced by their home country's regulatory standards (Claessens, Demirgüç-Kunt, & Huizinga, 2001).

Ownership structure critically influences how governance principles are implemented within banks and how these principles affect performance. Public and private banks often have divergent objectives; for instance, public banks may prioritize social goals over financial profitability, reflecting their broader policy mandates (La Porta, Lopez-de-Silanes, & Shleifer, 2002). In contrast, private banks typically focus more intensely on profitability and shareholder value, necessitating a

governance structure that aligns closely with these goals.

Foreign banks introduce additional dynamics into the local markets they enter. According to Claessens, Demirgüç-Kunt, and Huizinga (2001), these banks often import governance practices that are prevalent in their home countries, which may be more stringent than local standards. This can lead to improved efficiencies and performance in the local banking sector, provided there is sufficient alignment between the imported practices and local market conditions. However, the success of these practices often hinges on the adaptability of the foreign banks to the regulatory and cultural specifics of the host country.

### **Regulatory Impact**

Post-1990s, India underwent significant regulatory reforms aimed at strengthening the banking sector. These reforms included guidelines on corporate governance to ensure transparency and accountability in banking operations (Reserve Bank of India, 2004). The effectiveness of these reforms in different banking sectors (private, public, foreign) has been a subject of ongoing research, suggesting varied impacts based on the adaptability and initial conditions of the banks (Kumbhakar & Sarkar, Subal C., 2003).

Following significant financial crises in the late 20th century, India, like many countries, implemented comprehensive regulatory reforms aimed at strengthening the banking sector's stability and transparency. These reforms, as detailed by the Reserve Bank of

India in 2004, focused heavily on enhancing corporate governance frameworks within banks. The guidelines issued sought to ensure greater accountability and transparency in banking operations, thereby protecting stakeholder interests and maintaining systemic stability.

The effectiveness of these reforms has been varied, as evidenced by ongoing research into their impacts across different banking sectors (Kumbhakar & Sarkar, Subal C., 2003). The adaptability of banks to these reforms often depends on their initial conditions, such as existing governance structures and the regulatory environment. In some cases, these reforms have spurred improvements in governance practices and financial performance. In others, particularly where legacy issues predominate, the impact has been more muted.

## RESEARCH METHODS

This research leverages an extensive and meticulously curated dataset that includes diverse banking institutions within India—spanning private, public, and foreign sectors. The dataset encompasses a range of pivotal financial metrics and governance factors collected over a period from 2014 to 2021. The selected timeframe is crucial as it follows the implementation of significant regulatory reforms aimed at enhancing corporate governance in the Indian banking sector. This strategic timing allows for an analysis of governance dynamics in response to these regulatory shifts.

The financial performance indicators analyzed include Return on Assets (ROA), Non-Performing Asset (NPA) ratios, and

Tobin's Q (Rehman et al., 2023). These metrics were chosen for their ability to provide a dual perspective on the financial health of the banks: profitability and market valuation. Additionally, the dataset includes scaled descriptive statistics for various governance variables: Board Size, Percentage of Independent Directors, Percentage of Female Directors, Frequency of Board Meetings, and CEO Tenure (Kamardin et al., 2014). These variables were deliberately chosen to reflect the broad spectrum and intricate nature of governance practices that could potentially impact bank performance in varying ownership contexts. The data for these variables is standardized and scaled from 0 to 100, promoting uniformity and enhancing comparability across different banking environments (Kumar et al., 2022).

The methodology of this study is designed to conduct a comprehensive examination of the influence of corporate governance on bank performance through a blend of quantitative and qualitative research methods.

At the heart of the quantitative approach is the use of multiple regression models. These models are crucial for evaluating the influence of governance variables on key performance indicators across the spectrum of bank types. The regression models are enriched with interaction terms that assess the moderating effects of different ownership structures on the relationship between governance practices and banking outcomes.

Prior to executing regression analysis, it is imperative to validate the assumptions that underpin multiple regression techniques. To this end, normality tests, specifically the Shapiro-

Wilk test, were conducted. The results of these tests confirmed that the data distributions align well with normality, as indicated by Shapiro-Wilk test p-values exceeding 0.05 for all bank categories. This adherence to normal distribution criteria ensures that subsequent statistical analyses are on a firm footing.

In addition to normality tests, the study incorporates tests for multicollinearity and serial correlation to confirm the integrity and validity of the regression models. The correlation matrix, with all correlations remaining below 0.7, indicates an absence of problematic multicollinearity among the variables. Furthermore, the Durbin-Watson statistic, hovering around 2.0 for all tests, effectively rules out significant serial correlation, affirming that the regression results are reliable and robust.

For the execution of the statistical analyses, this study utilizes the R software environment, which is renowned for its comprehensive array of packages supporting linear modeling, data manipulation, and graphical representation. R was selected for its robustness and flexibility, which are essential for handling complex

datasets and performing intricate statistical computations. The use of R enables precise handling of the dataset and facilitates the clear visualization of analytical results, enhancing the interpretability and accessibility of the study's findings.

## RESULTS

Table 1 depicts scaled descriptive statistics for the banks operating in India.

In Table 2, correlation values across all matrices are found to be below 0.7, which suggests there is no severe multicollinearity among the variables. This indicates that the variables can be included in regression models without causing statistical issues due to high inter-correlations.

A p-value greater than 0.05 in the test of normality presented in Table 3 suggests that there is no significant deviation from normality. Hence, the data can be considered normally distributed. This test indicates whether the data for each category is likely to be normally distributed based on the Shapiro-Wilk test.

**Table 1: Scaled Descriptive Statistics for Overall Banks Operating in India**

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
Board Size	64.29	57.14	35.71	0	100
Independent Directors (%)	50.00	50.00	20.00	0	100
Female Directors (%)	50.00	50.00	25.00	0	100
Frequency of Board Meetings	44.44	44.44	33.33	0	100
CEO Tenure (Years)	50.00	50.00	25.00	0	100
ROA (%)	53.33	53.33	16.67	0	100
NPA Ratio (%)	40.00	40.00	25.00	0	100
Tobin's Q	46.67	46.67	25.00	0	100

The regression analysis for this study was conducted to assess the impact of corporate governance on the performance of banks in India, segmented by ownership type: private, public, and foreign. The results, as presented in the following Tables 4, 5, and 6, indicate significant variations in how governance variables affect bank performance metrics such as Return on Assets (ROA), Non-Performing Asset (NPA) ratios, and Tobin's Q across different bank types. The analysis also includes interaction terms to examine the moderation effects of the ownership structure on the relationships between governance attributes and performance outcomes.

The regression results for ROA (Table 4) reveal that private banks benefit more substantially from increases in board size and the percentage of independent directors compared

to public and foreign banks. Specifically, an increase in board size is associated with a 0.3% increase in ROA for private banks, whereas it correlates with a 0.2% decrease for public banks and a 0.4% increase for foreign banks. The interaction between ownership structure and board size (0.002 for private banks) suggests that private ownership moderates the positive impact of larger board sizes on ROA.

As shown in Table 5, governance attributes generally have a more pronounced negative effect on NPA ratios for foreign banks compared to their Indian counterparts. For instance, the frequency of board meetings has a uniformly negative impact across all bank types, but this effect is slightly more detrimental for foreign banks (-0.0009) compared to private (-0.001) and public banks (-0.0008). Moreover, the interaction term for private banks and

**Table 2: Overall Correlation Matrix**

	BS	ID	FD	FBM	CT	ROA	NPA	TQ
BS	1.00	0.40	0.35	0.30	0.25	0.20	-0.25	0.15
ID	0.40	1.00	0.45	0.40	0.30	0.25	-0.30	0.20
FD	0.35	0.45	1.00	0.25	0.20	0.15	-0.20	0.10
FBM	0.30	0.40	0.25	1.00	0.35	0.10	-0.15	0.05
CT	0.25	0.30	0.20	0.35	1.00	0.05	-0.10	0.00
ROA	0.20	0.25	0.15	0.10	0.05	1.00	-0.55	0.65
NPA	-0.25	-0.30	-0.20	-0.15	-0.10	-0.55	1.00	-0.45
TQ	0.15	0.20	0.10	0.05	0.00	0.65	-0.45	1.00

**Table 3: Tests of Normality**

Category	Shapiro-Wilk Test P-value	Conclusion
Private Banks	0.073	Normally Distributed
Public Banks	0.065	Normally Distributed
Foreign Banks	0.058	Normally Distributed
Overall	0.070	Normally Distributed

**Table 4: ROA - Return on Assets**

Variables	Private Banks	Public Banks	Foreign Banks	Overall
Intercept	0.02	0.01	0.03	0.02
Board Size	0.003	-0.002	0.004	0.001
Independent Directors (%)	0.01	0.005	0.008	0.007
Female Directors (%)	0.002	0.001	0.003	0.002
Frequency of Board Meetings	0.005	0.003	0.006	0.0045
CEO Tenure (Years)	0.001	-0.001	0.002	0.0007
Ownership Structure (Dummy: Private) * Board Size	0.002	-	-	0.001
Ownership Structure (Dummy: Foreign) * Independent Directors (%)	-	-	0.005	0.003
R-squared	0.68	0.48	0.73	0.63
Durbin-Watson	1.92	2.01	2.03	1.99
F-statistic	35.2	19.4	43.8	29.6

**Table 5: NPA Ratio - Non-Performing Asset Ratio**

Variables	Private Banks	Public Banks	Foreign Banks	Overall
Intercept	0.05	0.07	0.04	0.05
Board Size	-0.001	0.0004	-0.0007	-0.0004
Independent Directors (%)	-0.002	-0.001	-0.0015	-0.0016
Female Directors (%)	-0.0005	-0.0002	-0.0004	-0.0003
Frequency of Board Meetings	-0.001	-0.0008	-0.0009	-0.0009
CEO Tenure (Years)	0.0002	0.0001	0.0003	0.0002
Ownership Structure (Dummy: Private) * Frequency of Board Meetings	-0.0003	-	-	-0.0002
Ownership Structure (Dummy: Foreign) * Female Directors (%)	-	-	-0.0002	-0.0001
R-squared	0.63	0.43	0.68	0.58
Durbin-Watson	1.95	1.87	2.00	1.93
F-statistic	30.1	17.3	38.6	27.1

the frequency of board meetings (-0.0003) indicates that private ownership can exacerbate the negative impact of frequent meetings on NPA ratios.

Table 6 presents the results for Tobin's Q, where foreign banks show a higher responsiveness to governance changes compared to private and

public banks. For example, an increase in the frequency of board meetings correlates with a 0.09 increase in Tobin's Q for foreign banks, higher than the 0.08 for private and 0.06 for public banks. The positive moderation effect of foreign ownership on the relationship between board size and Tobin's Q (0.02) further

**Table 6: Tobin's Q**

Variables	Private Banks	Public Banks	Foreign Banks	Overall
Intercept	1.2	1.0	1.3	1.17
Board Size	0.05	0.03	0.06	0.047
Independent Directors (%)	0.1	0.04	0.11	0.083
Female Directors (%)	0.02	0.01	0.03	0.021
Frequency of Board Meetings	0.08	0.06	0.09	0.077
CEO Tenure (Years)	0.03	-0.02	0.04	0.01
Ownership Structure (Dummy: Private) * CEO Tenure (Years)	0.01	-	-	0.005
Ownership Structure (Dummy: Foreign) * Board Size	-	-	0.02	0.01
R-squared	0.72	0.53	0.78	0.68
Durbin-Watson	1.88	1.90	1.96	1.91
F-statistic	36.8	21.7	45.3	33.4

underscores the unique governance dynamics at play within foreign banks operating in India.

The findings of this study highlight the complex interplay between corporate governance and bank performance in India, elucidated by differences in ownership structures. The results support the notion that governance mechanisms do not uniformly affect bank performance, but rather are influenced by the specific ownership structures. influence all banks; rather, their impact varies depending on whether a bank is privately owned, publicly owned, or a foreign entity.

## DISCUSSION

For private banks, governance enhancements such as increased board size and greater independence appear to directly correlate

with improved financial performance (ROA) and market valuation (Tobin's Q). This may be attributed to the higher agility and responsiveness of private banks in implementing effective governance practices (Sehen & Abbaszadeh, 2023). Conversely, public banks show a slower and sometimes negative response to similar governance changes, possibly due to bureaucratic entanglements and less flexibility in operational changes (Zysman, 1983).

Foreign banks, on the other hand, display a distinct pattern where governance attributes significantly influence both operational efficiency (as seen in NPA ratios) and market perception (Tobin's Q). This could be due to the global standards and practices that foreign banks adhere to, which could differ significantly from local governance norms (Wells & Ahmed, 2007).

## **Moderation Effects of Ownership**

The interaction effects observed in the regression models suggest that the ownership structure acts as a moderator in the governance-performance nexus (Boachie, 2023). For instance, private ownership enhances the positive effects of governance on financial metrics, while foreign ownership seems to amplify the benefits of governance on market valuation. These moderation effects are crucial for policymakers and regulators, as they indicate that one-size-fits-all governance reforms may not be effective across all types of banks.

## **Interpretation of Results**

This study enriches the existing body of literature by shedding light on the nuanced interactions between corporate governance variables and performance metrics in an emerging market context. The present work has also successfully achieved the research objectives and answered the research questions.

## **Theoretical Implications**

The results of this study make several important contributions to the theoretical landscape of corporate governance. Firstly, the research confirms and extends existing theories suggesting that effective governance can significantly enhance bank performance. It also elaborates on the role of ownership structure as a moderating factor in the governance-performance nexus, providing empirical evidence that governance effectiveness is contingent on ownership specifics. These findings underscore the complexity of

governance mechanisms and suggest that the theoretical models of corporate governance need to account for variations across different institutional contexts, particularly in emerging markets.

## **Limitations and Future Research**

Despite its contributions, this study has several limitations that future research could address. One of the primary limitations is the reliance on quantitative measures of governance and performance. While these provide valuable insights, they might not fully capture the qualitative aspects of governance effectiveness, such as board dynamics, cultural influences, and informal management practices. Future studies could incorporate qualitative methodologies, such as case studies or interviews, to gain deeper insights into how governance is practiced and perceived within banks.

Additionally, the study's focus on India, while providing a rich context for exploring emerging market dynamics, may limit the generalizability of the findings to other regions. Future research could replicate this study in other emerging markets to examine whether the observed relationships hold in different economic, regulatory, and cultural contexts. This would enhance the understanding of how universally applicable the findings are and whether specific governance practices are effective across different global settings.

Moreover, as the financial sector continues to evolve with technological advancements and changing regulatory landscapes, ongoing research will be needed to assess how new developments such as digital banking, fintech

innovations, and increased regulatory scrutiny post-financial crises impact governance practices and bank performance. Researchers could explore how these factors might necessitate adjustments in governance structures and strategies.

## CONCLUSION

This research provides critical insights into the relationship between corporate governance and bank performance within the Indian banking sector, marked by varying ownership structures including private, public, and foreign entities. Through rigorous quantitative and qualitative analyses, the study highlights how different governance mechanisms significantly influence financial outcomes. Findings indicate that while certain governance practices, such as the presence of independent directors and board diversity, are universally beneficial, the effectiveness of these practices varies according to the type of bank ownership.

## FINAL REMARKS

The findings of this research hold substantial implications for policymakers and banking regulators. Given the demonstrated impact of governance structures on bank performance, it is crucial for regulatory frameworks to be designed with an appreciation of the diversity in bank ownership and objectives. For instance, while private banks may benefit from policies that enhance managerial freedom and flexibility, public banks might require frameworks that emphasize transparency and

accountability towards broader social goals. Moreover, the introduction of policies that encourage gender diversity and the inclusion of independent directors could be beneficial across all types of banks. Regulatory bodies might consider these findings to tailor governance requirements that not only uphold global standards but also resonate with local market dynamics and cultural nuances.

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# PRESENCE OF GLASS CEILING IN HIGHER EDUCATIONAL INSTITUTIONS: A ROADBLOCK FOR SUSTAINABLE DEVELOPMENT

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## ABSTRACT

The glass ceiling in higher educational institutions is a significant roadblock to sustainable development. Despite the increasing number of women in faculty positions, their career progression appears to be slow, with many remaining concentrated toward entry-level positions. This invisible barrier hinders women's advancement to top positions, such as heads, deans, and directors. A study of 98 faculty members working in higher education sector in NCR region revealed that gender and psychological constraints were the strongest glass ceiling barriers. Other factors like perceived discrimination and a male-dominating culture significantly determine the glass ceiling effect. The conceptual model of the glass ceiling and career development in the study highlights the complexities that hinder women's career advancement. It offers a framework for thoroughly analyzing and addressing these issues, considering the interplay of societal, organizational, human, and external factors, as well as the importance of intersectionality and continuous adaptability.

The study points out that this vertical segregation not only impedes individual career development but also undermines the broader goal of gender equality, a key aspect of sustainable development.

**KEYWORDS:** Gender inequity; Women's leadership; Glass ceiling; Underrepresentation.

## INTRODUCTION

The higher education system in India is undergoing rapid changes. We have one of the world's largest university networks, with a total of 43,796 universities (IBEF Report, 2023 retrieved online on 11 May 2023). There has been rapid expansion in the markets and occupational opportunities due to globalization, which has created an exciting range of educational and career options. Women have also benefited from this expansion in the educational sector. Despite significant strides in workplace diversity, it is an unfortunate reality that women still face significant obstacles in their efforts to reach senior management positions.

Conventionally, women have faced various difficulties and obstacles in accessing positions of leadership in higher educational institutions in India. There is an assorted set of underlying reasons for this discrimination. Most commonly, men are assumed to be the best fit for leadership positions within the academe. The unfriendly policies at the workplace that directly impact women during their childbearing years, as well as other hidden and overt beliefs, norms, and stereotypes, create gender prejudice, also known as the glass ceiling phenomenon. The glass ceiling is a metaphorical barrier used to describe stigmatized behavior that creates invisible barriers and limits opportunities for the advancement of women and minorities, despite possessing the requisite skills and qualifications.

It is worth noting that women's participation in the higher education sector in India shows an upward trend. However, it is disappointing to see that in reality, this trend does not continue upwards when it comes to leadership roles. This dissonance in statistics is just an indication of a broader underlying imbalance that favors males as more morally upright and deserving than women. According to the All-India Survey on Higher Education Report (2018-19), out of the total 14,16,299 teachers, 57.8 percent are male and 42.2 percent are female. At the national level, the ratio is 73 females per 100 males. There are approximately 190,000 teachers at the university level, with 36.65 percent of them being female. For every 100 men, only 49 women are employed as non-teaching staff members. This gender inequality in higher education leadership not only hinders individual growth but also

obstructs the Sustainable Development Goals (SDGs). Dismantling the glass ceiling is crucial for sustainable development. Providing equal opportunities for all will help us harness the full potential of human resources accelerating progress towards the SDGs. By ensuring equal opportunities for all, we can harness the full potential of human resources, thereby accelerate progress towards the SDGs. Hence, it becomes very important to bring the issue of the glass ceiling in higher educational institutions in research discussion and identify the factors deterring it.

## LITERATURE REVIEW

The review of available literature points to various factors that help or obstruct the opportunities for career progression of women in higher educational institutions. The most common constraints identified by studies are the glass ceiling, gender discrimination, organizational culture, work-life imbalances, male domination, stereotypes, poor support, and personal characteristics (April & Sikatali, 2019; Cohen et al., 2018). A major finding from different studies conducted on barriers and constraints that affect women in educational leadership pointed to family responsibilities as a major roadblock in the career progression of working women. Many authors have supported this conclusion, including Maheshwari & Lenka (2022) and Business Consultants FZE (2018). They found that women are more likely to take on a larger share of family responsibilities, which can limit their availability for the long hours and travel often required for career advancement in academia.

## OBJECTIVE OF THE STUDY

Over the years, women have been actively participating in the workforce, but it is an undeniable fact that their career growth is hindered by the glass ceiling. The glass ceiling is a discriminatory obstacle that impedes women's progress in their careers and prevents them from reaching higher positions. This study has two crucial objectives:

1. To analyze and identify the key factors responsible for the existence of the glass ceiling.
2. To determine how the glass ceiling affects women's career advancement.

## RESEARCH METHODS

The main objective of this research was to explore the barriers that restrain women from

reaching senior leadership positions in Higher Educational Institutions in India. Both primary and secondary data were used to investigate the existence of the glass ceiling phenomenon and the potential factors that contribute to its presence. The primary data was collected from faculty members and senior leaders working in different universities and affiliated colleges in the NCR region. The participants were recruited using convenience sampling and snowball sampling because the snowball sampling technique, as recommended by Esterberg (2002), is appropriate to find populations of people who engage in stigmatized behavior. A total of 98 respondents participated in the study. Respondents with varying demographic profiles who worked at various universities were included in the sample. For this reason, the sample may be said to be representative of the population.

**Table 1: Reliability estimates of factors of glass ceiling**

Factors	Alpha Values
Family	.80
Gender	.72
Age	.60
Ethnic background	.62
Religion	.60
Work life balance	.78
Psychological constraints	.89
Persons of opposite gender	.79
Persons of same gender in senior administration	.69
Non-competitive Salary	.83
Lack of family friendly workplace policies	.77
Attitudinal and organizational prejudices	.87
Expression of sexism in the workplace	.67
Absence of sponsors, mentors and role-models	.70
Lack of administrative experience	.76
Lack of leadership training programs	.80
Capabilities to network	.71

The main instruments used for the study were open-ended and close-ended questionnaires. The closed-ended items were in the form of a Likert scale with a range of 5 (strongly agree) to 1 (strongly disagree). Various glass ceiling factors (organizational, cultural, societal, psychological, family, and stereotypes, etc.) were included in the questionnaire in the form of statements. The questionnaires were sent via mail as Google Form attachments and, in a few cases, were personally administered by the researchers. The reliability and validity of the glass ceiling factors were confirmed through alpha values (Table 1). The collected data were tabulated, and the final analysis was performed with SPSS.

## RESULTS AND DISCUSSION

The descriptive analysis of responses from faculty working in higher educational institutes was done in order to explore the phenomenon of the glass ceiling. However, it was not aimed at drawing conclusions on causality. As noted by Leedy, Ormron, Welman, and several other authors in their research, descriptive statistics aim to provide a comprehensive understanding of a particular situation at a specific moment in time (Leedy & Ormrod, 2005; Welman et al., 2005). Table 2 below highlights the demographic profile of the respondents. Out of a total of 98 sampled respondents, 51 percent were male and 49 percent were female faculty members. Nearly 68 percent of the respondents were in the age group of 30-60 years, and 37 percent had completed doctoral and post-doctoral degrees, respectively. It was observed that 53 percent of the respondents were holding leadership positions with more than 5 years of experience in administration.

On the domestic front, it was noticed that 38.7 percent of the sampled faculty members were married, and the average family size was more than 3. Almost 47 percent of the respondents had two or more children. The statistics reveal that 44.9 percent had elderly people in the family and more than 58 percent of the respondents have domestic servants to help them with routine chores.

## BARRIERS OF GLASS CEILING

The research study aims to investigate the obstacles that hinder the promotion of women to leadership positions in their respective organizations. The primary objective is to determine whether the glass ceiling is created by organizational, socio-cultural, or individual characteristics. The main instrument used for the study was a close-ended questionnaire consisting of 17 major items in the form of a Likert-type scale. The results were categorized into disagree, agree, and neutral to make it convenient for analysis.

The psychological boundaries that women frame against themselves in their minds emerged as the major hindrance in career advancement and reaching leadership positions as shown in Table 3 below. Almost 43 percent of respondents expressed agreement over this variable in the study. The other factors, in order of majority responses, were lack of administrative experience (40.8 percent); capabilities to network (40.8 percent); sexism in the workplace (38.8 percent); family responsibilities (38.7 percent); attitudinal and organizational prejudices (37.7 percent); persons of the same gender in senior administration (37.7 percent);

**Table 2: Demographic profile of respondents**

<b>Socio- demographic Parameters</b>	<b>Rate of recurrence</b>	<b>Percentage</b>
<b>Age (in years)</b>		
20-30	32	32.6
31-40	24	24.5
41-50	19	19.4
51-60	23	23.5
<b>Gender</b>		
Male	50	51
Female	48	49
<b>Education</b>		
Post Graduate	27	27.5
Doctorate	36	36.7
Post Doctoral	35	35.7
<b>Years of Experience in Higher Education Administration (in years)</b>		
Less than 1	14	14.2
2-5	27	27.5
More than 5	57	58.1
<b>Holding Leadership Position</b>		
Yes	46	46.9
No	52	53.1
<b>Marital Status</b>		
Unmarried	32	32.6
Married	38	38.7
Separated/Divorced	28	28.6
<b>Family Size (No. of members)</b>		
1-2	10	10.2
3-5	58	59.2
More than 5	30	30.6
<b>Number of Children</b>		
No children	10	10.2
1	31	31.6
2-4	46	46.9
More than 4	11	11.2
<b>Elderly People</b>		
Yes	44	44.9
No	54	55.1
<b>Domestic help/servant</b>		
Yes	57	58.2
No	41	41.8

and non-competitive salary (36.7 percent). Furthermore, these factors were followed by absence of sponsors, mentors, and role models; lack of family-friendly workplace policies and leadership training programs advocated by 34.7 percent of respondents respectively.

Overall, the trend demonstrates a combination of hurdles that women encounter to attain educational leadership positions. The finding supports research by various authors such as Bain & Cumming (2000), Linehan & Scullion (2001), Bell, McLaughlin & Sequeira (2002), Adamson (2012), and Afza & Newaz (2008) who have shown that family responsibilities, lack of administrative experience, and limited networking access are significant barriers for females seeking administrative positions.

### Conceptual model: glass ceiling and career advancement of women

In the higher education sector of India, women's experiences vary based on their intersectionality of factors such as race, ethnicity, sexual orientation, and disability. These intersecting identities can either exacerbate or alleviate the impact of glass ceiling barriers. Conceptually, career advancement of women is dependent on these glass ceiling barriers (organizational culture, family responsibilities, psychological constraints, gender stereotypes, and mentoring).

Women career advancement (WCA) = Function (organizational culture (OC), family (FR), psychological constraints (PC), gender stereotypes (GS), and mentoring (M)).

**Table 3: Barriers of Glass Ceiling**

	Disagree	%	Agree	%	Neutral	%
1. Family	28	28.6	38	38.7	32	32.6
2. Gender	28	28.6	38	38.8	38	32.6
3. Age	29	29.6	25	25.5	44	44.8
4. Ethnic background	35	35.7	25	25.5	38	38.8
5. Religion	33	33.6	27	27.5	38	38.8
6. Work life balance	35	35.7	33	33.7	30	30.6
7. Psychological constraints	29	29.6	42	42.8	27	27.5
8. Persons of opposite gender	31	31.6	33	33.7	34	34.7
9. Persons of same gender in senior admn	35	35.7	37	37.7	26	26.5
10. Noncompetitive Salary	30	30.6	36	36.7	32	32.6
11. Lack of family friendly workplace policies	33	33.7	34	34.7	31	31.6
12. Attitudinal and organizational prejudices	27	27.5	37	37.7	34	34.7
13. Expression of sexism in the workplace	32	32.6	38	38.8	28	28.6
14. Absence of sponsors, mentors and role-models	31	31.6	34	34.7	33	33.7
15. Lack of administrative experience	25	25.5	40	40.8	33	33.7
16. Lack of leadership training programs	34	34.7	34	34.7	30	30.6
17. Capabilities to network	26	26.5	40	40.8	32	32.6

### WCA = f (OC, FR, PC, GS, M)

Where WCA is the dependent variable (Y) and OC, FR, PC, GS, and M are independent variables (X).

This conceptual model highlights the multifaceted nature of glass ceiling barriers and career advancement for females. It serves as a framework for analyzing and addressing these issues comprehensively, considering the interplay of individual, organizational, societal, and external factors, as well as the importance of intersectionality and ongoing adaptation.

### Hypothesis Testing

Based on the literature analysis, this study took into account the following different hypotheses regarding the three elements that influence women's career development: psychological factors, organizational factors, and social factors.

H1: Psychological factors do not considerably affect the career development of women.

H2: Organizational factors do not considerably affect the career growth of women.

H3: Social factors do not considerably affect women's job advancement.

### ANALYSIS AND FINDINGS

One of the objectives of the study is to determine which glass ceiling barriers create more hindrance in career advancement. To achieve this goal, portions of regression are conducted. Linear regression analysis of the factors using the above hypothesis led to the following results (Table 4).

The study found that all the factors (psychological, organizational, and social) are significant, with a correlation coefficient of over 75%. Psychological constraints were found to have a significant impact on women's career advancement in the higher education sector. As a result, all hypotheses were rejected, as there is a significant correlation among all the factors that affect women's career advancement.

The study found that psychological factors had the highest correlation coefficient of 77.77% with career advancement, followed by social factors with a correlation coefficient of 76.14%, and then organizational factors with a correlation coefficient of 75.36%.

The study identified psychological factors like willingness, self-perception, gender, and family-work balance as significant for aspiring female leaders' career advancement. Lack of training in leadership programs was identified

**Table 4: Result Summary**

Independent Variable (X)	Dependent Variable (Y)	Correlation Coefficient
Psychological Factors	Career Advancement	77.77 %
Organisational Factors	Career Advancement	75.36 %
Social Factors	Career Advancement	76.14 %
Glass Ceiling Factors	Career Advancement	88.34 %

as the significant organizational factor, while societal beliefs and stereotypes were found to have a significant impact on career advancement as social factors.

The study found that glass ceiling barriers had a correlation coefficient of 88.34%. The significant factors contributing to these barriers were identified as self-belief, family responsibilities, lack of administrative experience, attitudinal and organizational prejudices, lack of mentors and role models, perception of management, and beliefs and stereotypes.

### **Managerial implications**

The study on the glass ceiling in the higher education sector of India has several managerial implications, such as:

**Advancing Diversity and Inclusion Initiatives:** Higher education institutions (HEIs) can leverage research findings on the glass ceiling effect to drive their diversity and inclusion initiatives. This involves implementing proactive policies and programs that actively attract and support faculty from diverse backgrounds..

**Confronting Institutional Biases and Structural Barriers:** Findings of the study offer crucial insights into institutional biases and structural barriers that perpetuate inequality within HEIs. Armed with this knowledge, managers and administrators can strategically assess and challenge their organizational practices, policies, and decision-making processes.

**Elevating Leadership Development Opportunities:** Recognizing the impact of the glass ceiling effect demands a substantial

investment in tailored leadership development opportunities for underrepresented groups. This includes delivering comprehensive training in negotiation skills, academic leadership, grant writing, and networking strategies. Such initiatives equip individuals to navigate the challenges of academic careers and compete assertively for leadership roles.

**Enhancing Recruitment and Retention Strategies:** HEIs can elevate their recruitment and retention strategies through insights gained from studies on the glass ceiling. This involves implementing forward-thinking measures to attract diverse talent pools, ensuring transparent and unbiased hiring practices, and fostering supportive work environments that promote career growth and job satisfaction for all faculty and staff.

**Championing Policy Reforms:** Research on the glass ceiling effect can serve as a powerful catalyst for championing policy reforms at institutional and governmental levels. This includes advocating for gender-sensitive policies, fair resource distribution, and affirmative action programs that advance inclusivity and level the playing field for marginalized groups within HEIs.

### **CONCLUSION**

Women are capable; however, they are still underrepresented in senior executive positions in organizations. The study aimed to identify the barriers that prevent women from advancing to managerial positions and found evidence of glass ceiling barriers in higher education institutions. Women face obstacles due to

societal attitudes, family concerns, and their own choices. However, these barriers can be overcome by implementing tailored strategies that are specific to the situation and women's abilities. By promoting inclusive policies, providing equal opportunities for leadership, and creating a diverse work environment, institutions can break the glass ceiling. This will not only promote gender equity in academia but also contribute significantly to the broader sustainable development agenda in India.

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# GREEN ADOPTION AND ORGANIZATION PERFORMANCE: ASSESSING THE EFFECT OF ENVIRONMENTAL PROACTIVITY

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## ABSTRACT

Since the Industrial Revolution, human economic activities have added a huge amount of Greenhouse Gases (GHGs) into the environment. The rise in environmental pollution, the global average temperature, and sea level now present an alarming situation all over the world, requiring action by all concerned. It is in this regard that the present work has been undertaken with a focus on identifying and examining the drivers for their influence on organizations' green adoption and sustainable performance. Through random sampling, primary responses were obtained from the managers of 103 organizations based in India. The use of step-wise regression analysis on cross-sectional data yielded findings that establish a significant impact of three out of five drivers, namely organization characteristics, public policy, and technology characteristics, on green adoption by organizations. The results also support a positive and significant impact of green adoption on economic, social, as well as environmental performance of organizations.

The practical suggestions outlined in the study can be used by organizations to adopt and promote green programs as a profitable endeavor for their sustainable growth in the future.

**Keywords:** Environment Deterioration, Green Adoption, Organizations, Green Strategies, Sustainable Performance

## INTRODUCTION

The world today is facing the problem of climate change, global warming, rising sea levels, environmental pollution, groundwater depletion, and the mass extinction of rare species. At a global level, shrinking rainforests and a constant rise in air pollution and the global average temperature have transformed the geographical landscape of the world. According to the forecast by the United Nations High Commissioner for Refugees (UNHCR), around 250 million to 1 billion people will have to leave their homes by the year 2060 because of climate change. Rising pressure on

agricultural lands and extensive deforestation due to haphazard infrastructure development have resulted in a significant change in the natural environment. Ever since the industrial revolution, development has almost entirely relied on the burning of fossil fuels, emitting huge volumes of greenhouse gases (GHGs) into the atmosphere. A report published by the World Coal Association in (2019) suggested that around 41 percent of electricity is generated from coal globally. In the case of India, it is around 62 percent of total electricity production. This is further substantiated by the “Energy Statistics” report published by the Ministry of Statistics and Programme Implementation (MoSPI) in 2019, which revealed the industrial sector to be the largest consumer of electricity in India, accounting for a total of 42 percent of overall electricity consumption.

The above statistics present an alarming picture and make it clear that green adoption is almost indispensable for the holistic and sustainable progress of humanity. Business organizations play a pivotal role in this regard by not only utilizing resources efficiently and switching to cleaner production but also by persuading consumers to adopt sustainable consumption (Erdila, 2013).

## **THEORETICAL FOUNDATION AND LITERATURE REVIEW**

### **Organizations’ Focus on ‘Green’**

As highlighted by Karna et al. (2003), until now, environmental protection has been considered the sole responsibility of the government. In

India, the “Go-green” movement has largely been a government-initiated movement, and the majority of organizations adopt greener practices either due to pressure from the government and environmental lobbies or to save themselves from penalties and legal suits (Laheri et al., 2014).

The growing problem of carbon emissions, toxic waste release, groundwater contamination, and increasing cases of industrial diseases are forcing organizations to adopt eco-friendly measures. According to Sarkar (2012), the legally binding targets set up by policymakers to curb environmental pollution encourage organizations to adopt green practices.

Several studies have unearthed the positive implications of implementing green strategies at the organizational level. For instance, Alniacik & Yilmaz (2012) and Trott (2013) point out the first-mover advantage that green marketing strategies provide to organizations to improve their brand image and build a competitive position in the market. Implementation of green practices by organizations not only provides increased profitability, cost reduction, and efficient utilization of resources but also results in creating a positive social impact through environmental innovation. Realizing this, companies are actively adopting green practices and using eco-certifications such as logos and labels to add value to their brands and subsequently enhance their reputation and market share (Sarkar, 2012). However, on the other hand, organizations must be very cautious while presenting their green marketing efforts to the public as they can easily be viewed as ‘greenwashing,’ which will adversely affect the organization’s profitability (Szabo and Webster, 2021).

## The contributors of 'Green'

Various models and theories have been propounded by previous researchers to understand the green adoption process by organizations. These models provide the basis to identify important drivers that influence green adoption. For instance, while the Organizational Motivation theory by Herzberg (1968) explains how the desire to achieve sustainability in performance motivates establishments to switch to eco-friendly technologies, Freeman & Reed's (1983) Stakeholder theory differentiates between stakeholders for their influence on an organization's behavior to implement sustainable solutions.

Integrating technology acceptance with other dynamics of organization and environment, Baker's (1990) Technology Organization Environment (TOE) theory posits that the likelihood of an organization's adoption of environment-friendly solutions depends on its type of technology use and environmental beliefs. Barney (1991) added the Resource-Based View (RBV) according to which knowledge-based resources define the capabilities of an organization, support restructuring business processes, and help organizations achieve sustainability and better environmental performance. Taking it further, Hart (1995) in the Natural-Resource-Based View (NRBV) framework stated the competitive advantage generated by organizations that adopt eco-friendly measures in their business operations.

The Triple Bottom Line model (TBL) propounded by Elkington (1998) gives similar emphasis to sustainability by explaining sustainability as an intersection of three

different pillars: economic, environmental, and social. This has been further strengthened by the Belief-Action-Outcome Framework of Melvite (2010) which refers to the societal, organizational, and psychic states that form environmental beliefs and affect an organization's decision or action to behave in an environmentally-responsible manner.

Based on the above discussion and review of existing literature, the present study identifies five broad drivers that influence green adoption by organizations. A brief description of these factors is provided below.

### 1. Industry Characteristics

Concentration of firms in a particular geographical location, supply chain management, and vertical and horizontal integration of firms define the industry characteristics. Steg & Vlek (2009) have found that polluting firms prefer to set up their plants in underdeveloped countries with lenient environmental regulations. Since green adoption depends upon the availability of resources, a strong supply chain and linkage of firms help in capturing efficient distribution channels and ensuring easy availability of resources, thereby accelerating green adoption. In this regard, Mahapatra & Gustavsson (2008) have found that the integration of existing and potential networks of suppliers, producers, and users of green products and services impacts the green adoption process in an industry.

### 2. Organization Characteristics

Organization characteristics include the size of the firm, organizational capacity

based on annual turnover, human resources (number of employees), organizational culture, research and development (R&D) expenditure, and competitors' green practices. The ability to finance green adoption directly depends on the size of the firm. As opined by Wakjira & Ramulu (2018) and Luthra et al. (2016), a weak financial position often creates hindrance in the implementation of sustainability measures, and so small-scale firms with restricted availability of funds are less likely to adopt eco-friendly solutions. It is also seen that employees' lack of environmental awareness, absence of adequate skills or training can slow down the green adoption process (Sommerfeld et al., 2017). In other words, an organization's learning capabilities also have a likely impact on its ability and willingness to adopt green practices (Wang et al., 2021a). On the other hand, strong support from top-level management, an eco-friendly culture, organizational values, and competitive intensity to use eco-activities as a brand differentiator prompt organizations to go for green adoption (e.g., Sarkar, 2012; Davis, 2017).

### 3. Technological Characteristics

A technology is characterized by its price, productivity, performance, compatibility, simplicity, testability, observability, and perceived risk. Adoption of green technology depends upon its perceived usefulness and involves sequential stages with various levels of scrutiny and cost-benefit analysis. Rogers (2003) explains simplicity and compatibility to be the two significant drivers of technology

adoption. Furthermore, the mass adoption of innovative technology depends upon its testability and perceived risk.

### 4. Public Policy

Policymakers set legally binding targets for protecting the environment and adopt various measures to promote green adoption by organizations, such as environmental norms and regulations, green certification, stimulus expenditure, utility rebates for using green technologies, state and local grants, and other public incentives. Li & Just (2018) have talked about some government policies and instruments that have been formulated to encourage the adoption of green technologies. For example, Energy Star label and energy efficiency standards on electrical appliances, tax incentives and utility rebates for renewable energy plants, and green certifications for eco-friendly infrastructure development (Green Highway projects of India). According to Glaser (2009), proactive government support through monetary incentives promotes green adoption and plays an important role in encouraging the adoption of innovative technologies by organizations (Elmustapha et al., 2018). Wang et al. (2021b) further point out that the aggressiveness of government regulations should consider the level of competition in the industry. In industries where the competition intensity is high, more aggressive government regulation would encourage more firms to adopt a green technology once it has been invented, but at the same time, it will discourage a firm from developing it.

## 5. Environmental Awareness

Green adoption is the best practice that an organization can perform to achieve superior and sustainable capabilities. This also requires environmental awareness and the installation of green organizational values. At a broader level, environmental awareness exhibits organizations' awareness of environmental degradation, display of environmental concern, as well as their responsible measures of environmental protection.

### **The Outcome: Sustainable Performance**

Sustainability can be understood as an internal reform in an organization that connects green practices with business operations (Grant, 2007). Trianni et al. (2017) stated that though sustainable measures result in improved financial performance, its implementation often requires a trade-off between environmental and monetary goals. The choice becomes challenging as organizations generally assign more importance to financial targets than sustainability. Proofread version:

In accordance with the existing literature, the sustainable performance of organizations can be broadly categorized into three groups, namely economic performance, social performance, and environmental performance (see Table 1). A brief description of these performance indicators is provided below.

#### **Economic Performance**

Economic performance is measured through the financial information presented in income

statements, balance sheets, and cash flow statements of organizations. The economic performance of organizations is assessed through an increase in sales revenue, profitability, market share, share price, and return on investment, as well as cost reduction as a result of the adoption of green measures. Empirically, the study by Masoumik et al. (2015) found a significant relation between green adoption, environmental, and financial performance. They further bifurcated the financial performance into tangible (such as a rise in market share, reduction in production cost, and increased productivity) and intangible parameters (i.e., improved product quality, clean corporate image, and legitimacy). Farza et al. (2021) point out that green innovation drives resource efficiency and boosts corporate reputation, thereby enhancing financial performance.

#### **Social Performance**

Green adoption involves the protection of the environment that benefits the society. Organizations' social performance is a measure of non-financial variables, which comprise an increase in customer loyalty, social audit scores, and a reduction in employee absenteeism due to the commitment of the organization towards society.

#### **Environmental Performance**

A sustainable business model focuses on reducing the negative impact on the environment, which can be measured by assessing organizations' adoption of eco-friendly production processes such as waste reduction and recycling,

environmental performance ratings, pollution control, environmental training programs, reduced energy consumption, and reduced carbon emissions.

### Objective of the Study

The present study has been undertaken with a two-fold objective: (i) assessing the impact of various drivers on green adoption by organizations, and (ii) examining the impact of green adoption on the sustainable performance of organizations.

## METHODOLOGY

The present quantitative cross-sectional study has been undertaken with the help of both primary as well as secondary data. While the published government documents, official press releases, academic reports of various government departments, Ministries, and specialized agencies, and public documents of the International Energy Agency (IEA), the World Bank, and UNFCCC served the secondary data requirement, a well-structured questionnaire was used to collect the primary response from a sample of all those organizations that are based in India and had participated in the Carbon Disclosure Project (2020). \*Using the probability sampling method, organizations were first segregated based on sector (manufacturing and non-manufacturing), and a random selection of 175 firms was made. Middle-level managers of these organizations were then contacted through emails and telephone calls. Of the surveys mailed, 103 responses

(58.9% response rate) from the managers of 68 manufacturing firms and 35 non-manufacturing firms were received. The detailed composition of sample firms is provided in Table 3.

The questionnaire was categorized into four sections that sought information related to the organization (such as type, size, location, and number of employees), green practices, and performance indicators. Table 2 provides a summarized view of the scales along with their source.

A pilot testing of the questionnaire was conducted to assess the relevance of questions. For this purpose, questionnaires were cross-checked by one senior faculty member of the University of Delhi, with expertise in the area of marketing research. Furthermore, two middle-level managers were interviewed for the pre-test, and based on their suggestions, some similarly-worded questions were removed from the final version of the questionnaire. Adopting measures from previous studies (see Table 1), a five-point agreement-disagreement Likert scale was employed to quantify the responses. The data gathered was entered into SPSS 27.0 version for further analysis using statistical techniques.

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\*Carbon Disclosure Project (2020) is published by not-for-profit charity with the same name in which India has secured the 5th position. The report measures the commitments to science-based targets (SBT) and actions undertaken by corporates to reduce their carbon emission.

**Table 1: Sample Composition**

Manufacturing Sector	No. of Firms	Non-Manufacturing Sector	No. of Firms
<b>Type of Firm</b>		<b>Type of Firm</b>	
Food & beverage processing	6	Financial Services	21
Automobiles & Components	4	Media, telecommunications & data center services	3
Electrical & electronic equipment	8	Intermodal transport & logistics	2
Garments & Textiles (yarn, cloth, synthetic fabrics)	3	Bars, hotels & restaurants	2
Oil & gas processing	7	Construction	1
Metal smelting, refining & forming	9	Coal mining and Oil & gas extraction	2
Cement	4	IT & software development	4
Chemicals	10		
Biotech & Pharma	11	<b>Total</b>	<b>35</b>
Thermal power generation	6		
<b>Total</b>	<b>68</b>		
<b>Employees</b>		<b>Employees</b>	
100-1000	17	100-1000	11
>1000	51	>1000	24
<b>Annual Turnover</b>		<b>Annual Turnover</b>	
100-1000Cr	20	100-1000Cr	9
>1000Cr	48	>1000Cr	26
<b>Annual R&amp;D Expenditure</b>		<b>Annual R&amp;D Expenditure</b>	
2-5%	47	2-5%	25
>5%	21	>5%	10

(Source: Data Collection)

**Table 2: Measures used in the Study**

Construct	Indicators	No. of Items	Source	Alpha	Validity
Industry Characteristics	<ul style="list-style-type: none"> <li>● Concentration</li> <li>● SCM</li> <li>● Vertical and horizontal integration</li> <li>● Society</li> </ul>	6	Banerjee et al., 2003	0.883	0.571
Organizational Characteristics	<ul style="list-style-type: none"> <li>● Size</li> <li>● Culture</li> <li>● Type of competition</li> <li>● Turnover</li> <li>● R&amp;D</li> <li>● No. of Employees</li> </ul>	10	Wakjira & Ramulu, 2018	0.836	0.502

Construct	Indicators	No. of Items	Source	Alpha	Validity
Technological Characteristics	<ul style="list-style-type: none"> <li>● Price</li> <li>● Productivity</li> <li>● Performance</li> <li>● Complexity</li> <li>● Testability</li> <li>● Compatibility</li> <li>● Perceived Risk</li> </ul>	9	Akman & Mishra, 2015	0.956	0.543
Public Policy	<ul style="list-style-type: none"> <li>● Environmental norms and regulations</li> <li>● Green certification</li> <li>● Stimulus expenditure</li> <li>● Utility rebates</li> <li>● State and local grants</li> <li>● Public incentives</li> </ul>	5	Carberry et al., 2017	0.925	0.586
Environmental Awareness	<ul style="list-style-type: none"> <li>● Environmental Concern</li> <li>● Environmental Awareness</li> <li>● Environmental Responsibility</li> </ul>	3	Arnocky et al., 2007; Wakjira & Ramulu, 2018	0.826	0.524
Green Adoption	<ul style="list-style-type: none"> <li>● Prefer to adopt green initiatives</li> <li>● Take efforts to understand the damage non-green activities can cause to environment</li> </ul>	2	Chang & Fong, 2010	0.788	0.629
Economic Performance	<ul style="list-style-type: none"> <li>● Sales Revenue</li> <li>● Cost Reduction</li> <li>● Profitability</li> <li>● Market Share</li> <li>● Share Prices</li> <li>● Return on Investment</li> </ul>	7	Rejikumar, 2016; Sirsly & Lametrz, 2008	0.890	0.514
Social Performance	<ul style="list-style-type: none"> <li>● Customer Loyalty</li> <li>● Employees absenteeism</li> <li>● Social Audit Score</li> </ul>	4	Carberry et al., 2017; Wakjira & Ramulu, 2018	0.811	0.546
Environmental Performance	<ul style="list-style-type: none"> <li>● Environmental Performance Ratings</li> <li>● Waste Reduction &amp; Recycling</li> <li>● Environmental Training Programs</li> <li>● Energy Consumption</li> <li>● Carbon Emission</li> </ul>	6	Roberts, 2009	0.856	0.513

(Source: Literature Review and Data Analysis)

## ANALYSIS AND FINDINGS

Before applying statistical analysis to the data set, the reliability and validity were assessed for all the measures. The Cronbach alpha value exceeding 0.700 and within-factor correlation greater than 0.5 respectively indicated the presence of reliability and convergent validity. Furthermore, only 162 violations were found out of 1824 possible comparisons, thus supporting discriminant validity.

### Impact of Drivers on Green Adoption

The five primary drivers were analyzed for their impact on organizations' green adoption through step-wise multiple regression. The

results in Table 3 depict the best linear combination of three factors, namely technological characteristics, public policy, and organization characteristics, that explain green adoption by organizations (Adj. R2 = .834, F = 171.498, p < .05). Furthermore, technological characteristics ( $\beta = .752$ ) emerge as the main predictor (highest beta weight) followed by public policy ( $\beta = .410$ ). In consonance with the findings of some previous studies, the results of the present work also reveal a negative impact of organizational characteristics ( $\beta = -.261$ ) on green adoption. Due to their insignificant impact, two independent variables, namely industry characteristics and environmental awareness, were excluded from the model.

**Table 3: Model Summary of Stepwise Multiple Regression Analysis**

Model B		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adj. R2	F	Sig.*
		Std. Error	Beta						
		-0.38	.203		-.188	.851	.817	457.785	.000 <sup>b</sup>
Step1	Technological Characteristics	1.004	.047	.905	21.396	.000			
		-.011	.197		-.054	.957	.827	245.496	.000 <sup>c</sup>
Step2	Technological Characteristics	.522	.190	.471	2.749	.007			
	Public Policy	.474	.182	.447	2.612	.010			
		.737	.392		1.880	.063	.834	171.498	.000 <sup>d</sup>
Step3	Technological Characteristics	.835	.235	.752	3.557	.001			
	Public Policy	.435	.179	.410	2.427	.017			
	Organization Characteristics	-.438	.200	-.261	-2.193	.031			

(Source: Data Analysis), \*sig.<0.05

a. Dependent Variable: Green Adoption

b. Predictors: (Constant): Technology Characteristics

c. Predictors: (Constant): Technology Characteristics, Public Policy

d. Predictors: (Constant): Technology Characteristics, Public Policy and Organization Characteristics

Excluded Variables: Industry Characteristics and Environmental Awareness

## 2. Impact of Green Adoption on Sustainable Performance

The results of the regression analysis once again reveal a significant impact of green adoption on the three components of sustainable performance, namely economic, social, and environmental performance. Furthermore, out of the three, green adoption is found to have the maximum impact on social performance ( $\beta = .802$ ), followed by environmental performance ( $\beta = .790$ ) and economic performance ( $\beta = .785$ ).

A closer assessment of the mean values for the aspects comprising the three performance indicators helps in assessing the positive impact of green adoption on specific organizational activities. For instance, with respect to economic performance, the adoption of green practices significantly reduces the cost of operation of businesses due to an increased focus on waste reduction, recycling, and energy efficiency (mean = 4.27). An improved image achieved through a green focus and a premium price charged for green products and services further generates increased sales revenue (mean = 4.22), profitability (mean = 4.31), and market share for firms, paving the way for a subsequent increase in an organization's share prices (mean = 4.19) and return on investment (mean = 4.24).

Similarly, on the social front, not only does customer loyalty for the brand increase (mean = 4.27) when an organization offers green products and services, but its employees also feel motivated when they associate themselves

with an environmentally responsible organization, thus reducing absenteeism (mean = 4.29). Furthermore, private sector organizations are now taking an active part in social audit surveys and are investing more in green initiatives, thereby improving organizations' social audit performance (mean = 4.17).

Lastly, green adoption by organizations helps them to reduce their waste generation (mean = 4.30), energy consumption (mean = 4.32), carbon footprint (mean = 4.22), and improve their overall environmental performance ratings (mean = 4.28). Regular and well-planned environmental training programs make employees sensitive to the environment (mean = 4.35), which further results in an organization's better environmental performance. In all, it may be inferred that green strategies adopted by organizations at the right time and in the right place exert a significant positive impact on the sustainable performance of organizations and help them to efficiently achieve their objectives.

**Table 4a: Impact of Green Adoption on Sustainable Performance**

Variable	$\beta$	t	Sig.
GA $\square$ EP	.785	12.735	0.000
GA $\square$ SP	.802	13.502	0.000
GA $\square$ ENVP	.790	12.965	0.000

(Note:  $p < 0.05$ , GA: Green Adoption EP: Economic Performance SP: Social

Performance ENVP: Environmental Performance)

(Source: Primary Data)

**Table 4b: Mean Assessment of Sustainable Performance**

Statements	Mean	Std. Deviation
<b>Economic Performance (mean= 4.245)</b>		
Sales Revenue	4.22	.625
Cost Reduction	4.27	.641
Profitability	4.31	.674
Market Share	4.24	.686
Share Price	4.19	.642
Return on Investment	4.24	.618
<b>Social Performance (mean= 4.243)</b>		
Customer's Loyalty	4.27	.660
Absenteeism	4.29	.717
Social Audit	4.17	.666
<b>Environmental Performance (mean= 4.294)</b>		
Environmental Performance Ratings	4.28	.648
Waste Reduction & Recycling	4.30	.698
Environmental Training	4.35	.696
Energy Consumption	4.32	.689
Carbon Emission	4.22	.609

(Source: Primary Data)

## CONCLUSION AND IMPLICATIONS

The biggest problem of environmental deterioration makes it imperative for all stakeholders to take active action in curbing the situation. In addition to taking measures and supporting the government in its environmental programs, the Indian corporate sector has also been making efforts to imbibe greenness in its systems and processes to the extent possible. This paper sheds light on this important aspect by delving into organizations' green adoption behavior in detail. The findings establish a significant and differential impact

of three out of five antecedents, namely technology characteristics, public policy, and organization characteristics, on the adoption of green by organizations. While the impact of technology and public policy is found to be positive, the results reveal a negative beta value for organization characteristics. This is perhaps because these comprise the variables that are internal to a firm (such as size, culture, competition, and turnover) and thus influence its financial position and the level of green adoption. Thus, it can be inferred that green practices cannot be implemented arbitrarily and under competitive pressure and should be aligned in accordance with the nature and size of an organization.

The study results also establish a positive and significant impact of these drivers on the economic, social, as well as environmental performance of organizations. However, despite efforts being taken in this respect, there still remains a gap in complete attainment of green objectives. The present study provides some useful suggestions that can be considered by the corporate sector and policymakers for better implementation of such programs in the long run.

To begin with, there is a need for top management commitment and support towards the adoption of green marketing practices and green agendas. Appointing special green officials such as 'chief green officers' and 'General Managers-Environment' to make key decisions regarding green policies and systems can be a useful step in this direction. Besides this, 'green champions', having the necessary authority and adequate understanding of the organization,

should also be selected among the executives to administer effective implementation of green programs.

Second, the adoption of green strategies requires modifications and sometimes a complete overhaul across different aspects of the organization, primarily marketing, including packaging, labeling, pricing, distribution, and promotion. For this, it is suggested that management involve all units and departments of the organization in developing a holistic strategy to implement green initiatives. Table 5 provides a brief idea of some of such green activities that can be adopted by organizations. Alongside, it would help if regular programs are organized to prepare, train, and sensitize the internal workforce about the benefits and challenges involved in the implementation of green strategies. However, one should not see green marketing strategy as a tool for increasing sales but as a part of ethical business practices that should be followed by every organization deriving resources from the environment. Furthermore, organizations need to avoid the practice of greenwashing by giving a false impression of being environmentally responsible.

Lastly, it is seen that a majority of firms adopt green practices only as a result of government or regulatory pressure. A few firms, particularly in the manufacturing sector, even fail to comply with environmental regulations, resulting in the imposition of heavy penalties or closure of such units. A more stringent approach is therefore required by the government to ensure the implementation of environmental laws by organizations. Moreover, big companies with high turnover

and access to capital for investment are usually more inclined to adopt green practices. The cost involved in using green technology acts as a hindrance for small companies, making them uninterested in initiating such activities. For better penetration and feasibility of green adoption across all sectors and industries, it is important that the government provides more incentives and subsidies to small and medium-scale enterprises. The findings of the present work also reveal a significant and positive impact of public policy in promoting green adoption, which reasserts that a suitable policy design and implementation can help towards the attainment of sustainable development goals by all.

In sum, it can be inferred that there is a need to adopt a balanced approach whereby organizations work in synergy with other stakeholders, the government and non-government organizations, civil society, and academic institutions to promote green programs as a profitable endeavor for sustainable growth.

## LIMITATIONS AND FUTURE SCOPE

Sufficient efforts have been made to make this study as comprehensive as possible. However, there still remain some gaps that can be addressed by future researchers. Considering the feasibility of the research, the present work has focused on only the most important drivers, identified with the help of previous studies, of green adoption by organizations. The possibility of some other factors which may influence an organization to either accept or reject green adoption cannot be

denied. Also, though organizations from both the manufacturing and non-manufacturing sectors have been included in the sample, the analysis has not been performed across sectors

or industries. As green practices may vary with respect to differences in organization characteristics, future studies in this regard may yield further interesting insights.

**Table 5: Suggested Green Activities**

Areas	Green Strategies
Lighting	<ul style="list-style-type: none"> <li>• Use of maximum daylight</li> <li>• Proper illumination to carry operations safely and efficiently.</li> <li>• Installation of efficient lamps and sensors to turn on the light only when necessary.</li> </ul>
Air ventilation System	<ul style="list-style-type: none"> <li>• Installation of optimum size of air compressors and elimination of leakages in the air compressed system</li> <li>• Designing air ventilation systems based on localized distribution and providing a safe and productive ambient for the workplace.</li> </ul>
Input/Raw Materials	<ul style="list-style-type: none"> <li>• Substitution of toxic and other harmful materials both for nature and human beings with lesser or a non-toxic option.</li> <li>• Adjustment in the production process to reduce the use of scarce raw material</li> <li>• Minimizing waste</li> </ul>
Operations	<ul style="list-style-type: none"> <li>• Adoption of Bio-remediation and Bio-mining</li> <li>• Green Supply Chain Management</li> <li>• Extended Producer Responsibility</li> </ul>
Machinery	<ul style="list-style-type: none"> <li>• Replacing inefficient machineries</li> <li>• Setting green criteria for the purchase/ design of new machinery</li> <li>• Substitution of noisy machinery (low noise purchasing policy)</li> </ul>
Emission	<ul style="list-style-type: none"> <li>• Elimination of the harmful contaminants in the environment that pollute land, water and air.</li> <li>• Setting emission limits</li> <li>• Continuous monitoring of emission</li> </ul>
Employees Training	<ul style="list-style-type: none"> <li>• Creating awareness about energy conservation.</li> <li>• Green orientation program for employees</li> <li>• Providing training to employees on the consequences of non-compliance with environmental procedures</li> </ul>
Marketing	<ul style="list-style-type: none"> <li>• Green Advertisements</li> <li>• Eco-labeling</li> <li>• Eco-branding</li> <li>• Training of sales representatives to promote eco-friendly products</li> </ul>
Green Bonds	<ul style="list-style-type: none"> <li>• Raising funds for supplement R&amp;D on green projects</li> </ul>

(Source: Conceptualized by the Authors)

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# IMPACT OF IND AS ADOPTION ON THE FINANCIAL PERFORMANCE OF INDIAN COMPANIES

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## ABSTRACT

The Indian companies are provided with a global reporting landscape with the introduction of Indian Accounting Standards (Ind AS). These standards are in line with the global International Financial Reporting Standards (IFRS) and have made the financial statements comparable at a global level. In India, the MCA gave a strategic plan for the introduction of Ind AS, which are in line with IFRS, in 2010. A planned roadmap was given for the adoption of Ind AS voluntarily from April 2015, mandatorily for all companies with a net worth of 500 crore or more from April 2016, and so on in a phased manner. The objective of the research is to analyze the impact of Ind AS adoption on the financial performance of selected companies in India, based on the cutoff year 2016. Data from 39 eligible companies (ranging from 2012-2023) was collected, and hypotheses were tested using paired sample t-tests. The results show that there is no significant impact of Ind AS adoption on the financial ratios of

the selected companies. The study has practical implications for the companies that are still lagging behind in reporting Ind AS data and companies for whom adoption is still voluntary, as findings suggest that adoption and reporting of Ind AS do not affect the financial performance of the company.

**Key Words:** Ind AS, financial performance ratios, IFRS, t-test.

## INTRODUCTION

The rise of globalization, the internationalization of capital markets, increased cross-border listings, and the necessity for comparable financial reporting have accelerated the steps towards uniformity in accounting rules worldwide, fostering the implementation of uniform accounting standards. This drive for standardization and harmonization of accounting rules began in the 1990s and progressed towards convergence in the 2000s (Zeff, 2007).

Establishing common accounting standards can assist investors in distinguishing between low-quality and high-quality companies, providing them with more information and enhancing safety in their investment decisions. Consequently, in today's global business landscape, companies advocate for a universally recognized accounting language through globally harmonized accounting standards. To achieve this harmonization, the International Accounting Standards Board (IASB) introduced International Financial Reporting Standards (IFRS), which have become the international standard for accounting. Currently, over 130 nations have adopted IFRS, with many more committed to doing so in the future. Unlike their predecessors, these new accounting standards are principle-based. In India, the Ministry of Corporate Affairs oversees the operations of Indian companies and released a strategic roadmap for convergence with IFRS in January 2010. Subsequently, in February 2011, after extensive deliberations and consultations, the Ministry of Corporate Affairs issued 35 Accounting Standards known as Ind AS to facilitate the process of adoption.

Although Ind AS has progressed a lot and is becoming quite close to IFRS, there are still some differences which can lead to differences in the financial statements of the firm and can also have an impact on the company's financials. Researchers around the world have reported a mixed impact of the adoption of IFRS on a company's financials. This paper seeks to examine the impact of the adoption of Ind AS on the financial performance of Indian companies.

## LITERATURE REVIEW

Companies today are operating at a global level, running in multiple countries. With each country having its own accounting standards, it is a time-consuming task to prepare financial statements as per the requirements of local accounting standards of each country. The introduction of IFRS is a solution to this problem. Therefore, all countries worldwide must adhere to the IFRS, which is approved by IASB. The IFRS standards are implemented as Ind AS in India. Keeping in mind the legal and judicial framework in India, some changes are made during the convergence process. Ind AS was adopted in a phased manner in India, giving companies sufficient time to clearly understand the new standards. Many researchers around the world have studied the impact of this adoption on the company's financial performance. Some of the results are discussed here.

Tlemsani et al., (2024) investigated the impact of IFRS adoption on companies' financials in Saudi Arabia. Using a paired-sample t-test, the results revealed significant differences between GAAP and IFRS for the measurement, recognition, and classification of non-current assets and liabilities. Another study by using a sample of German companies from the years 1998 to 2002. Ebaid (2022) Revealed that there was no significant difference between the profitability, leverage, and liquidity of Saudi Arabian companies in the post-IFRS era. Rudzioniene et al., (2022) I evaluated the impact of IFRS on the liquidity, profitability, and leverage of 15 state-owned companies in Lithuania. The results revealed an insignificant decrease in the profitability and liquidity ratios.

However, the decrease in the leverage ratio was significant. Opare et al., (2021) Used meta-analysis of 56 studies and discovered that adopting IFRS enhances financial reporting comparability and market liquidity while lowering the cost of equity. In 2018, the ICAI conducted a thorough examination of the impact of Ind AS. They conducted both quantitative and qualitative impact analyses of the consolidated financial statements of 170 selected companies listed under Ind AS, representing various industry sectors. The objective was to assess how the transition from Ind AS to US GAAP affected key financial metrics. Additionally, they employed a qualitative approach through surveys to gauge how the industry handled the implementation of Ind AS, drawing insights from experts in the field. The findings suggest that there is no significant impact on critical financial metrics such as total assets, tangible assets, borrowings, equity, revenue, and profit after tax (PAT) when considered collectively. However, the analysis indicates that the mandated adoption of Ind AS has led to diverse consequences in the Indian manufacturing sector. Chandrasekar et al. (2016) conducted research on Wipro to investigate the influence of these international standards on its financial statements and various key ratios. They compared the consolidated financial statements prepared under GAAP with those prepared under IFRS. By analyzing specific ratios, they identified discrepancies between the two sets of statements. The findings suggest an increase in liquidity ratios and the interest coverage ratio, a slight rise in the debt equity ratio, and no significant improvement in profitability ratios except for a slight increase in the profitability ratio in 2013. Overall, the study indicates that

the adoption of IFRS standards based on fair value accounting and strict adherence to the same have strengthened financial indicators, offering decision-makers transparent and accurate accounting insights. Yhlas Sovbetov (2013) investigated the influence of IFRS implementation on UK public listed firms by analyzing three categories of ratios: profitability, capital structure and productivity, and liquidity, both pre- and post-IFRS implementation. According to the study in the UK, IFRS has led to an increase in the ratios of return on assets (ROA) and net profit. Dimitrios et al. (2013) found that transitioning from Greek Accounting Standards (AS) to IFRS could lead to variations in financial ratios. Their study focused on companies newly listed on the Athens Exchange and those with longstanding listings. The findings indicated that there were no significant differences in the operational dynamics of the two groups of companies following the implementation of IFRS. Blanchette, Racicot, and Girard (2011) examined the effect of IFRS adoption on leverage, liquidity, coverage, and profitability measures among a cohort of Canadian businesses. Their survey findings showed fluctuations in means, medians, and volatility across various financial ratios of organizations, although these variances were not statistically significant in most cases. Additionally, they found no notable disparities in outcomes when analyzing results based on groups of companies that adopted IFRS at different points in time. Using 20 financial parameters, Pazarskis and collaborators (2011) examined the potential impact of IFRS adoption by IT sector firms listed on the Athens Exchange in Greece. According to their findings, only the EBIT margin ratio showed a statistically significant

increase, while the leverage ratio demonstrated a significant decrease. Ferrer et al., (2011) investigated how liquidity and leverage ratios influence the level of IFRS compliance among 100 publicly listed firms in the Philippines, using disclosure indicators derived from balance sheets and income statements. Their research concluded that liquidity and financial leverage do not affect IFRS compliance when represented as indicators on the balance sheet and income statement. As per Swaminathan. S (2011), The convergence of conservative Indian accounting standards with IFRS has a minimal impact on metrics such as ROE, ROA, total asset turnover, or profitability ratio, but it significantly affects the financial leverage ratio. When a company adopts a new accounting standard for its financial statements, the impact on financial indicators may vary, sometimes remaining unchanged. After extensive review, it can be said that there is no consensus on the impact of IFRS/Ind AS on financial ratios because of the time and country differences in the studies.

Arouri et al. (2010) conducted longitudinal research to analyze the return on equity (ROE) and the value relevance of 40 French-listed firms in the fiscal year 2004 following IFRS implementation. Utilizing the fair valuation concept, they observed increases in ROE, net income, and gearing ratio (GR). However, there was limited evidence indicating an improvement in clarity or value relevance.

Lantto and Sahlstrom (2009) analyzed the years 2004 and 2005 as the “pre-adoption” and “post-adoption” periods, respectively, regarding the adoption of IFRS. They observed that this implementation has altered the magnitudes

of fundamental financial ratios due to changes in book value and the imposition of stricter regulations. According to their findings, IFRS influenced critical accounting ratios by slightly increasing the profitability ratio (PR) and the gearing ratio (GR), while significantly decreasing the P/E ratio, equity ratio, and quick ratio.

Hung et al. (2007) analyzed the impact of the adoption of IFRS on the financial statements. Results revealed that the absolute variation of total assets, equity, as well as net earnings is significantly greater with IFRS than under German AS. But the difference in financial ratios after the adoption of new standards was insignificant.

Agca et al. (2007) conducted research on 147 firms listed on the “Istanbul Stock Exchange”. They looked at the effect of IFRS implementation on the Financial Ratios of these firms between 2004 and 2005. 2004 was used as the “pre-adoption” year and the other as the “post-adoption” year. The results revealed that both the liquidity ratio and the net asset turnover were significantly impacted.

Callao et al. (2007) examined the impact of the adoption of IFRS on the Financial Ratios of 35 Spanish listed companies during 2004 and 2005. It was concluded that following the adoption of IFRS, there was an increase in cash and cash equivalents, current ratio, long-term liabilities, return on equity, and gearing ratio. Conversely, there was a decrease in equity, debtors, operating revenue, and solvency ratio. The researchers highlighted that the revisions under the new regime directly affected the concepts of fair value, particularly in relation to return on equity, gearing ratio, and equity.

Goodwin et al. (2007) discovered that IFRS implementation led to increased liabilities and leverage ratios, alongside decreased equity and earnings on average. These findings align with those of Hung & Subramanyam (2007), who examined the particular impacts of IFRS implementation on a company's financials by comparing statements prepared using IFRS and German GAAP. In their report on 125 Finnish businesses.

## RESEARCH GAP

After an extensive review of the literature, it was found that maximum studies have been conducted in a foreign context, and very few studies have been conducted in the Indian context. Either they use data from a short span of time or they focus on very few companies. The present study contributes to the existing literature by filling this gap using an extensive sample of 39 companies over a period of 12 years. The study is novel in its approach as it uses data from the maximum number of available companies for the maximum time period. It also compares the pre and post implementation of Ind AS.

## RESEARCH METHODOLOGY

**Objectives of the Study:** To analyze the impact of Ind AS adoption on the financial performance of Indian companies.

**Data Collection:** Top 50 NSE NIFTY companies that adopted Ind AS in the year 2016 were selected for the study. The final dataset included 39 companies due to the

applicability of Ind AS. The list of companies is presented in Table 1 below. Data is taken from the Prowess and Capitaline database to ensure its authenticity. The collected data ranges from 2011-12 to 2022-23 and has been divided into the Pre-Ind AS adoption phase (2011-12 to 2015-16) and the Post-Ind AS adoption phase (2016-17 to 2022-23) to meet the objective.

## List of Companies

### Hypothesis of the Study

To meet the objective of this research, the following hypothesis will be examined:

1. H01: Implementation of Ind AS has no significant impact on the Return on Net Worth of Indian firms.
2. H02: Implementation of Ind AS has no significant impact on the Debt-Equity Ratio of Indian firms.
3. H03: Implementation of Ind AS has no significant impact on the Interest Coverage Ratio of Indian firms.
4. H04: Implementation of Ind AS has no significant impact on the Return on Capital Employed of Indian firms.
5. H05: Implementation of Ind AS has no significant impact on the Current ratio of Indian firms.
6. H06: Implementation of Ind AS has no significant impact on the Profit After Tax Ratio of Indian firms.

**Research Tool and Test Used:** To meet the objective and test the hypotheses, a paired sample t-test was performed using SPSS.

## DATA ANALYSIS & INTERPRETATION

As the objective of the research is to analyse the impact of Ind AS adoption on the financial

performance of the Indian companies, the collected data was analysed using paired sample t-test. The results are presented in the tables as follows:

**Table 1:**

Company Name	Sector	Company Name	Sector
Adani Ports and SEZ	Infrastructure	M & M	Automobile
Asian Paints	Paints and Varnishes	I. & T	Automobile
Bajaj Auto	Automobile	Power Grid	Power Generation
BPCL	Refineries	Nestle	Consumer Food
Bharti Airtel	Telecommunications	ONGC	Oil Exploration
Britannia	Consumer Food	NTPC	Power Generation
Coal India	Coal	Maruti Suzuki	Automobile
Cipla	Pharmaceuticals	Sun Pharmaceutical Industries Ltd	Pharmaceuticals
Divis Labs	Pharmaceuticals	Reliance Industries	Diversified
Dr. Reddy's Lab	Pharmaceuticals	Shree Cement	Cement
Eicher Motors	Automobile	Tata Steel	Iron and Steel
HCL Technologies	IT services and consulting	Tata Consumer	Consumer Food
Grasim	Diversified	TCS	IT services and consulting
Infosys	IT services and consulting	Tata Motors	Automobile
Hero Motocop	Automobile	Titan	Consumer goods
Hindalco	Iron and Steel	Tech Mahindra	IT Services and Consulting
HUL	FMCG	UPL	Pesticides and Agrochemicals
IOC	Coal	Ultra Tech Cement	Cement
JSW Steel	Iron and Steel	Wipro	IT Services and Consulting
ITC	Diversified		

**Table 2:**

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	RONW Before	22.1372	39	14.63246	2.34307
	RONW After	22.8637	39	27.5114	4.40535
Pair 2	DE Before	0.5836	39	0.67246	0.10768
	DE After	0.5903	39	0.63741	0.10207
Pair 3	IC Before	193.794	39	518.06389	82.95661
	IC After	157.8196	39	443.62144	71.03628
Pair 4	ROCE Before	33.8067	39	104.98886	16.81167
	ROCE After	20.3712	39	12.98123	2.07866
Pair 5	CR Before	1.6174	39	0.79524	0.12734
	CR After	1.7497	39	1.06391	0.17036
Pair 6	PAT Before	12.8938	39	9.10121	1.45736
	PAT After	12.0308	39	8.12469	1.30099

The descriptive statistics of various ratios of selected companies is presented in table 2. The average mean value of Return on Net Worth before adoption of Ind AS and after adoption of Ind AS has a minor difference of 0.73 only while standard deviation has greater difference. In case of Debt-Equity ratio both mean and standard deviation have minor difference while Interest Coverage and Return on Capital Employed have higher difference in mean and standard deviation, the reason for difference in standard deviation is size and nature of companies while for difference in mean the reason is increase/decrease in debt. The average Current Ratio and Profit After Tax also have minor differences in mean and standard deviation, it means the companies do not have visible impact on financial ratios after adoption of Ind AS as compared to the before adoption Ind AS data.

**Table 3:**

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	RONW Before & RONW After	39	0.226	0.166
Pair 2	DE Before & DE After	39	0.897	0
Pair 3	IC Before & IC After	39	0.722	0
Pair 4	ROCE Before & ROCE After	39	0.184	0.262
Pair 5	CR Before & CR After	39	0.807	0
Pair 6	PAT Before & PAT After	39	0.892	0

Above table 3 describes the correlation between the financial ratios before Ind AS

adoption and after adoption of selected companies. According to the analysis presented in the table, there is a significant positive correlation for the Debt-Equity Ratio, Interest Coverage Ratio, Liquidity Ratio, and Profit after Tax Ratio. However, for the Return on Net Worth and Return on Capital Employed, the correlation is positive but not significant. The reason for this non-significant positive correlation is the amount of capital employed by a few of the companies.

## CONCLUSION & IMPLICATION

The objective of the study was to analyze the impact of Ind AS implementation on the financial performance of Indian companies. The collected data of 39 companies was divided into pre- and post-era of Ind AS implementation. As the data set belongs to the same set of companies in the pre- and post-era, the paired sample t-test was applied for hypothesis testing. The results showed that there is an insignificant impact of Ind AS implementation on the financial performance of the companies, and these results are in accordance with the previous studies and support the work by Ibiameke & Ateboh Briggs (2014), Abdul Baki et al. (2014), Aggarwal Rishika (2020), Callao et al. (2007), Lantto and Sahlstrom (2009). The study has practical implications for companies that are still lagging behind in reporting Ind AS data and companies for whom adoption is still voluntary, as findings suggest that adoption and reporting of Ind AS do not affect the financial performance of the company.

**Table 4:**  
Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 RONW Before - RONW After	-0.73	28.09	4.50	-9.83	8.38	-0.16	38	0.87
Pair 2 DE Before - DE After	-0.01	0.30	0.05	-0.10	0.09	-0.14	38	0.89
Pair 3 IC Before - IC After	35.97	365.03	58.45	-82.35	154.30	0.62	38	0.54
Pair 4 ROCE Before - ROCE After	13.43	103.39	16.55	-20.08	46.95	0.81	38	0.42
Pair 5 CR Before - CR After	-0.13	0.63	0.10	-0.34	0.07	-1.31	38	0.2
Pair 6 PAT Before - PAT After	0.86	4.12	0.65	-0.47	2.12	1.31	38	0.2

**Table 5:**

Hypotheses	Accepted/Not Accepted	Supported by previous studies
H <sub>01</sub>	Accepted	Ibiamke & Ateboh Briggs (2014); Abdul Baki et al. (2014); Aggarwal Rishika (2020); Callao et. al (2007); Lantto and Sahlstrom (2009).
H <sub>02</sub>	Accepted	
H <sub>03</sub>	Accepted	
H <sub>04</sub>	Accepted	
H <sub>05</sub>	Accepted	
H <sub>06</sub>	Accepted	

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# INFLATIONARY DYNAMICS AND CAUSAL NEXUS OF BUDGETARY GAPS AND MONETARY EXPANSIONS: A TIME SERIES ANALYSIS WITH ARDL MODELLING FOR BANGLADESH

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## ABSTRACT

This paper examines the causal relationships between inflation, budget deficit, and money supply in Bangladesh from 1980 to 2023 using the Autoregressive Distributed Lag (ARDL) approach. Short-run causality analysis reveals unidirectional influences from budget deficits and money supply to inflation. Contrary to common conjectures that link budget deficits to inflation through increased money supply, our findings reveal no causality between money supply and inflation in both the short-run and long-run. The study contributes to the empirical literature by focusing on the unique economic context of Bangladesh, which has not been extensively explored in this tri-variate relationship. The results suggest that conventional economic theories may not fully apply to developing countries like Bangladesh, where monetary expansions do not necessarily

lead to inflationary pressures in the long run. The paper concludes with policy recommendations based on the analysis of the ARDL model and diagnostic tests confirming the model's stability.

**Keywords:** Inflation, Budget Deficit, Money Supply, ARDL Model, Causality Analysis

**JEL Codes:** C32, E31, E52, H62

## INTRODUCTION

Amidst the dynamic economic landscape of Bangladesh, the government's projected budget deficit for the year ending in June 2024 is uncertain. It depends a lot on how the economy grows. Yet, as cautioned by Fitch Ratings, the deficit might not stay as expected, especially if the optimistic growth targets aren't realized. This could potentially unsettle the nation's economic stability. Bangladesh's consumer price inflation stands as a testament to the nation's economic

intricacies. Over the past decade, inflation has gone up by an average of 6.2%, which is far beyond the average in the Asia-Pacific region, to be precise of 4.1 substantial margin points. Notably, in 2022, prices went up by an average of 7.7%, underscoring the persistence of inflationary pressures in the country's economic landscape. The Austrian School of Economics describes inflation as an increase in money and credit, not just rising prices. According to the Austrian school of economics, government deficits are inflationary. While governments print money to pay off debts by increasing the money supply, it causes inflation. The Austrian school believes that any increase in the money supply not supported by a corresponding increase in the production of goods and services leads to an increase in prices, but not all goods' prices increase simultaneously. In his pioneering work "Ten Great Economic Myths," Murray N. Rothbard debunks the idea that budget deficits don't cause inflation. According to Rothbard, deficit financing, or printing money, became a tool for governments to spend beyond their means, which initiates inflation. Printing money is the easiest thing. Every government is clever enough to do it. The government denies responsibility for inflation; they blame it on "bad actors" like unions or corporations. However, inflation results from the government's decision to increase the money supply. The government tries to manage inflation by setting prices, but it hides its own function in making it happen. Inflation occurs when the money supply increases faster than the supply of goods, which leads to a rise in prices. This cycle can persist if there's a check on the government's ability to expand the money supply. Ultimately, governments are often

responsible for destabilizing monetary systems through unrestrained inflation (Rothbard, 1984). Budget deficits, emblematic of a government's proposed expenditure exceeding its available public revenues for a fiscal year, are pervasive in the economic narratives of developing nations. These deficits, often termed fiscal gaps, present a nuanced lens through which to analyze the economic trajectories of nations poised on the cusp of development (Amin & Murshed, 2017; Jimmy, 2014; Aworinde, 2013; Chihi & Normandin, 2008; Saleh & Harvie, 2005). In the pursuit of funding public projects, developing countries frequently turn to foreign sources, including aid from international donor agencies and developed nations (Amin & Murshed, 2018). The macroeconomic repercussions of budget deficits have spurred myriad investigations aimed at deciphering their interplay with key economic indicators (Burdekin & Langdana, 2015; Nguyen, 2015; Willett & Laney, 2014; Laubach, 2009). However, the discourse surrounding budget deficits lacks uniformity. While some studies advocate for their presence, linking deficits to economic growth, particularly in developing economies, others highlight their adverse effects on overall economic stability (Oladipo & Akinbobola, 2011). Rooted in Keynesian export-led growth theory, proponents of deficit spending argue that it stimulates aggregate demand, fostering economic expansion (Oladipo & Akinbobola, 2011). Conversely, critics point to the inflationary pressures and escalating public debt associated with sustained deficits (Biza et al., 2015; Lee & Ng, 2015). Amid these debates, the trinity of inflation (INF), budget deficits (BD), and money supply (M2) emerges as pivotal macroeconomic variables subject to extensive

scrutiny by economists worldwide. Persistent government deficits and burgeoning debt have assumed critical importance for both developed and developing economies, spurred by declining tax revenues during recessions and escalating debt service payments (Biza et al., 2015). Bangladesh, a nation in the throes of development, mirrors this narrative, grappling with budgetary deficits and relying on foreign aid to bridge fiscal gaps. Against this backdrop, this paper embarks on a novel exploration, delving into the causal relationship between BD, M2, and INF within the context of Bangladesh from 1980 to 2014.

Unveiling insights previously unexplored, this study employs the Autoregressive Distributed Lag (ARDL) econometric model to dissect the interplay between these macroeconomic variables. By elucidating the impacts of M2 on BD and INF across both short and long run horizons, this paper seeks to address fundamental conceptions. If a long-term relationship exists between BD, M2, and INF in Bangladesh and if a causal link exists between these macroeconomic variables, our study aims to unveil these intricacies. Through this research, we endeavor to fill a void in the empirical literature, offering fresh perspectives on the economic dynamics of Bangladesh and contributing to a deeper understanding of the global discourse on fiscal policy and economic development.

## LITERATURE REVIEW

During the early 1920s, economist Ludwig Von Mises lived through hyperinflation in Austria. He defined the relationship between monetary inflation and prices in three phases. In the first phase, prices rise sporadically while

people remain optimistic. Assets excluded from inflation statistics still get more expensive due to money and credit expansion. The second phase involves widespread price increases, individuals shift preferences from money to goods, and they blame speculation for inflation. Finally, in the third phase, people rapidly lose faith in currency. As people rush to spend money before it becomes worthless, this leads to a “crack-up boom” (Mises, 1949). In a study by Parida et al. (2002), the relationship between fiscal deficit (BD), money supply (M2), and price level in India was scrutinized using a Vector Auto Regression (VAR) model over a 40-year period from 1961 to 2001. The findings unveiled bidirectional causality between fiscal deficit and M2, alongside unidirectional causal links from price level to both fiscal deficit and M2. Solomon & De Wet (2004) delved into Tanzania’s economic landscape, characterized by historically elevated inflation rates and persistent fiscal deficits. Employing data spanning from 1967 to 2001, the authors investigated the causal nexus between fiscal deficit and inflation. Their analysis suggested that shocks in fiscal deficit and GDP adversely affected inflation in Tanzania, echoing earlier assertions by Sargent and Wallace (1981) and Easterly and Schmidt-Hebbel (1994) regarding the multifaceted nature of inflationary pressures. Oladipo & Akinbobola (2011) explored the relationship between fiscal deficit and other macroeconomic variables in Nigeria. Utilizing data from 1971 to 2005, the authors employed pairwise Granger causality tests to examine causal relationships among fiscal deficit, inflation rate, exchange rate, and GDP. Their findings highlighted a unidirectional

causality from fiscal deficit to inflation in the long run, accompanied by an indirect effect whereby fiscal deficit led to exchange rate fluctuations, subsequently fueling inflation.

Abel et al. (2012) investigated the impact of the fiscal deficit on inflationary pressures in the Nigerian economy using data from 1980 to 2009. Employing cointegration analyses and Vector Error-Correction Model (VECM) causality techniques, the authors identified a unidirectional causal relationship from the fiscal deficit to inflation without feedback, alongside a similar causal link from the fiscal deficit to the money supply. However, the study focused solely on short-run causal relationships, overlooking long-term dynamics. A common limitation across these studies is the emphasis on either short-run or long-run causal analyses, without elucidating potential variations in causal relationships over time horizons. Additionally, the literature predominantly focuses on African developing countries, neglecting insights into South Asian contexts. Thus, this paper seeks to address these gaps by analyzing causal associations within the context of Bangladesh. The empirical model employed in this study builds upon the framework of Parida et al. (2002), adapting it to accommodate relevant data on the macroeconomic variables under scrutiny. The regression model posits inflation as a function of the fiscal deficit and the money supply, reflecting the dynamic interplay between government fiscal policies and monetary expansion. While fiscal deficit-induced monetary expansion may stimulate economic growth and revenue generation, it may also precipitate inflationary pressures due to heightened demand for goods and services,

underscoring the intricate balance between fiscal and monetary policy objectives.

The economic landscape of Bangladesh has been the subject of extensive research, particularly in relation to inflation and its determinants. Studies have consistently highlighted the significant influence of GDP, money supply, exchange rate, and interest rates on inflation (Uddin et al., 2014). Government expenditure and imports are also noted to have a positive impact on inflation, with exports exerting a negative effect (Arif & Ali, 2012). Al-Mukit (2015) further corroborates these findings, emphasizing the acceleration of inflation due to GDP growth, money supply, exchange rate fluctuations, and government expenditure. In contrast, other research across different countries, including Bangladesh, Jordan, Malaysia, and OECD countries, presents varied results regarding the factors influencing inflation (Ferdous & Sultana, 2017; Hossain, 2002; Begum, 1996; Mukitadar-Al-Mukit et al., 2015; Alawin & Oqaily, 2014; Islam et al., 2017; Bowdler & Nunziata, 2006). These disparities underscore the complexity of inflation dynamics and the need for context-specific analyses. The literature on inflation's determinants presents a diverse range of findings. Al-Mutairi et al. (2020) explored the impact of goods and tax revenue on inflation in Kuwait, concluding that goods have a positive and significant influence, while tax revenue can reduce inflation levels. In Bahrain, Al-Ezzee (2016) found that monetary instruments such as money supply, nominal effective exchange rate, and nominal interest rate have a long-term positive effect on the Consumer Price Index (CPI), with government expenditure

also contributing to inflation (Al-Ezzee, 2016). The study of Ubide (1997) identified seasonal impacts due to agricultural production and policy changes as key determinants of inflation in Mozambique. Dragos et al. (2013) conducted a multiple regression analysis on the emerging economies of the USA and China, revealing that money supply, interest rate, and exchange rate policy significantly influence inflation in both nations (Dragos et al., 2013). Pourroy (2012) observed that in the short run, external shocks and currency depreciation create inflation, while in the medium term, the intensity of the impact depends on money supply and domestic demand. The economic implications of inflation, budget deficits, and money supply have been extensively studied across various countries. (Basher & Elsamadisy, 2012) explored the determinants of inflation in Gulf Arab states and found that money supply and exchange rate significantly influence inflation rates in both the short and long run. Similarly, (Oduşanya & Atanda, 2010) concluded that GDP, money supply, lagged inflation, real import, and exchange rate are crucial determinants of the inflation rate in Nigeria. In Ghana, (Adu & Marbuah, 2011) employed the ARDL model to reveal that real output, exchange rate, money supply, interest rate, and fiscal deficit significantly impact the inflation rate. The study conducted by (Kim, 2001) on Poland utilized Co-integration and ECM methodologies to conclude that currency appreciation and wage increase reduce the inflation rate, while the impact of monetary policy instruments is passive on inflation. In Pakistan, (Bashir et al., 2016) found that in the long run, inflation is increased by government expenditure, import, government revenue,

and public debt, whereas it is reduced due to an increase in foreign direct investment and electricity generation growth. Another research on Saudi Arabia concluded that oil price, domestic demand, and the fall in the price of the dollar are the main determinants of inflation in the long run (Alotwajiri, 2011). Lastly, another study by (Bashir et al., 2011) focusing on Pakistan using Johansen Cointegration and VECM methodologies revealed that money supply, import, and government expenditures have a positive innovation on inflation, whereas government revenue reduces inflation in the long run. A study by Islam et al. (2022) investigates the determinants of inflation in Bangladesh using time series ARDL model. The research finds that gross domestic product (GDP), broad money supply (M2), export growth (XG), import growth (MG), and population growth (PG) are major determinants of inflation in Bangladesh. While some earlier studies argue that deficits and inflation aren't related, (Rothbard, 1984) explains that during the 1982–83 period, despite accelerating deficits and decreasing inflation, the overall relationship between deficits and inflation still holds true because inflation depends on both money supply and demand, which can fluctuate due to various economic factors. Murray Rothbard cautioned that if central banks directly fund the government, like what happens with quantitative easing (QE), it could cause serious inflation.

### **Theoretical Paradigm**

Macroeconomic principles posit that as the disparity between government spending and

revenue widens, governments often resort to expansionary monetary policies, leading to an increase in the money supply (M2) in the economy. This strategic maneuver aims to bolster government revenues, predominantly sourced from both direct and indirect taxation. Consequently, augmenting national income becomes imperative, necessitating injections of monetary capital into the economy to elevate investment levels and foster greater employment opportunities. Thus, the surge in fiscal deficit (BD) can be correlated with an upsurge in M2 through this mechanism.

However, traditional economic tenets also suggest that expansionary monetary policies may spur inflation ( $\pi$ ) in the economy. This is due to the disruption in the local money market whenever the government adjusts the level of M2. Such disequilibrium imposes adverse effects on the broader economy. In order to restore equilibrium, the domestic price level increases as a mechanism to offset the decline in the marginal value of money. To analyze the relationship between fiscal deficits, money supply, and inflation, the Quantity Theory of Money (QTM) is used. The equation is typically expressed as:

$$MV = PY$$

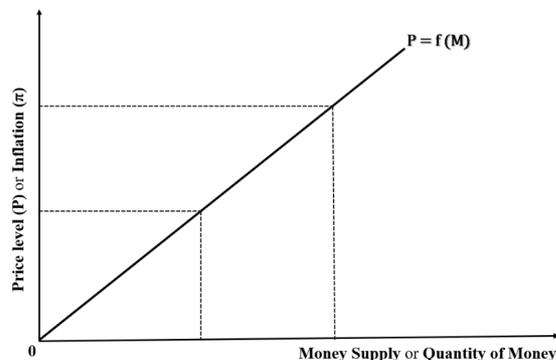
Here,

M is the money supply,

V is the velocity of money,

P is the price level,

Y is the real output of goods and services.



**Fig. 1: Quantity Theory of Money (QTM)**

According to this theory, when there's more money supply (M) or M2, the price level (P) or inflation ( $\pi$ ) usually goes up, ceteris paribus. Consequently, an increase in money supply (M) or M2 may serve as a catalyst for inflation ( $\pi$ ) within the economy. This clear relationship between money supply and inflation can be illustrated graphically in figure 1.

We can rearrange this equation to solve for the price level (P):

$$P = MV / Y$$

This equation implies that the price level (P) is determined by the ratio of the money supply (M) to the real output of goods and services (Y), multiplied by the velocity of money (V).

Now, let's introduce fiscal deficit (BD) into the model. Fiscal deficit implies government spending (G) exceeds government revenue or tax (T); this can be represented as:

$$BD = G - T$$

Now, let's consider the government's financing alternative choices for the deficit. One option is to borrow funds from the

central bank, which will increase the money supply ( $M$ ). The change in the money supply is denoted as  $\Delta M$ . So, the change in money supply ( $\Delta M$ ) due to fiscal deficit (BD) can be expressed as,

$$\Delta M = B D$$

Now, let's consider the impact of this change in money supply on the price level (P) or inflation ( $\pi$ ). We Assume that the velocity of money ( $V$ ) and real output ( $Y$ ) are constant, we can rewrite the Quantity Theory of Money equation as:

$$\Delta M = P \times \Delta Y$$

Here,  $\Delta Y$  represents the change in real output. Now, we substitute  $\Delta M = BD$  into the equation,

$$BD = P \times \Delta Y$$

So, this equation shows that the fiscal deficit (BD) affects the price level (P) or inflation ( $\pi$ ) by changing real output ( $\Delta Y$ ).

## DATA AND METHODOLOGY

### Data description and Model

This study delves into a comprehensive analysis spanning four decades, from 1980 to 2023, utilizing extensive time series data. In this investigation, inflation ( $\pi$ ) takes the spotlight as the dependent variable, while the budget deficit (BD) and broad money supply (M2) assume roles as explanatory variables.

The regression model is represented as:

$$\pi_t = \phi_0 + \phi_1 (\omega)t + \phi_2 (\eta)t + \varepsilon_t \quad [1]$$

Here,

$\pi_t$  is the inflation at time  $t$ .

$\phi_0$  is the intercept term.

$\phi_1$  and  $\phi_2$  are the coefficients for the budget deficit ( $\omega$ ) and broad money supply ( $\eta$ ), respectively, at time  $t$ .

$\varepsilon_t$  is the error term at time  $t$ .

### Unit Root Test

In time series and panel data analysis, a key question is whether the series stay the same or change over time, known as the unit root phenomenon. Unit root means the average and spread change over time, helping researchers choose the best models for figuring out cause and effect. It's difficult for forecasting because the average and spread change over time. As the need for forecasting grows for making policies, unit root tests become really important for understanding how economic factors change. These tests help us figure out if variables like inflation, budget deficit, and broad money are connected and cause each other.

### Autoregressive Distributed Lag (ARDL) Bound Test Method

The Autoregressive Distributed Lag (ARDL) bound test method is a stalwart model for probing long-run co-integration among variables. Normally, in an effort to show these long-term connections, it requires the mean and variance of time series data to remain constant over time—a rare thing in the real world (Emeka & Kelvin, 2016). However, the ARDL model doesn't require such stringent assumptions. Even if the experimental variable has different properties, either  $I(1)$  or  $I(0)$ , it still presents reliable approximations of the

long-run coefficient. Through the ARDL Bound test, this model offers a range of values that are perfectly fit for factors that are purely I(1), purely I(0), or a mix of both, making it easier to find long-run associations. This method is more dependable than traditional F-statistics and t-statistics, especially when it's hard to fathom the exact order of integration for the regressands.

The Unrestricted Error Correction Model (UECM) for the ARDL Bound Test approach can be represented as:

Here, in this equation  $\Delta y_t$  is the differenced dependent variable at time  $t$ .  $\Delta y_{t-i}$  is the lagged differenced values of the dependent variable.  $\Delta x_{t-i}$  is lagged differenced values of the explanatory variable.  $EC_{t-1}$  is the lagged error correction term.  $\alpha_0$ ,  $\alpha$ ,  $\beta_i$ , and  $\gamma$  are the coefficients, and  $\varepsilon_t$  represents the error term. This model integrates both short-run dynamics with long-run equilibrium without losing long-run information. The error correction term (EC<sub>t-1</sub>) is included to capture the long-run relationship between the variables. If the coefficient  $\gamma$  is negative and statistically significant, it suggests that the previous period's disequilibrium is being corrected.

## EMPIRICAL ANALYSIS

### Stationarity Tests

**Table 1: Outcomes of Augmented Dickey-Fuller test (BD( $\omega$ ) at level data)**

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Null Hypothesis: $\omega$ has a unit root		
Exogenous: Constant, Linear Trend		
Lag Length: 5 (Automatic - based on SIC, maxlag=9)		

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		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.293268	0.4267
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

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\*MacKinnon (1996) one-sided p-values.

Source: Authors' estimation

Findings: The test statistic is -2.293268 with a p-value of 0.4267, which is higher than the critical values at significance levels, indicating that BD is non-stationary at level data. BD likely has a unit root at this level. This means it may have a time-varying mean and variance (Table 1).

**Table 2: Outcomes of Augmented Dickey-Fuller test (BD( $\omega$ ) at 1st difference data)**

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Null Hypothesis: D( $\omega$ ) has a unit root			
Exogenous: Constant, Linear Trend			
Lag Length: 0 (Automatic - based on SIC, maxlag=9)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.378314	0.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

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\*MacKinnon (1996) one-sided p-values.

Source: Authors' estimation

Findings: It is observed from the (Table 2), that the test statistic is -6.378314 with a p-value of 0.0000, which is lower than the critical values, suggesting that BD becomes stationary after the first difference. Once we take the first difference, it shows that BD is integrated of order one, I(1).

**Table 3: Outcomes of Augmented Dickey-Fuller test (M2( $\eta$ ) at level data)**

Null Hypothesis: $\eta$ has a unit root		
Exogenous: Constant		
Lag Length: 0 (Automatic - based on SIC, maxlag=9)		
	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.979865	0.7518
Test critical values:	1% level	-3.596616
	5% level	-2.933158
	10% level	-2.604867

\*MacKinnon (1996) one-sided p-values.

Source: Authors' estimation

Findings: The test statistic is -0.979865 with the p-value of 0.7518, indicating that the null hypothesis (that M2 has a unit root) cannot be rejected at the significance levels. It suggests that the money supply series is non-stationary and have a unit root at level data (Table 3).

**Table 4: Outcomes of Augmented Dickey-Fuller test (M2 ( $\eta$ ) at 1st difference)**

Null Hypothesis: D( $\eta$ ) has a unit root		
Exogenous: Constant		
Lag Length: 0 (Automatic - based on SIC, maxlag=9)		
	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.479353	0.0000
Test critical values:	1% level	-3.600987
	5% level	-2.935001
	10% level	-2.605836

\*MacKinnon (1996) one-sided p-values.

Source: Authors' estimation

Findings: It is observed from the (Table 4), The test statistic is -5.479353 with a p-value of 0.0000, which is well below the 5% level of significance. So, we reject the null hypothesis, and this implies that the M2 series is stationary at the first difference.

**Table 5: Outcomes of Augmented Dickey-Fuller test (Inflation ( $\Pi$ ) at level data)**

Null Hypothesis: $\Pi$ has a unit root		
Exogenous: Constant		
Lag Length: 0 (Automatic - based on SIC, maxlag=9)		
	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.192170	0.0020
Test critical values:	1% level	-3.596616
	5% level	-2.933158
	10% level	-2.604867

\*MacKinnon (1996) one-sided p-values.

Source: Authors' estimation

Findings: The test statistic is -4.1921705 with a p-value of 0.0020, which is below the critical values, also below the 5% level of significance. This indicates a 95% chance that the inflation series is stationary and does not have a unit root at level data (Table 5).

**Regression Analysis:**

The regression model utilized for this analysis is,

$$\Delta \Pi = \phi_0 + \phi_1 \Delta \Pi_{t-1} + \phi_2 \Delta \Pi_{t-2} + \phi_3 \Delta \omega_{t-1} + \phi_4 \Delta \eta_{t-2} + \phi_5 \Delta \eta_{t-1} + \phi_6 \Delta \eta_{t-2} + \phi_7 \Pi_{t-1} + \phi_8 \omega_{t-1} + \phi_9 \eta_{t-1} + \varepsilon_t$$

In the scope of this equation,  $\Delta \Pi$  is the change in inflation.  $\Delta \omega$  is the change in budget deficit.  $\Delta \eta$  represents the change in money supply.

The (t-1) and (t-2) denote the lagged values of the variables.  $\phi_0, \phi_1, \phi_2, \dots, \phi_9$  are the coefficients and  $\varepsilon_t$  represents the random error term.

Source: Authors' estimation

Findings: The (Table 6) presents the results of a regression analysis with inflation as the dependent variable. As shown in this table, the coefficients of  $\Pi_{t-1}$  and  $\Pi_{t-2}$  reveal that there is a negative relationship between past inflation and current inflation. The past budget deficit

has a diverse impact on current inflation, since the coefficient of  $\Delta\omega_{t-1}$  is positive, and the coefficient of  $\Delta\omega_{t-2}$  is negative. The money supply also has a mixed impact on current inflation. The one-year lagged inflation with a negative coefficient is only a statistically significant variable at the 5% level. This suggests that past inflation negatively affects current inflation in the short run.

**Table-6: Outcomes of Regression**

Dependent Variable: D( $\Pi$ )				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.941228	2.338656	1.685253	0.1023
D( $\Pi$ (-1))	-0.015432	0.210489	-0.073317	0.9420
D( $\Pi$ (-2))	-0.160539	0.163165	-0.983901	0.3330
D( $\omega$ (-1))	48.32527	53.33944	0.905995	0.3722
D( $\omega$ (-2))	-10.21858	51.79255	-0.197298	0.8449
D( $\eta$ (-1))	-0.048445	0.173530	-0.279172	0.7820
D( $\eta$ (-2))	0.102397	0.181814	0.563198	0.5775
$\Pi$ (-1)	-0.705001	0.260180	-2.709669	0.0110
$\omega$ (-1)	-53.80898	35.01487	-1.536746	0.1348
$\eta$ (-1)	-0.017909	0.031002	-0.577659	0.5678
R-squared	0.459503	Mean dependent var		-0.120500
Adjusted R-squared	0.297354	S.D. dependent var		3.225951
S.E. of regression	2.704120	Akaike info criterion		5.039748
Sum squared resid	219.3679	Schwarz criterion		5.461968
Log likelihood	-90.79496	Hannan-Quinn criter.		5.192409
F-statistic	2.833833	Durbin-Watson stat		2.110447
Prob(F-statistic)	0.015370			

Source: Authors' estimation

Findings: This (Table 7) exhibits an analogous regression analysis with slight variations. The coefficient for differenced inflation with lag 2 is negative, indicating a potential inverse relationship with current inflation. The coefficients for  $\Delta\omega_{t-1}$ ,  $\Delta\omega_{t-2}$ ,  $\Delta\eta_{t-1}$ , and  $\Delta\eta_{t-2}$  suggest a mixed impact of prior budget deficit and earlier money supply (M2) on current inflation. The most significant predictor of current inflation is the previous year's inflation. Previous year's inflation ( $\Pi_{t-1}$ ) has a negative coefficient with a p-value of 0.0003, signifying a strong inverse relationship.

**Table-7: Outcomes of Alternative Regression**

Dependent Variable: D( $\Pi$ )				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.048880	1.790831	2.260895	0.0309
D( $\Pi$ (-2))	-0.153869	0.133260	-1.154649	0.2571
D( $\omega$ (-1))	48.89257	51.82167	0.94166	0.3536
D( $\omega$ (-2))	-9.649605	50.37964	-0.191538	0.8494
D( $\eta$ (-1))	-0.049180	0.170438	-0.288551	0.7748
D( $\eta$ (-2))	0.100180	0.176382	0.567973	0.5741
$\Pi$ (-1)	-0.718846	0.176074	-4.082634	0.0003
$\omega$ (-1)	-55.01215	30.43087	-1.807775	0.0804
$\eta$ (-1)	-0.018851	0.027754	-0.679224	0.5020
R-squared	0.459406	Mean dependent var		-0.120500
Adjusted R-squared	0.319898	S.D. dependent var		3.225951
S.E. of regression	2.660386	Akaike info criterion		4.989927
Sum squared resid	219.4073	Schwarz criterion		5.369925
Log likelihood	-90.79854	Hannan-Quinn criter.		5.127322
F-statistic	3.293047	Durbin-Watson stat		2.109230
Prob(F-statistic)	0.007774			

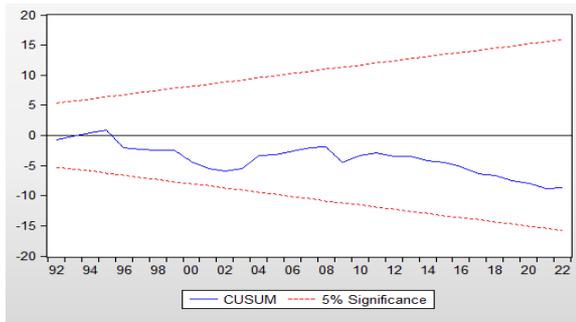
Source: Authors' estimation

**Table-8: Breusch-Godfrey Serial Correlation LM Test**

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.185489	Prob. F(2,29)	0.3200
Obs*		Prob.	0.2206
R-squared	3.023149	Chi-Square(2)	

Source: Authors' estimation

Findings: In (Table 8), we examined the presence of serial correlation in the residuals of a regression model. The p-values are above the conventional 5% significance levels, indicating that there is no serial correlation in the model.



**Fig.2: Stability Test**

Source: Authors’ estimation

Findings: This (Figure 2) represents CUSUM analysis. We used this test to check the stability of our econometric model over time. The chart displays that the value fluctuates within the 5%

significance level boundaries. This suggests that the process is stable throughout the period.

**Table-9: Wald Test**

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	5.759062	(3, 31)	0.0030
Chi-square	17.27719	3	0.0006

Source: Authors’ estimation

Source: Authors’ estimation

Findings: The Wald Test results suggest the presence of a long-run relationship among the variables, as the F-statistic exceeds the upper bound value (Table 9). Thus, we reject the null

**Table-10: Outcomes of ARDL**

Dependent Variable: D(Π)				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.173411	0.466378	-0.371824	0.7125
D(Π (-2))	-0.269677	0.136330	-1.978114	0.0566
D(ω (-1))	-1.372787	45.78724	-0.029982	0.9763
D(ω (-2))	67.02989	44.08585	-1.520440	0.1382
D(η (-1))	-0.048718	0.163047	-0.298797	0.7670
D(η (-2))	0.118792	0.167191	0.710519	0.4825
ECT(-1)	-0.776608	0.172433	-4.503828	0.0001
R-squared	0.472979	Mean dependent var		-0.026154
Adjusted R-squared	0.374163	S.D. dependent var		3.211729
S.E. of regression	2.540795	Akaike info criterion		4.863979
Sum squared resid	206.5804	Schwarz criterion		5.162567
Log likelihood	-87.84760	Hannan-Quinn criter.		4.971110
F-statistic	4.786446	Durbin-Watson stat		2.023326
Prob(F-statistic)	0.001381			

Source: Authors’ estimation

hypothesis of no cointegration. This implies that despite the lack of short-run effects, there may be a long-run equilibrium relationship between inflation, budget deficit, and money supply.

Findings: This (Table 10) presents the results of an Autoregressive Distributed Lag model. It shows that the error correction term (ECT) is significant, with a coefficient of -0.776608. This indicates a speed of adjustment towards long-run equilibrium of approximately 77.6%, and any short-run disequilibrium in inflation will be corrected at this rate towards the long-run equilibrium. The F-statistic is significant, so this infers a good fit of the model.

**Table-11: Breusch-Godfrey Serial Correlation LM Test**

Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.167157	Prob. F(2,29)	0.8468
Obs*		Prob.	
R-squared	0.429818	Chi-Square(2)	0.8066

Source: Authors' estimation

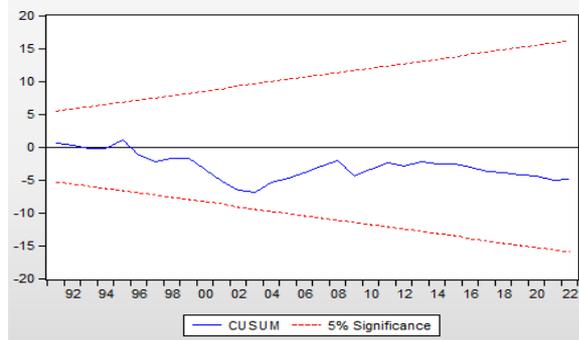
**Table-12: Wald Test for Budget Deficit Causality**

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	1.156799	(2, 32)	0.3273
Chi-square	2.313597	2	0.3145
Null Hypothesis: C(3)=C(4)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value		Std. Err.
C(3)	-1.372787		45.78724
C(4)	-67.02989		44 08585
Restrictions are linear in coefficients.			

Source: Authors' estimation

Source: Authors' estimation

Findings:As shown in Table 11, the F-statistic and Obs R-squared values suggest that there is no serial correlation in the model. Both p-values are higher than the 5% significance level. So, this insinuates that the residuals are not correlated over time.



**Fig.3: Stability Test**

Source: Authors' estimation

Findings: This (Figure 3) represents CUSUM analysis of residuals. The diagram demonstrates that the CUSUM line does not cross the red dashed lines of 5% significance

levels. This implies that the values are consistent without any major fluctuations.

**Findings:**In this (Table 12), we used the Wald test to examine if budget deficit (BD) causes inflation in the short run. The test statistic values suggest no significant causality from BD to inflation. The null hypothesis that budget deficit ( $\omega$ ) does not cause inflation in the short run cannot be rejected.

**Findings:**As shown in Table 13, the test statistic values indicate that money growth does not significantly cause inflation in the short run. The null hypothesis that M2 does not cause inflation in the short run is accepted. So, this suggests that changes in the money supply do not have an immediate effect on inflation rates.

## CONCLUSION

The 21st century is marked by both extreme political conflict and enormous economic

challenges all around the world. Over recent years, significant events like the COVID-19 pandemic, the Russia-Ukraine conflict, and the Iran-Israel proxy war have shaped the global economic landscape. The effects of inflationary pressures have a heterogeneous effect across countries due to factors such as economic structure, monetary policy, and fiscal policy framework. In this age of inflationary impulsiveness, our study aimed to unveil the relationship between budget deficits, money supply, and inflation in the context of the emerging Asian tiger “Bangladesh,” over the period of 1980 to 2023. We have applied the Augmented Dickey-Fuller test to determine the stationarity of the series. The ADF test reveals that the inflation rate is stationary at the level, whereas budget deficits and money supply are stationary at first difference. In the short run, there exists a unidirectional causality from the budget deficit to inflation, as well as from money supply to the current inflation rate. This suggests that when the government

**Table-13: Wald Test for Money Growth Causality**

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	0.265787	(2, 32)	0.7683
Chi-square	0.531573	2	0.7666
Null Hypothesis: $C(5)=C(6)=0$			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(5)	-0.048718	0.163047	
C(6)	0.118792	0.167191	
Restrictions are linear in coefficients.			

Source: Authors' estimation

spends more than its revenue, it may lead to inflationary pressure. The most momentous regressor of current inflation is the previous year's inflation. The results of the Breusch-Godfrey Serial Correlation LM test reveal that there is no serial correlation in the model. The CUSUM analysis also substantiates the stability of our econometrics model. The Autoregressive Distributed Lag ARDL (2,2) model was selected based on AIC and SIC criteria. It showed that broad money supply (M2), budget deficit (BD), and inflation are integrated in Bangladesh's economy, and the ARDL model reveals that there is no significant long-run or short-run impact of money supply (M2) and Budget Deficit (BD) on inflation in Bangladesh. Even though the money supply has proliferated, inflation has stayed quite steady in Bangladesh. This indicates that more money in the system doesn't always mean there will be a lot of inflation over time. The absence of a direct association between money supply and inflation could mean that other factors, such as economic growth, demand, and external factors, might be influencing inflation more significantly than the money supply itself. The F-statistics demonstrate long-run cointegration among the variables and also suggest a stable relationship over time.

## POLICY SUGGESTIONS

Monetary and government institutions should look beyond M2 and BD as primary factors of inflation. They should also consider other potential determinants. The government needs to manage the budget deficit very efficiently because the mismanagement of budget deficit

can influence inflation rates. Monetary authorities should not solely rely on money supply adjustments; they ought to develop a robust monetary policy framework that can effectively respond to various economic conditions. The findings of this study emphasize the need for long-term strategies to ensure economic stability and control inflation.

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# MODELLING THE FACTORS AFFECTING CUSTOMERS' INTENTION TO USE ARTIFICIAL INTELLIGENCE POWERED CHATBOT SERVICES IN BANKS

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## ABSTRACT

Indian banks are using AI-powered chatbots to provide better customer service through real-time communication and problem-solving. This research study aims to compare customer intent in using chatbot services offered by private and public sector banks. Additionally, the study investigates the significant factors that explain customer behavioral intent to use AI-powered chatbot services. The paper collected primary data from Indian public and private sector bank customers in Delhi-NCR through Google form links, Instagram, and Facebook. The Unified Theory of Acceptance and Use of Technology (UTAUT) 2 was assessed, and statistical tools such as paired sample t-tests and multiple regression were used to test the hypotheses. The results of the multiple regression analysis showed that hedonic motivation plays a significant role in understanding the intent of public sector customers to use chatbots, while habit plays a significant role for private bank customers.

The authors observed a significant difference between public sector bank customers and private bank customers in terms of behavioral intent to use chatbot services, concluding that private bank customers are more intent on using chatbots compared to public sector customers.

**Keywords:** Chatbots and artificial intelligence have been subjects of interest and discussion due to their perceived complexity. Technological anxiety, risk, and social influence.

**JEL Codes:** C32, E31, E52, H62

## INTRODUCTION

The acceptance of robots in chats is referred to as a chatbot. A chatbot is a smart, user-friendly, and readily adoptable technology. It is available 24/7/365 to provide one-to-one conversations and customized offers (Sarbabidya & Saha, 2020). The same is adopted in banking services to provide automated communication with

customers. Such advanced banking features uplift customer motivation and ease of direct connection (Elena, 2020). The study has used primary data collected from bank chatbot users using a random sampling method through a structured questionnaire (Magaji, 2021). The banking chatbot offers numerous advantages to the banker such as cost-saving, early fraud detection, reduced human errors, and many more (Kurode, 2018). Banks should focus on chatbot-centric services to provide customer service and thus ensure the growth and development of the bank and the economy as a whole. Chatbots act as a viable and informative interaction layer between banks and customers

(Anetta, 2021). This study provides a deeper understanding of how bank customers perceive chatbots as upgraded technology in banking services and communication channels in both private and public banks (Alzaidi, 2018). The UTAUT2 theory is framed with independent factors, namely social influence (SI), facilitating conditions (FC), performance expectancy (PE), hedonic motivation (HM), price value (PV), effort expectancy (EE), and habit and behavioral intention (BI), to use chatbot services as a dependent factor to predict a higher intention to use chatbot services (Reena, Kanda, Chanchal, & Vij, 2023). Artificial intelligence (AI) powered chatbots adopted



**Fig.1: Use cases of chatbot in banking**

Source: Sinha, S. (2022)

by banks can be used in several ways, such as quick detection of fraud transactions, checking account transactions and statements, answering basic queries of customers, timely notification of customers, and transferring funds from one account to another, and the like.

## LITERATURE REVIEW

The literature review provides a robust understanding of the use of chatbots in the banking industry, concerning how Indian banks react to the adoption of AI-powered chatbots. Presently, several banks in Indonesia have adopted chatbot technology in banking customer service. The AI application in customer service helps prepare banks for the upcoming challenges related to fraud and customer service (Wicaksono & Zahra, 2022). Gupta and Sharma (2019) investigated the use of chatbots in the banking industry as a preferred option for customers, evidenced by a positive correlation between utility, accessibility, threats, and customers' attitudes towards chatbots. Cardona et al. (2019) studied customers' intention to use a chatbot in the insurance sector and concluded that the sample population is highly aware of technology and its use, preferring to recommend it to others. Richad et al. (2019) and Anetta et al. (2021) studied behavior intention and concluded that perceived usefulness, perceived ease of use, and innovativeness play a positive significant role in shaping customer behavior. Sarbabidya and Saha (2020) observed that chatbots, as one of the banking service framing customer interaction tools, have been positively affected by ease of use, relationship services, responsive

service, advisory services, value-based useful services, and maintaining customer privacy and security. Rani et al. (2023) aim to study the working of chatbots in the banking sector and conclude that most of the questions customers query for are already available on websites, so there is a need for updated features in chatbot assistance. The author develops a baseline for how customers in emerging markets interact using chatbots and concludes that technological experience and age play a significant role in the UTAUT model and impede intention to use (Aaron & Smith, 2020). Based on the existing literature review, the research topic is in its pre-seeding phase and includes qualitative analysis of banking performance. Very few studies have analyzed the chatbot acceptance model in banking (Richad et al., 2019), (Cardona et al., 2019), and comparison is the least, which becomes a research gap. Thus, the paper compares the public sector and private sector bank customers' intention to use AI-powered chatbot services.

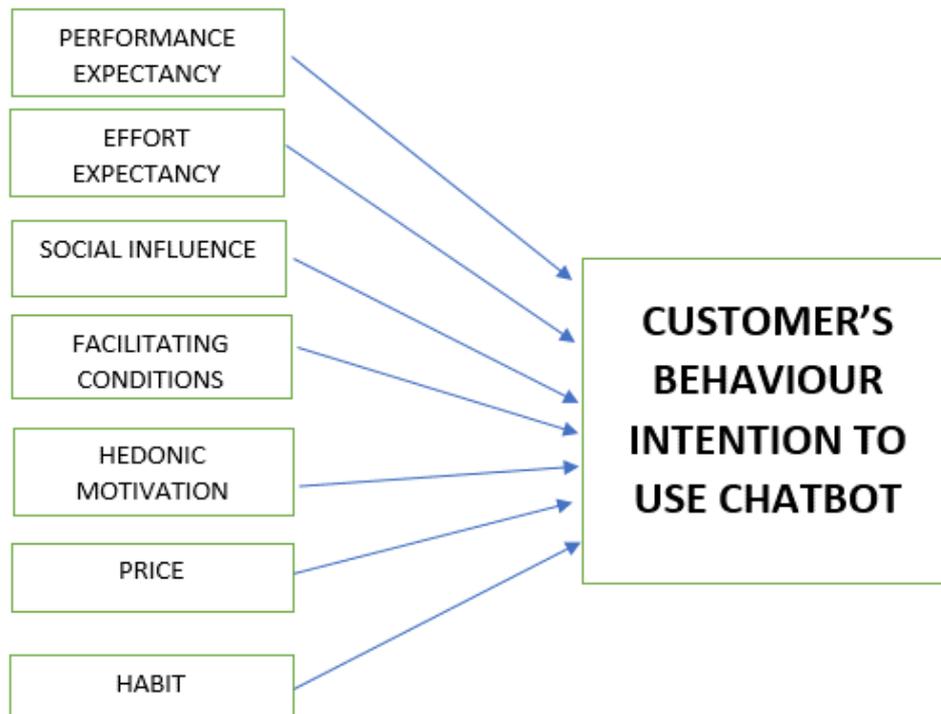
## OBJECTIVES OF THE STUDY

To compare the customer intention to use chatbot services powered by public and private sector banks.

To examine the significant factors that explain the customer's behavioral intention (BI) to use AI-powered chatbot services.

## CONCEPTUAL MODEL PROPOSED

The conceptual model above depicts the extended theory of UTAUT (Venkatesh et al.,



**Fig.2: Conceptual Model**

Source: Author's creation

2003) provided by Venkatesh et al. (2012). It is considered a base theory to analyze the substantial factors that explain the behavioral intention (BI) of customers to use a banking chatbot. This is one of the few studies that have considered the UTAUT 2 theory concerning chatbot acceptance among customers, but a comparison of public and private sector bank customers in India was missing. Through this model, the authors have tried to understand and compare the public and private sector bank customers' intention to use AI-powered banking chatbot services effectively.

## SETTING OF HYPOTHESES

To test the behavioral intention of customers in the private and public sector banks towards the use of chatbot services in banking, based on seven parameters: social influence (SI), facilitating conditions (FC), performance expectancy (PE), hedonic motivation (HM), price value (PV), effort expectancy (EE), and habit (Venkatesh et al., 2019). Hypothesis testing was conducted on primary data collected via structured questionnaires from customers of public and private segment banks. To test the hypotheses, the authors have separately set the following hypotheses for each parameter based on the UTAUT2 theory (Venkatesh et al., 2012):

Factor	Definition	Items
Performance expectancy	It is expressed in terms of increasing performance by using systems and updated technology at the workplace.	<p>PE1: chatbot are useful and effective in my daily life</p> <p>PE2: With the help of the chatbot, I can achieve important things regularly</p> <p>PE3: Things can be accomplished by saving time using a chatbot.</p> <p>PE4: Productivity enhanced using chatbot.</p>
<b>H<sub>11</sub>: There is a significant change in the chatbot's performance expectancy of public sector and private sector customers</b>		
Effort expectancy	It determines the level of ease while using the system	<p>EF1 Chatbot provides clear and understandable interaction for me</p> <p>EF2 How to use a chatbot is easy for me</p> <p>EF3: Chatbot is easy to use for me</p> <p>EF4: Chatbot also makes me skilful to interact effectively.</p>
<b>H<sub>12</sub>: There is a significant change in chatbot's effort expectancy of public sector and private sector customers</b>		
Social influence	It expresses the degree that claims the importance of a system by which others get influenced to use the same.	<p>SI1: People whose opinions matter to me prefer to use chatbot.</p> <p>SI2: People who impact my behaviour intention think that I should continue using a chatbot.</p> <p>SI3: Important people in my life think that I should continue using chatbot.</p>
<b>H<sub>13</sub>: There is a significant change in the social influence parameter of public sector and private sector customers</b>		
Facilitating conditions	It explains factors of people and the surrounding social environment that can affect the use of the system.	<p>FAC1: Necessary resources are available to me for using a chatbot.</p> <p>FAC2: Necessary knowledge imparted to use a chatbot</p> <p>FAC3: Compatible with other technologies for a chatbot is satisfactory.</p> <p>FAC 4: Others are also familiar with the chatbot and are ready to help me when required.</p>
<b>H<sub>14</sub>: There is a significant change in chatbot's facilitating conditions of public sector and private sector customers</b>		
Hedonic motivation	It expresses the fun and pleasure derived from adopting newer technologies in the workplace.	<p>HM1: Using a chatbot is enjoyable.</p> <p>HM2: Using a chatbot is gratifying.</p> <p>HM3: Using a chatbot is very pleasure.</p>

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**H<sub>15</sub>: There is a significant change in chatbot's hedonic motivation of public sector and private sector customers**
**Price Value****User conduct cost-benefit analysis for the price as cost and benefits as time-saving by using new technology**

*PV1 Chatbot prices are affordable.*  
*PV2: Chatbot support value for money.*  
*PV3: The price of the chatbot provides a satisfactory value for money.*

**H<sub>16</sub>: There is a significant change in the chatbot's price value of public sector and private sector customers****Habit****It is the measurement of constant behaviour towards any stimulus that gets adapted to the user's beliefs.**

*HT1: I am habitual in using chatbot.*  
*HT2: I am addicted to using chatbot.*  
*HT3: Chatbot is a must-use.*  
*HT4: Chatbot is naturally used by me every time.*

**H<sub>17</sub>: There is a significant change in the habits of public sector and private sector customers concerning chatbot****Customer's intention to behave while using chatbot services****Behavioural intention is the level at which someone has planned to do or will not do something in the future source**

*BI1:I intend to use a chatbot in future for very and every purpose.*  
*BI2:I will always try to use chatbot in my daily routine*  
*BI3:I plan to continue the use of chatbot more often.*

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**RESEARCH METHODOLOGY**

Measurement items are kept the same as in previous literature (Venkatesh et al., 2012). A five-point Likert scale extending from Strongly Disagree (1) to Strongly Agree (5) is used in all statements. The respondents are the existing customers of private banks and public banks from Delhi/NCR, who are considered as the target audience. The random sampling method was adopted for the selection of the sample. After that, the snowball sampling method was followed to obtain responses from bank customers. A total of 102 responses were received, which were found suitable for the study. The final sample of 51 private bank customers and 51 public segment bank

customers was considered for data analysis. The survey data obtained was analyzed using both descriptive and quantitative techniques. Descriptive statistics explain the use of respondent profiles, whereas quantitative techniques involve various statistical tools, namely t-test and Multiple regression analysis. The data was evaluated using Microsoft Excel and specialized software - The Statistical Package for Social Science (SPSS).

The quantitative results revealed that 47.06% of respondents are male and the remaining 52.94% are female. The highest proportion of respondents by age group is 67.76% in the 0-30 years category, followed by 26.48% in the 31-45 years category, and 11.76%

**Table.1: Profile of the respondents**

Demographic	Frequency	Percentage	Cum. frequency
Gender			
Male	48	47.060%	47.060%
Female	54	52.940%	100%
Age (in years)			
0- 30	63	61.76%	61.76%
31-45	27	26.48%	88.24%
46-60	12	11.76%	100.00%
Bank type			
Public sector Bank	51	50.00%	50.00%
Private sector Bank	51	50.00%	100.00%
Years of experience in using chatbot			
Less than 1 year	40	39.21%	39.21%
1-2 years	30	29.42%	68.63%
2-3 years	12	11.76%	80.39%
More than 3 years	20	19.61%	100.00%

**Table 2: Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PE PVT	3.80	51	.739	.103
	PE PSB	3.41	51	.765	.107
Pair 2	EE PVT	4.11	51	.617	.086
	EE PSB	3.65	51	.783	.110
Pair 3	SI PVT	3.78	51	.638	.089
	SI PSB	3.29	51	.745	.104
Pair 4	FC PVT	4.00	51	.567	.079
	FC PSB	3.59	51	.778	.109
Pair 5	HM PVT	3.54	51	.809	.113
	HM PSB	3.40	51	.904	.127
Pair 6	PV PVT	4.04	51	.762	.107
	PV PSB	3.39	51	.781	.109
Pair 7	HABIT PVT	3.17	51	.960	.134
	HABIT PSB	3.12	51	.852	.119

Source: Output from SPSS 21.0

in the 46-60 years category. The majority of survey respondents who have not used a chatbot for a longer period are recorded based on their experience with a chatbot in years. The highest is less than 1 year, with 40 respondents (39.21%), followed by 1 – 2 years, with 30 respondents (29.42%), followed by more than 3 years, with 20 respondents (19.61%), and 12 respondents (11.76%) for 2-3 years.

### Data Analysis and Results

Social Influence (SI), Facilitating Conditions (FC), Performance Expectancy (PE), Hedonic

Motivation (HM), Price Value (PV), Effort Expectancy (EE), Habit, Public sector banks (PSB), and Private sector banks (PVT).

The table above showcases the mean values and standard deviation (SD) of all seven parameters of private segment bank customers and public segment bank customers. It is quite evident from the above table that private sector customers have higher average mean values compared to public sector customers. This means that private sector customers' intention to use AI-powered chatbot is higher compared to public sector customers.

**Table 3: Paired Samples Test**

		Paired Differences			T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	PE PVT - PE PSB	.392	1.163	.163	2.408	50	.020
Pair 2	EE PVT - EE PSB	.461	1.090	.153	3.019	50	.004
Pair 3	SI PVT - SI PSB	.490	.999	.140	3.506	50	.001
Pair 4	FC PVT - FC PSB	.417	1.010	.141	2.947	50	.005
Pair 5	HM PVT - HM PSB	.137	1.242	.174	.789	50	.434
Pair 6	PV PVT - PV PSB	.654	1.081	.151	4.318	50	.000
Pair 7	HABIT PVT - HABIT PSB	.049	1.345	.188	.260	50	.796

Source: SPSS Output sheet

The paired sample T-test enables inspecting the significant difference in behavior intention (BI) to use AI-powered chatbot services between public segment and private segment customers. The results of the T-test indicated that the mean difference score is significant at the 0.05 level for five variables, i.e., Performance expectancy (PE), facilitating

conditions (FC), social influence (SI), effort expectancy (EE), and price value (PV), which represents a significant difference in customer perception for both banks in the above-stated variables. Private bank customers have a noteworthy positive intention to adopt chatbot as banking services compared to public sector customers. As a result, the alternate hypothesis

**Table 4: ANOVA**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	29.700	7	4.243	20.647	.000 <sup>b</sup>
	Residual	8.836	43	.205		
	Total	38.536	50			

a. Dependent Variable: BI PSB

b. Predictors: (Constant), HABIT PSB, EE PSB, SI PSB, PV PSB, HM PSB, PE PSB, FC PSB

Source: SPSS Output sheet

**Table 5: Multiple Regression Coefficient- Public sector bank customers**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	-.731	.359		-2.036	.048
	PE → BI	.248	.175	.216	1.422	.162
	EE → BI	.213	.183	.190	1.164	.251
	SI → BI	.057	.174	.049	.328	.744
	FC → BI	.169	.188	.150	.898	.374
	HM → BI	.260	.112	.268	2.312	.026
	PV → BI	.118	.132	.105	.889	.379
	H → BI	.111	.103	.108	1.083	.285

Source: SPSS Output sheet

of parameters no. 1, 2, 3, 4, and 6 is acceptable (H11, H12, H13, H14, and H16), and the alternate hypothesis of parameters no. 5 and 7 is rejected (H15 and H17).

The model conducted by public sector bank customer analysis by running R square value through SPSS stands out as 0.771, which indicates that 77.10% of the change in behavioral intention of public sector customers to use chatbot services is explained by seven independent factors considered in a research study.

The study uses the ANOVA (Analysis of Variance) test to identify the informed variation between samples to determine the presence of considerable differences in the behavioral intention of customers. The use of the F test implies the mean difference significance of collected responses given for samples. Checking the F test states that a value below 0.05 is evidence to reject the H0 in favor of H1. The above table depicts that the model so designed is acceptable and momentous as the value in the significance is 0.00, less than the 0.05 criterion value.

Multiple regression analyses the relationship between constructs with multiple measurement items. This study attempted to describe the customers' behavioral intention towards chatbot technology usage by considering the extended UTAUT 2. The above table explains that the only alternate hypotheses of the Hedonic motivation parameter are accepted as relationships between these variables are strong (t value = 2.312 and  $p < 0.05$ ). All other alternate hypotheses are rejected as the association between variables is weak ( $p > 0.05$ ). Hedonic motivation, as an independent variable, has a positive and adequate impact on public sector customers' intention to use AI-powered chatbot services (Paraskevi et al., 2023).

The model conducted private sector bank customer analysis in SPSS to estimate R square value, which turned out to be 0.657. This indicates that 65.70% of the change in behavioral intention of private sector customers to use chatbot services is explained by seven independent factors considered in the research study.

**Table 6: ANOVA (2)**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.869	7	3.410	11.790	.000 <sup>b</sup>
	Residual	12.436	43	.289		
	Total	36.305	50			

a. Dependent Variable: BI P

b. Predictors: (Constant), HABIT PVT, HM PVT, PV PVT, FC PVT, PE PVT, EE PVT, SI PVT

Source: SPSS Output sheet

**Table 7: Multiple Regression Coefficient- Private sector bank customers**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.151	.706		-.214	.831
PE → BI	.132	.202	.115	.655	.516
EE → BI	-.079	.219	-.057	-.362	.719
SI → BI	.270	.239	.202	1.128	.265
FC → BI	.186	.201	.124	.926	.360
HM → BI	.008	.140	.008	.059	.953
PV → BI	.060	.121	.054	.496	.622
H → BI	.453	.123	.511	3.697	.001

a. Dependent Variable: BI PVT

Source: SPSS Output sheet

The above table depicts that the model so designed is acceptable and momentous as the value in the sig. column is 0.00 less than criterion value.

The above table explains that the only alternative hypotheses of the Habit parameter are accepted as relationships between these variables are strong (t-value = 3.697 and  $p < 0.05$ ). All other alternative hypotheses are rejected as the association between variables is weak ( $p > 0.05$ ). Habit, as an independent variable, has a positively noteworthy impact on private sector customers' intention to use AI-powered chatbot services (Almahri, 2020).

## DISCUSSION AND CONCLUSION

Chatbot applications powered by AI are becoming one of the popular communication tools for improving customer service in the

banking sector, particularly regarding grievance handling, quick updates, and fraud detection. It has now become imperative for big banks to offer chatbot services to their customers. Most banks implement chatbot services to reduce costs and enhance the customer experience. The findings of the study confirmed that the five parameters, namely price value (PV), social influence (SI), effort expectancy (EE), performance expectancy (PE), and facilitating conditions (FC), have shown significant differences in the perception of using chatbot between public and private bank customers. Private bank customers have a higher intention to use chatbot compared to public bank customers. Furthermore, the multiple regression results showed that hedonic motivation plays a significant role in the intention of public bank customers to use chatbot, whereas habit plays a significant role in the intention of private sector bank

customers to use chatbot. In summary, private bank customers are habitual users of chatbot services, whereas public bank customers mostly use chatbot for fun and pleasure.

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# MACHINE LEARNING APPLICATIONS IN AGRICULTURE 4.0 –A RENAISSANCE IN THE FIELD OF AGRICULTURE, IMPACT ON THE PRECISION AGRICULTURE AND REVOLUTION IN CROP MANAGEMENT

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## ABSTRACT

The paper focuses on the growth of the agricultural sector from the past to current trends and its growth in smart farming. The agriculture sector in India has successfully met the production targets set by the government and has also set new production records in almost all commodities. The paper is a bibliometric analysis of the systematic literature review of precision agriculture, including technical terms like IoT, precision agriculture, machine learning, artificial intelligence, and traditional farming. The paper discusses the various phases in the agricultural management system, including advancements from the past centuries to current trends. The study compares different machine algorithms for agriculture management in precision agriculture. The different sectors include crop disease detection, weed detection, yield prediction, crop recognition and recommendation,

water management, animal welfare, livestock production, and soil management. The challenges faced by farmers are a matter of concern and have been highlighted in this paper. The future prospects are also discussed, giving India a new edge in the world.

**Keywords:** IoT, precision agriculture, machine learning, artificial intelligence, traditional farming, crop disease detection, weed detection, yield prediction, crop recognition, soil management.

**JEL Codes:** C32, E31, E52, H62

## INTRODUCTION

The research for Precision Agriculture began more than two decades ago. The project being described in the study uses a variety of machine learning techniques to address issues in

horticulture and agriculture. India is a country where the prime source of income is vegetation or the agriculture sector. The time has come when innovations and advancements are taking place. Keeping in view the processes involved in agriculture, the induction of technologies such as IoT's, Artificial Intelligence, Machine learning, Image processing, and Deep learning are now commonly used in smart farming. The bibliometric study for Systematic Literature Review has been analyzed. The papers with keywords like precision agriculture and machine learning from different journals from the year 2015 to 2024 have been searched and the results have been filtered and shown in the results section.

## LITERATURE REVIEW

Machine learning research techniques, including a software workbench for testing various strategies based on actual data sets and a case study on dairy herd management, where culling criteria were taken from a medium-sized herd registration database (Singh, 2020). This paper studies the Machine Learning for Soil Fertility and Plant Nutrient Management, focusing on the analysis of soil characteristics, including organic matter, vital plant nutrients, and micronutrients that influence crop growth, and using supervised learning to determine the appropriate proportion relationship between those characteristics. With reference to crops' growth properties, available nutrient grades, and capacity to supply nutrients from its own resources, Back Propagation Networks (BPN) are trained. BPN will ascertain and suggest the right correlation proportion between

those features using outside crop production applications.

The first stage of this machine learning system involves sampling (various soil with the same amount of properties but different settings), followed by the Back Propagation Algorithm and Weight update. Test data will be used to assess the Back Propagation Neural Network model's performance.

When it comes to predicting a realistic result as an output and establishing correlations and abstracting patterns between diverse data sets, machine learning techniques are especially helpful. It can be successfully applied to boost efficiency in the Indian agriculture sector. We have discussed the application of machine learning techniques to soil fertility assessment in the Indian agriculture sector. One of the most interesting subjects for analysis and study has always been agriculture. The objective of this study is to evaluate soil data according to various attributes, categorize it, and enhance the effectiveness of every model by employing various terminologies and classifications. The goal of the study was to analyze the soil data by collecting it from different sources (Kanade, 2023).

The accuracy of predictions and outperforms conventional techniques based on automatic processing of weight updates. The paper's potential scope is to develop a self-trained function for predicting soil properties with parameters in Back-propagation network (McQueen et.al., 1995).

The paper titled "Crop Selection Method for Maximizing Crop Yield Rate by using ML Technique" (Rakesh Kumar et al.) has mentioned that in an agro-based country,

agriculture plays a significant role in economic growth and food security. The selection of crop(s) is an important issue that depends on various other parameters such as production rate, the market price of crops, and government policies in every five-year plan. Researchers advise employing statistical and machine learning approaches to anticipate high rates of crop yielding, forecast the weather, and classify crops and soil for agricultural planning. It becomes a difficult and tough decision for having more options to plant crops at a time by using limited land resources. The paper proposes a methodology named the Crop Selection Method (CSM) to bring about the resolution of the crop selection issue, which maximizes crop production yield and rate from one season to the next and, as a result, leads to the nation's ultimate economic growth. A strategy is created that has the potential to raise crop net production.

The method known as the Crop Selection Method is employed to determine the arrangement and order of crops to be planted on a seasonal basis.

The method possibly will improve the yield rate of crops to be planted over the season. The suggested approach determines crop selection by forecasting production rate, which is impacted by key factors like climate, crop type, soil type, water density, and weather. It finds a sequence of crops whose daily output is greatest throughout the course of the season by taking into account the crop, their sowing time, planting days, and expected yield rate for the season. The predicted values of the affected parameters determine the performance and accuracy of the CSM technique, so a prediction

method with higher performance and accuracy must be used.

The paper titled "Machine Learning Applications for Precision Agriculture: A Comprehensive Review" (Abhinav Sharma et al., 2021) states that crop yield forecast and methods for increasing yield are critical pieces of knowledge for any farmer. Predicting crop production involves a number of critical factors, such as soil type, pH level, and quality; weather patterns, such as temperature, humidity, rainfall, and sunshine hours; fertilizers; and harvesting schedules.

The crop yield depends on the efficiency of the optimal utilization of resources. If there is some kind of variance that goes unobserved in the initial stage, it may harm the crop yield in an exceptional way and the recovery might be difficult and tedious. According to the report, farming households in peripheral areas frequently incur debt as a result of poor income prospects, may lack the skills necessary to employ inputs, and may necessitate substantial government help. Accurate weather forecasts might prove to be extremely beneficial for farmers in a country such as India, where resources for storing produced crops are scarce and storage conditions are erratic. When ML models are consistently used in a system, they function as feedforward control. Innovation and machine learning algorithms are what allow for precise prediction (Sharma et al., 2021). In addition to the decision-support question and a few other crucial research difficulties, there are a number of other significant issues that need immediate and continuing attention by researchers in order to fully develop the PA

idea. The remaining concerns are listed with an approximate ranking of importance. The acceptable criteria for economic assessment in precision agriculture are as follows: (a) It is not enough to recognize temporal variation. (b) Neglecting the farm. (d) The techniques for evaluating crop quality for maximum yield. (e) Traceability and product tracking. (f) Environmental auditing is the right standard for economy.

The use of Precision Agriculture - It was studied earlier that the variability in soil fertility led to the concept of precision agriculture. The agricultural production system is an integrated output of soil-water-nutrient-plant-atmospheric interactions, and if this system is to be optimized, then all the individual components like soil, water, nutrients (fertilizer), plant (crop), and atmosphere (weather) have to be monitored. Each of these components has to be characterized through different parameters reflecting different properties.

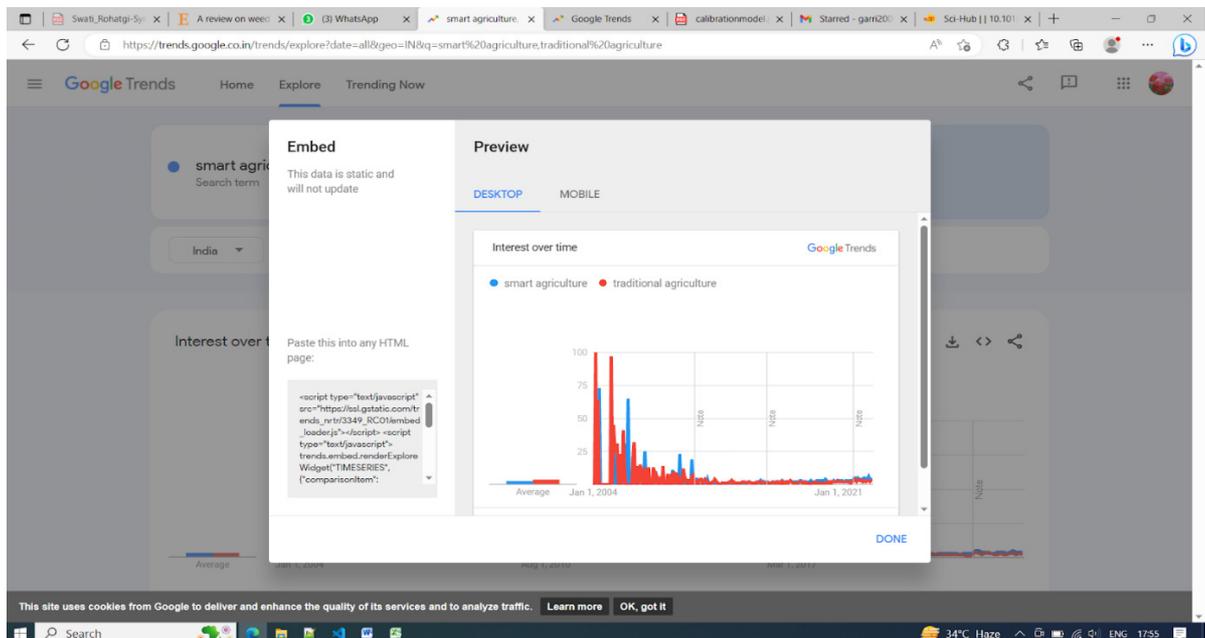
Precision Agriculture's Necessity -The potential benefits of precision agriculture, both economically and environmentally, can be seen in the decreased use of pesticides, fertilisers, water, and herbicides in addition to farm equipment. As previously said, a precision agricultural strategy detects variations within fields specific to a site and modifies management activities accordingly (Goovaerts, 2000). Most farmers are aware that the yields in their farms vary depending on the terrain. These differences can be linked to environmental factors, soil qualities, and/or management techniques. A soil's texture, structure, moisture content,

organic matter content, nutrient status, and landscape orientation all have an impact on yields. Weeds, insects, illnesses, and weather are examples of environmental features. IoT Application in Agriculture An essential component of agricultural IoT infrastructure are sensors.

Numerous uses in agriculture are possible for it, such as assessing crop development using spectral vegetation indices (Travlos et al., 2021), identifying weeds (Khan et al., 2021), pests (Schrader et al., 2022), and diseases (Gonzalez-Huitron et al., 2022), machine guidance (Conesa-Munoz et al., 2016), real-time spot spraying (Alam et al., 2020), and robotic weeding (Kunz et al., 2015). Additionally, there are RGB-D cameras, which can greatly improve detection accuracy by providing depth information in addition to RGB spectral bands (Zbiciak et al., 2023) and therefore the control of pests (Utstumo et al., 2018). Because soil sampling is a labor-intensive and costly process, the conventional approach involves taking a limited number of samples from a field and analyzing them in a lab. Geostatistics has been shown to be a useful technique for assessing soil variability since it may give a broad picture of the analyzed soil attribute throughout the entire area. The most popular geostatistical method for estimating values at unsampled sites from a set of observed values at nearby locations is kriging. The variogram, a mathematical model that quantifies the degree of similarity between data values as a function of

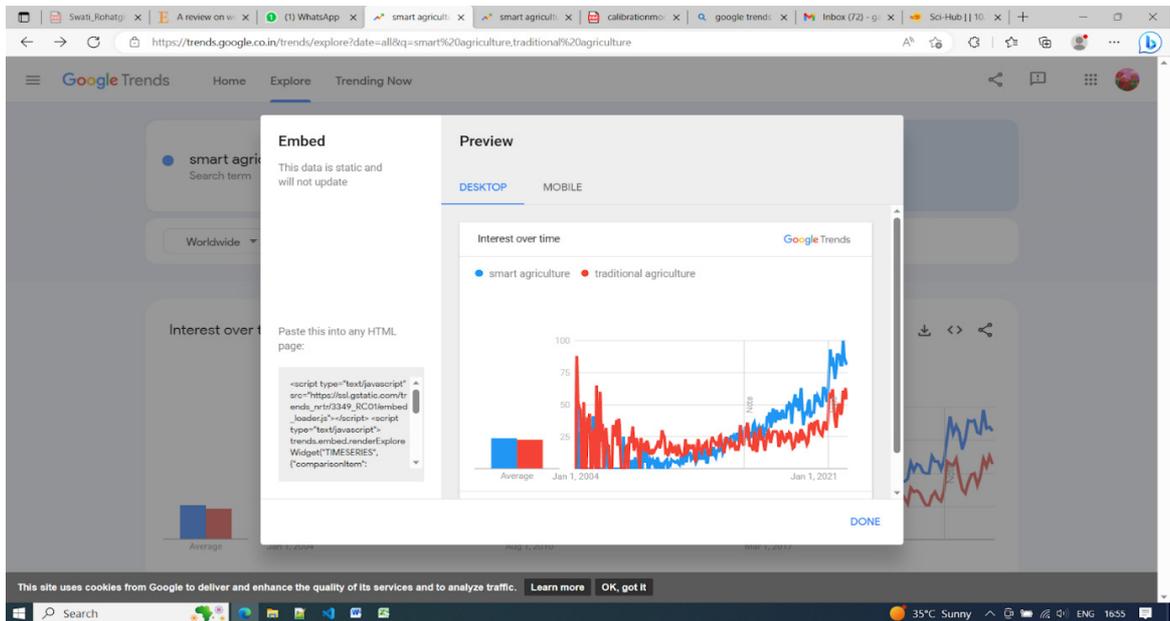
distance, is used by the Kriging technique to characterize the spatial autocorrelation of the data. Kriging has been extensively used in PA to map the spatial (Dorijan Radocaj et al., 2023). Utilizing multispectral cameras was the second most popular kind of recording equipment. Compared to spectral vegetation indices based only on RGB bands, those based on other spectral bands, such as the Near Infrared and the Red Edge, have demonstrated a stronger correlation with crop vitality, meaning that multispectral cameras can provide richer information than RGB cameras (Prey et al., 2018). In nearly every year except 2013–2015–2017, just 14 research articles employed hyperspectral cameras. Because it can gather data in over

50 bands, this kind of recording equipment can provide the most information. As a result, weed identification has been done using hyperspectral cameras (Liu et al., 2019), weed resistance to herbicides (Scherrer et al., 2020), disease detection (Pineda et al., 2022), and thermal micro-dosing (Zhang et al., 2012). Nevertheless, the high acquisition costs of this technology limit its application in agricultural research. Between 2015 and 2024, just three research articles used thermal cameras. This is explained by the fact that, should they be employed with airborne platforms, thermal cameras may be affected by weather and altitude changes and that, in any event, they must have sufficient spectral or measurement resolution for suitable data.



**Fig. 1: Google trend for comparison smart agriculture Vs Traditional agriculture in India.**

Source: Google Trends as showing trends for past 15 years India.



**Fig.2: Google trend of smart farming Vs Traditional Farming Worldwide**

Source: Google Trends as showing trends for past 15 years Worldwide.

The number of searches regarding the two keywords, smart agriculture and traditional agriculture, has shown a spike in the year 2021 worldwide, whereas the case is not the same in India. The current trend shows that there is not much awareness about precision agriculture or smart farming in a developing country like India.

Smart agriculture is a field where research is going on at an utmost pace in order to make agriculture, which is considered to be one of the most important occupations in India, a chief occupation. Many emerging entrepreneurs have left their reputed corporate jobs and have moved into the agricultural sector, particularly in organic farming. There is a need to develop certain tools or equipment to enhance the process

of e-farming. The following are different government sites where data repositories are maintained, and where data about the soil maps of India is depicted.

1. Soil and Land Use Survey of India (dacnet.nic.in)
2. data.gov.in
3. bhoonidhi.nrsc.gov.in
4. www.ibef.org
5. github.com
6. soilgrids.org

## RESEARCH METHODS

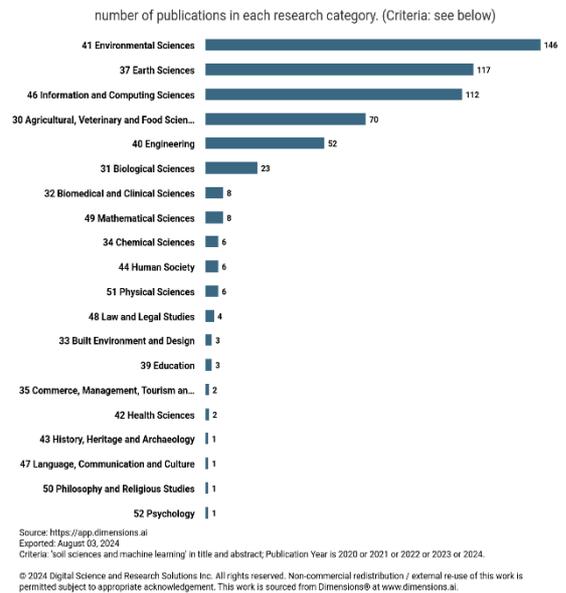
The tools used for the Systematic Literature Review are the Dimensions database and VOS viewer for conducting the bibliometric analysis.

The number of journals is pictorially listed categorically based on Environmental Sciences, Earth Science, Soil Science, and Agricultural Sciences, numbered as follows: 146, 117, 112, 108, and 70. There is a surge in citations from the year 2019 until 2024. Figure 3 shows the Analytical Views of the SLR.



**Fig.3: Shows Analytical Views**

The chart represents the number of publications in each research category from the time period of 2020-2023. Given below are the research papers showing the systematic literature review of the research carried out in the emerging field of Precision Agriculture using Machine Learning.



**Fig.4: Shows data chart of the journals**

## Models of Machine Learning

There is a categorization of the different types of models used in Machine learning: Supervised models. Supervised models are the models which learn from the datasets, where the output or the outcome is defined. They are as follows:

1. Classic Neural Networks (Multilayer Perceptrons)
2. Convolutional Neural Networks (CNNs)
3. Recurrent Neural Networks (RNNs)

Unsupervised Learning. Unsupervised models are the ones which do not have an input dataset, but tend to learn from the inputs as they do not have the set of outcomes for the results.

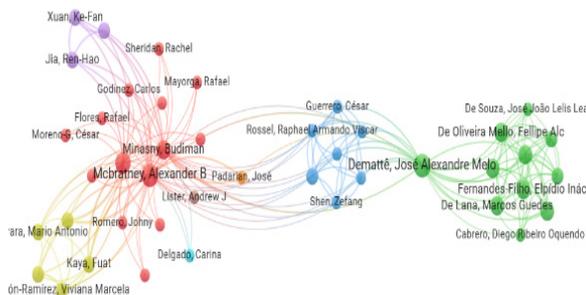
1. Self-Organizing Maps (SOMs)
2. Boltzmann Machines
3. Auto Encoders

The agricultural landscape in India has witnessed various waves of transformation, from mechanization to the Green Revolution. The Indian agriculture market is poised to reach a staggering value of \$580.82 billion by 2028 (Travlos et al., 2017), underscoring the sector's immense potential. Today, it stands on the cusp of a new era of Precision Agriculture, powered by the convergence of digital technologies, including the following:

1. Internet of Things (IoT) and Big Data
2. Artificial Intelligence (AI) and robotics
3. Monitoring with Sensors
4. Aerial Imagery
5. GPS Technology

## RESULTS

The map representation of the bibliometric file in dimensions of different authors and their citations. The clusters of the authors showing close relationship among each other and their references of the citations.



**Fig. 5: Network Visualization of clusters of citations.**

There are 366 research papers that were found with the keywords as “machine learning

technique” and “soil” from the time period from 2015-2024.

## DISCUSSIONS

The research objective was to conduct a bibliometric analysis on Systematic Literature Review. The LR study focuses on the different machine learning techniques employed to achieve precision agriculture. Future trends - Crop protection is predicted to experience a vital transformation in the upcoming years as a result of technological improvements and the request for sustainable agricultural techniques. The way crop health is monitored will fundamentally change as a result of new sensors (such as wearable sensors and fungus spore sensors), which offer unparalleled precision and real-time input. When paired with edge computing, these sensors will allow for real-time data processing, resulting in prompt replies and reduced decision-making times.

Challenges or limitations faced by AI in precision agriculture:

- According to a recent government poll, only a small percentage of Indian farmers are literate; as a result, closing the digital divide between farmers and technology will be difficult.
- Farmers are less inclined to step outside of their comfort zone and learn digital skills in order to improve their farming practices.
- The majority of agricultural land is found in rural areas. In rural locations without dependable internet connectivity, implementing IoT architecture and WSN

which depend on cloud services for data storage and analysis is a major problem.

- In different geographical settings, it is challenging for machines to make accurate predictions and categorizations using their cognitive abilities.
- The initial setup of digital farming, which includes hardware and software, requires a huge investment.
- The deployment of smart sensors and other electronic gadgets requires heavy energy consumption.

**Civil aviation regulations:** Many regions have strict regulatory frameworks governing civil aviation activities because of the potential risks associated with UAV operations. Consequently, only specific applications may be allowed for the usage of UAVs, or users may need to obtain a pilot's license.

**Processing power:** Gathering, analyzing, storing, sharing, and displaying UAV data can require a significant amount of processing power. Potential users might have to buy more equipment or pick up new abilities in order to manage the massive amounts of data that come along with using UAVs. (Gokool et al, 2023)

There are several potential future applications of vegetation indices in precision agriculture that are not presently utilized. One such application is the use of high-resolution imagery and machine-learning algorithms to map soil properties and variability across a field. By combining soil data with vegetation indices, the present studies can be additionally enriched in the scope of fertilization, irrigation, and planting, leading to improved crop health and yield. (Radocaj et al, 2023)

## CONCLUSION

A quick overview of machine learning (ML) algorithms, which are most frequently employed in precision agriculture, is given before exploring the impact of AI and IoT on smart farm management.

Precision agriculture (PA) agricultural applications made possible by UAVs have the power to drastically change smallholder farmers' lives. Using these technologies to inform decisions can increase agricultural productivity and encourage the wise and sustainable use of vital resources (Gokool et al., 2023). The foundation of agricultural yield prediction, weather forecasting, and soil attributes is regression algorithms. In order to identify weeds and diseases in plants, DL algorithms like CNN and ML classification algorithms like SVM, Decision trees, and RF were investigated. Precision agriculture relies heavily on intelligent irrigation systems and harvesting methods since they expedite tasks and minimize the need for human labor.

For this work, robots and drones equipped with digital cameras are used. Globally, farmers are very concerned about livestock management. Livestock management is effectively handled by a knowledge-based agriculture system that uses AI technologies and smart IoT devices. Future research might include developing an NLP-based chatbot for farmers and investigating more ML, DL, and hybrid algorithms in the agriculture sector to ensure the sustainable use of resources. This study produced insightful information about broad trends, significant books, journals, and writers, as well as present issues and potential future directions. It should

be mentioned, nonetheless, that the subjective standards and procedures utilized to discover and gather the data for our study may have reduced the findings' representation (Zhang et al., 2012).

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# DEMOGRAPHIC DYNAMICS OF FINTECH ADOPTION: EXPLORING PATTERNS AND PREFERENCES IN AN EMERGING ECONOMY

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## ABSTRACT

In recent years, the global financial landscape has undergone a significant transformation propelled by the rapid proliferation of Financial Technology (Fintech). This technological revolution has not only reshaped traditional financial services but has also democratized access to financial products and services, ushering in a new era of financial inclusion and empowerment. Understanding the underlying demographic dynamics behind Fintech adoption has become increasingly crucial for policymakers, financial institutions, and market participants alike, especially within emerging economies. This research aims to delve into the intricate interplay between demographic factors and Fintech adoption within the context of emerging economies. Through a multidimensional approach encompassing quantitative analysis and theoretical frameworks, the study endeavors to investigate the patterns and preferences across different demographic segments. By analyzing data from 15 emerging countries representing diverse regions across the globe, the research seeks to uncover insights into

the drivers and barriers influencing Fintech adoption.

Key findings indicate that while demographic factors intersect with technological trends to shape the Fintech landscape, other variables like economic prosperity and regulatory policies also play crucial roles. The study highlights the complexity of factors influencing Fintech adoption, emphasizing the need for tailored strategies to address the specific needs and preferences of different demographic segments. This research contributes to the evolving discourse on Fintech adoption by providing a comprehensive understanding of the demographic dynamics within emerging economies.

**Keywords:** Fintech adoption, demographic factors, emerging economies, financial inclusion, technological innovation, multidimensional approach Top of Form.

**JEL Codes:** C32, E31, E52, H62

## INTRODUCTION

In recent years, the global financial landscape has witnessed a profound transformation driven by

the rapid proliferation of Financial Technology, or Fintech. This technological revolution has not only reshaped traditional financial services but has also democratized access to financial products and services, ushering in a new era of financial inclusion and empowerment. As Fintech continues to gain momentum, understanding the underlying demographic dynamics behind its adoption becomes increasingly crucial for policymakers, financial institutions, and market participants alike.

This research seeks to delve into the intricate interplay between demographic factors and the adoption of Fintech within the context of an emerging economy. By analyzing patterns and preferences across different demographic segments, this study aims to uncover insights into the drivers and barriers influencing Fintech adoption. Moreover, it endeavors to shed light on how socio-economic characteristics such as age, gender, income level, educational attainment, and geographic location intersect with technological trends to shape the Fintech landscape.

Through a multidimensional approach encompassing quantitative analysis, qualitative research, and theoretical frameworks from disciplines such as economics, sociology, and psychology, this study endeavors to provide a comprehensive understanding of the demographic dynamics of Fintech adoption. By doing so, it aims to inform policymakers, financial institutions, and Fintech firms about strategies to foster greater inclusivity, address disparities, and harness the full potential of Fintech to drive socio-economic development in the emerging economy context.

In summary, this research aims to contribute to the evolving discourse on Fintech adoption by elucidating the nuanced relationship between demographic factors and technological innovation within the financial services sector of an emerging economy.

### **Financial Technology (fintech)**

Financial technology (fintech) denotes the application of technology in the delivery of diverse financial services (Baber, 2020). Fintech entities are pioneering financial intermediaries leveraging technological innovations to foster innovative business models, refine operational processes, and offer enhanced products and services (Zhang et al., 2021). Emerging in the early 1990s alongside the internet revolution, fintech's trajectory has been profoundly influenced by the advent of the internet (Haddad & Hornuf, 2019). However, scholarly exploration of fintech, primarily documented in the Scopus database, dates back to Mackenzie's seminal article in 2015 (Mackenzie, 2015).

Fintech is hailed for its potential to render finance more transparent, user-friendly, and cost-efficient. Moreover, it is poised to disrupt the financial landscape by challenging incumbent financial institutions, including banking, insurance, and investment firms. Notably, fintech benefits from a distinct regulatory environment, enabling firms to operate more flexibly within regulatory sandboxes to innovate new products and services (Buchak et al., 2018).

The fintech ecosystem comprises various stakeholders and encompasses a wide array of business models and services. This ecosystem includes fintech startups, technology developers, government agencies, customers, and traditional financial institutions. Business models within fintech span payment solutions, wealth management, crowdfunding, peer-to-peer (P2P) lending, capital markets, and insurance (Insurtech) (Lee & Shin, 2018).

Fintech, a convergence of financial services and cutting-edge technology, encompasses a diverse array of services, from alternative credit scoring to mobile payments, all aimed at providing innovative solutions to traditional banking services (Ratecka, 2020).

The advent of the fourth industrial revolution (4IR) has propelled fintech to the forefront of innovation, leveraging technologies such as Artificial Intelligence (AI) and Distributed Ledger Technology (DLT) to enhance efficiency, accessibility, and security in financial services provision. Fintech emerges as a catalyst for financial inclusion, offering novel solutions to the unbanked and under banked populations, while also challenging traditional banking institutions to adapt to changing consumer preferences and market dynamics (Brynjolfsson and McAfee, 2016).

Drawing on a nationwide-representative sample, that the mobile access, lower levels of security concerns, and fewer geographic obstacles are positively associated with fintech adoption. Conversely, high levels of security concerns, lack of confidence in new technological solutions, and obstacles with

service intuitiveness act as deterrents to fintech adoption (Hwang and Kim, 2018).

### Adoption Factors

In recent years, the adoption of fintech solutions, particularly those aimed at individual consumers, has gained significant momentum, reshaping traditional banking practices and challenging established financial institutions. The transformative potential of fintech lies in its ability to leverage the digital technologies of the fourth industrial revolution (4IR), including artificial intelligence, distributed ledger technology, and high-speed internet connectivity, to democratize access to financial services and promote financial inclusion (World Bank Group & International Monetary Fund, 2019).

However, the successful adoption of fintech hinges not only on technological innovation but also on understanding the factors influencing users' willingness to embrace these digital financial solutions. The factors affecting the adoption of fintech can be listed as follows: -

**Accessibility and Convenience:** Fintech services offer convenience and accessibility, especially through mobile applications, which can be accessed by individuals at their convenience. Factors such as mobile access and geographic obstacles influence adoption rates (Int. J. Financial Stud. 2023).

**Security Concerns:** Users' perception of security risks associated with fintech services significantly affects adoption. Lower levels of reported concerns with security increase the

likelihood of fintech adoption, while high levels of concerns for security and financial scam issues decrease adoption rates (Int. J. Financial Stud. 2023).

**Technological Confidence:** Users' confidence in using new technological solutions influences fintech adoption. Lower levels of confidence using new technology decrease adoption rates (Int. J. Financial Stud. 2023).

**Service Intuitiveness:** The ease of use and intuitiveness of fintech services impact adoption. High reported levels of obstacles with service intuitiveness decrease fintech adoption rates (Int. J. Financial Stud. 2023).

**Trust:** Trust in service providers plays a crucial role in fintech adoption. Lack of trust in service providers negatively affects adoption rates (Hwang and Kim, 2018).

**Previous Experience:** Users' previous experience, especially related to security incidents on fintech platforms, influences adoption rates. Negative experiences can deter users from adopting fintech services (Hwang and Kim, 2018).

**Demographic and Economic Factors:** Factors such as demographic characteristics (e.g., gender, age), economic variables (e.g., disposable income), and attitude variables (e.g., risk tolerance, financial knowledge) also influence fintech adoption (Gerlach and Lutz, 2017).

These factors interact in complex ways and vary between different contexts and user groups. Understanding and addressing these factors are crucial for successful fintech adoption strategies. By addressing these adoption factors comprehensively and strategically, fintech

providers, policymakers, and regulators can create an enabling environment that encourages widespread adoption of digital financial services, driving financial inclusion and empowerment on a global scale. Top of Form

## LITERATURE REVIEW

In Jordan, Al-Okaily et al. (2021) demonstrated that perceived usefulness and enjoyment significantly influenced the intention to adopt fintech services. Personal variables emerge as crucial determinants or mediators of the relationship between factors and their impact on fintech adoption intention, extending beyond mere demographic or socio-economic dimensions. For instance, Kakinuma (2022) highlighted that individual with ample leisure time exhibited a greater propensity to experiment with novel fintech solutions, consequently manifesting higher levels of adoption intention. This correlation was found to be mediated by factors such as quality of life and financial literacy.

Xie et al. (2021) expanded upon the factors influencing technology adoption by extending the Unified Theory of Acceptance and Use of Technology (UTAUT) model. Their study revealed that perceived usefulness, perceived risk, and social factors collectively determined user adoption intention. Moreover, the investigation of perceived value emerged as another significant dimension, where factors such as performance expectancy, effort expectancy, and perceived risk interacted to influence the perceived value of the technology, thereby significantly impacting adoption intention.

In a study conducted in Bahrain, Ahmed et al. (2020) emphasized that perceived benefit outweighed perceived risk in influencing fintech adoption. Given the varying demographic and economic profiles across customer segments and countries, the relative importance of these factors naturally varies. Mu and Lee (2017) conducted a comparative study in China and Korea, elucidating that while cost was a primary factor for Chinese customers, the credibility of fintech service providers played a more pivotal role in adoption intention among Korean customers.

Daragmeh et al. (2021) surveyed Generation X fintech users in Hungary and found that perceived usefulness, perceived ease of use, COVID-19-related norms, and risks collectively accounted for a significant proportion of the variation in intention to use mobile payment systems. Similarly, Nawayseh (2020) identified that perceived benefits and social factors exerted significant influence on intention to use fintech services, especially during the COVID-19 pandemic. Moreover, Nawayseh (2020) highlighted the mediating effect of trust on fintech adoption intention.

Following the Technology Acceptance Model (TAM), Jin et al. (2019) in Malaysia found that perceived usefulness, ease of use, awareness, and costliness significantly predicted fintech usage. Notably, perceived benefits positively impacted intention to use fintech services, whereas perceived risks exerted a negative influence. However, Ryu (2018) suggested that the effect of risks, including financial, legal, security, and operational risks, was stronger among early adopters, whereas

other variables played a more significant role for late adopters. This finding was corroborated by Gerlach and Lutz (2021), who emphasized the nuanced interplay between benefits and risks in influencing fintech adoption intention among different customer groups.

There appears to be an inverse correlation between age and fintech utilization, with financial literacy serving as a facilitator for customers to engage with new fintech services (Hasan et al., 2022). The findings from Hasan et al. (2022) corroborate similar trends observed across multiple studies in the Asia-Pacific (APAC) region, emphasizing the necessity for targeted initiatives to enhance financial inclusion, particularly among older demographics. The significance of fintech in advancing financial inclusion extends even to developed markets, as evidenced by its role in expanding access to financial services in regions like British Columbia, where underbanked communities have benefited from the introduction of new fintech solutions (Clements, 2020). The advantages offered by fintech have the potential to mitigate the limitations inherent in microfinance facilities, as highlighted by findings from Nigeria, which underscore the existence of constraints and systemic biases within traditional microfinance systems (Pedrosa and Do, 2011).

Across various studies, a consistent pattern emerges regarding disparities in adoption rates and intentions among different gender and age cohorts. Generally, fintech adoption rates skew higher among younger demographics and males. This pattern persists in assessments of fintech adoption intentions across multiple

markets, including the South Asian Association for Regional Cooperation (SAARC) and the Association of Southeast Asian Nations (ASEAN), where males and younger users exhibit greater propensity for adopting fintech services compared to their female and older counterparts (Imam et al., 2022). This underscores the imperative for fintech service providers and regulators to address these disparities and ensure equitable distribution of the anticipated benefits of fintech. Achieving universal appeal necessitates the design of fintech platforms that cater to diverse demographics, with specific measures required to facilitate equal access for women and the elderly (Imam et al., 2022). Furthermore, comprehensively capturing the intricate interplay among these factors calls for enhanced measurement methodologies. Cross-country comparisons could benefit from improved indexes that account for the complexity of interactions among variables influencing varying levels of fintech adoption (Huong et al., 2021).

Substantial disparities persist across countries, underscoring the pivotal role of macro-level indicators in shaping user intention and adoption levels at the national scale. Kumar et al. (2021) elucidated significant country-level heterogeneity in adoption intention, evident both between and within countries, drawing insights from data spanning 30 different nations. Concurrently, adoption rates exhibit marked divergence across countries (Ernst & Young, 2019a). Notably, an intriguing revelation surfaced from research conducted in Indonesia, where financial literacy emerged as the least influential factor in determining customer adoption (Setiawan et al., 2021).

Instead, the study highlighted the pivotal role of user innovativeness, suggesting the necessity for intensified efforts from fintech service providers alongside supportive regulatory frameworks.

Amidst lower debt levels and the ascension of a burgeoning middle class, Asia largely circumvented the severe repercussions of the 2008-2009 Global Financial Crisis. Favorable macroeconomic conditions facilitated the rise of an empowered middle class with increasing purchasing power, fostering a burgeoning demand for novel services and products. Consequently, Asia witnessed the proliferation of a robust banking network, albeit significant portions of populations in countries such as India and China remained excluded from traditional banking channels. Fintech emerged as a transformative force, leveraging this conducive environment to extend financial services to substantial under banked and unbanked populations, particularly in Asia's largest economies (Alexander et al., 2017). Moreover, the role of supporting industries and ICT clusters emerged as instrumental in nurturing fintech ecosystems, with financial services clusters assuming a comparatively subdued role (Laidroo and Avarmaa, 2020).

At the national level, fintech emerges as a catalyst for empowering female populations, as evidenced by the International Monetary Fund's (IMF) cross-country analysis across 114 nations. Loko and Yang (2022) demonstrated the significant economic benefits of fintech in facilitating financial access for women, with countries exhibiting higher fintech penetration witnessing a surge in the number of female

workers in firms. Fintech's transformative potential extends beyond borders, holding vast promise for under banked and unbanked populations worldwide (Salampasis and Mention, 2018). While regulatory oversight, institutional quality, and macroeconomic and technological landscapes shape the nature of fintech's impact, its overarching effect manifests in expanded financial access and enhanced opportunities for financial prosperity. Strategic interventions and commercial strategies must intricately navigate these variables to maximize impact.

Moreover, Laos, Vietnam, and Cambodia emerge as frontrunners in the ASEAN region, boasting conducive geopolitical, technological, political, and socio-economic environments that foster fertile ground for fintech firms (Loo, 2019). The discourse in international development literature accentuates the imperative of harnessing digital technologies, including blockchain, mobile networks, and cloud computing, to uplift populations long excluded from formal banking channels. Fintech serves as a conduit for realizing financial inclusion in some of the world's poorest nations, with factors such as network effects, customer-centricity, and the appropriateness of commercial strategies standing out among the determinants of firms' success in this endeavor (Soriano, 2017).

## RESEARCH OBJECTIVES

Investigate the interplay between demographic factors and Fintech adoption within an emerging economy.

Analyze patterns and preferences across different demographic segments to uncover

insights into the drivers and barriers influencing Fintech adoption.

## MATERIAL AND METHODOLOGY

This study examines fintech adoption across 15 emerging countries. It analyzes various types of fintech based transactions, including those conducted through mobile devices, the internet, and other digital platforms. To conduct this analysis, the study relies primarily on data sourced from the *Global Findex Database*.

The *Global Findex Database* conducts surveys periodically, with editions published in 2011, 2014, 2017, and 2021. These surveys are nationally representative and encompass a diverse array of economies globally. For instance, the 2021 edition surveyed approximately 128,000 adults across 123 economies, offering comprehensive insights into financial inclusion, particularly amidst the challenges posed by the COVID-19 pandemic.

This study requires data on demographic, economic indicators, and technological infrastructure from multiple authentic sources. The data from these sources are heterogeneous, varying in range and the number of indicators used to compute each dimension. Therefore, the study will aggregate the heterogeneous data subset into one to devise corresponding scores. Based on the stated approach following scores have devised:

### Economic Index Score ( $EI_{Score}$ )

*Economic Index Score* ( $EI_{Score}$ ) adopted a normalization and aggregation methodology for

the country specific indicators data taken from Human Development Index (HDI) and the Sustainable Development Goals Index (SDGI). *Economic Index Score* ensure comparability and equal weighting across the dimensions. This standard methodology involved a two-step process described involves two-step normalization and aggregation procedure to calculate a new metric, the “ $EI_{Score}$ ,” which serves as a baseline measure for assessing the relationship between economic development and households’ financial decisions.

In the first step, raw dimensional scores for the  $EI_{Score}$  are normalized for each country using the min-max method. This normalization ensures that scores are on a consistent scale across different dimensions and countries. The formula used for normalization is:

$$\text{Normalized Score} = \frac{\text{Raw Score} - \text{Min Score}}{\text{Max Score} - \text{Min Score}}$$

Here, the Raw Score represents the original score for a various economic and human development indicator, while the Min Score and Max Score denote the minimum and maximum scores observed across all countries for these indicators, respectively.

In the second step, the normalized scores are aggregated using the geometric mean approach. This method is chosen due to its suitability for aggregating heterogeneous variables with limited substitutability. The geometric  $EI_{Score}$  for each country is computed as:

$$ICT_{Score} = \frac{W_1 \times N_{Mobile} + W_2 \times N_{Broadband} + W_3 \times N_{Internet} + W_4 \times N_{IntIndex} + W_5 \times N_{IntIndex}}{5} \quad (2)$$

$$EI_{score} = (S_{Quantity} \times S_{Quality} \times S_{Environment})^{\frac{1}{3}} \times 100 \quad (1)$$

Here, refer to the normalized scores for the three dimensions. The resulting “” represents a composite measure of a country’s economic performance. It ranges from 0 to 1 (0-100%), where higher scores indicate better performance. This score serves as a baseline measure for analyzing the relationship between fintech development and households’ financial decisions, allowing for assessment based on percentage changes rather than absolute changes.

### ICT Infrastructure Score

The ICT Infrastructure Score, derived from data provided by the *ICT Indicators database* (International Telecommunication Union, 2018) and the Inclusive Internet Index 2020 (The Economist Intelligence Unit, 2020). It offers a comprehensive assessment of a country’s technological landscape. By amalgamating key indicators such as mobile phone subscriptions, fixed broadband subscriptions, internet users, and indices like the Inclusive Internet Index, this score provides valuable insights into a nation’s readiness and accessibility in the realm of information and communications technology. The formula for calculating the ICT (Information and Communications Technology) Infrastructure Score based on the provided indicators and weights can be expressed as follows:

Where:

- $W_1, W_2, W_3, W_4$  are the weights assigned to each indicator (in this case, each weight is 0.25 since all indicators are considered equally important).
- $N_{\text{Mobile}}$  is Normalized Mobile Phone Subscriptions
- $N_{\text{Broadband}}$  is Normalized Fixed Broadband Subscriptions
- $N_{\text{Internet}}$  is Normalized Internet Users
- $N_{\text{IntIndex}}$  is Normalized Inclusive Internet Index Score
- $N_{\text{IntIndex}}$  is Normalized Mobile Connectivity Index

With higher scores indicating superior infrastructure and accessibility, and lower scores highlighting potential areas for improvement, the ICT Infrastructure Score serves as a vital tool for decision-makers.

### Financial Infrastructure Score

To calculate the Financial Infrastructure score, a systematic approach has followed. Relevant indicators are identified, focusing on components that reflect the accessibility and availability of financial services within an economy. This includes metrics such as commercial bank branches per 100,000 adults, commercial bank branches per 1,000 km<sup>2</sup>, ATMs per 100,000 adults, and ATMs per 1,000 km<sup>2</sup>. Each indicator is assigned a weight to reflect its relative importance in the overall assessment. For example, if all indicators are considered equally important, a weight of 0.25 is assigned to each.

The raw data for each indicator is normalized using the min-max normalization method. This scales the data to a common range between 0 and 1, allowing for meaningful comparison across different indicators. The normalized values of all indicators are then aggregated to compute the Financial Infrastructure score. This can be done by taking the average of the normalized values, giving each indicator equal importance in the final score. The formula for calculating the Financial Infrastructure score based on the provided indicators and weights can be expressed as follows:

Where:

- $W_1, W_2, W_3, W_4$  are the weights assigned to each indicator (in this case, each weight is 0.25 since all indicators are considered equally important).
- $N_{\text{BBF}}$  is Normalized Commercial Bank Branches per 100,000 Adults” refers to the normalized value of this indicator using min-max normalization.
- $N_{\text{BBG}}$  is Normalized Commercial Bank Branches per 1,000 square km” refers to the normalized value of this indicator using min-max normalization.
- $N_{\text{ATMI}}$  is Normalized ATMs per 100,000 Adults” refers to the normalized value of this indicator using min-max normalization.
- $N_{\text{ATMG}}$  is Normalized ATMs per 1,000 square km refers to the normalized value of this indicator using min-max normalization.

This formula calculates the Financial Infrastructure score by combining the normalized values of the four indicators, each weighted equally. It provides a comprehensive measure of financial infrastructure, taking

into account the density of commercial bank branches and ATMs per capita and per unit area.

These scores provide an indication of the overall ICT infrastructure readiness and accessibility in each country, considering factors such as mobile and fixed broadband subscriptions, internet users, and various ICT indices.

## ANALYSIS AND RESULT

These 15 emerging countries including Argentina, Brazil, Chile, China, Colombia,

India, Indonesia, Korea, Rep., Malaysia, Mexico, Nigeria, Russian Federation, South Africa, Turkey, and UAE have selected for this study. These countries have been selected based on their significant economic, technological, and demographic characteristics. They represent diverse regions across the globe, encompassing Latin America, Asia, Africa, and the Middle East. Additionally, these countries are known for their growing economies, large populations, and increasing integration into the global financial and technological

**Table. 1: Computed Data for Adult Population, and another Score**

Country	Adult population Growth (2011-21) %	Economic Index Score	ICT Infrastructure Score	Financial Infrastructure Score
<i>Argentina</i>	13.65	10.2	0.561	0.29
<i>Brazil</i>	14.52	21.5	0.499	0.41
<i>Chile</i>	16.11	8.2	0.559	0.42
<i>China</i>	6.03	21.8	0.767	0.76
<i>Colombia</i>	20.37	9.6	0.565	0.30
<i>India</i>	19.32	25.7	0.413	0.18
<i>Indonesia</i>	17.68	7.5	0.484	0.34
<i>Korea, Rep.</i>	8.92	13.8	0.658	0.67
<i>Malaysia</i>	21.89	9.2	0.556	0.44
<i>Mexico</i>	18.88	13.8	0.588	0.26
<i>Nigeria</i>	31.28	5.7	0.384	0.22
<i>Russian Federation</i>	-3.20	12.6	0.429	0.37
<i>South Africa</i>	17.22	10.5	0.584	0.35
<i>Turkey</i>	21.30	8.3	0.491	0.27
<i>UAE</i>	13.48	12.6	0.640	0.47

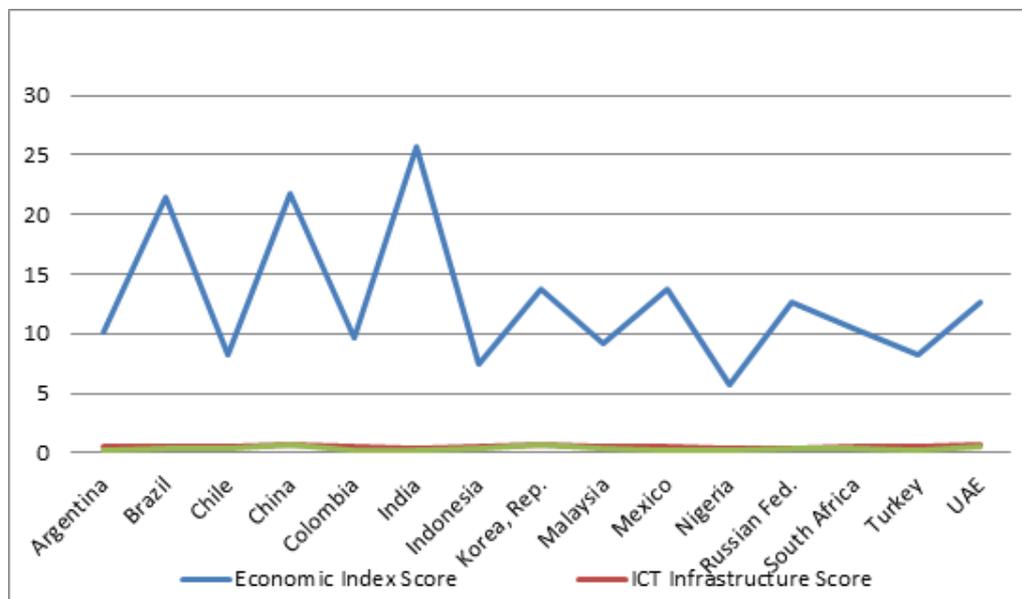
landscape. By including them in our analysis, we aim to provide insights into the financial and technological development trends across different regions and economic contexts, thus contributing to a comprehensive understanding of the global fintech landscape.”

The scores devised above have utilized datasets prepared by multilateral agencies, as mentioned earlier. Using these datasets and formulations presented in (1), (2), and (3), we have computed the Economic Index Score, ICT Infrastructure Score, and Financial Infrastructure Score for selected countries. The score calculated for these countries have been presented in the table-1

The table-1 presents the Adult Population Growth (% change from 2011 to 2021) alongside scores for Economic Index, ICT Infrastructure, and Financial Infrastructure for

15 countries. Countries with positive Adult Population Growth rates, such as Malaysia (21.89%), Nigeria (31.28%), and Turkey (21.30%), show significant increases in the adult population over the past decade. This suggests potential expansion in the adult consumer base for financial and technological services. Whereas, the Russian Federation stands out with a negative Adult Population Growth rate (-3.20%), indicating a decrease in the adult population over the same period. This may pose challenges for economic and technological development initiatives due to a shrinking consumer base.

There seems to be no direct correlation between Adult Population Growth and Economic Index or Infrastructure Scores. While some countries with high population growth also have high scores in these indices (e.g., Nigeria, Malaysia), others show a mix of



**Fig. 1: Comparison of Scores for Different Countries**

high and low scores. High population growth rates in countries like Nigeria and Turkey, coupled with relatively moderate to high scores in infrastructure and economic indices, suggest significant market potential for financial and technological services. Conversely, negative growth in Russia may require different strategies for market penetration and expansion.

### Financial Technology Score (FT Score)

The ' $FT_{Score}$ ' is a composite metric designed to assess the level of engagement with digital technology based financial transaction services within a population. It combines various indicators related to the adoption, usage, trust, and accessibility of digital money services into a single index, providing a holistic measure of digital financial inclusion. It ensures fairness and comparability across the dimensions. In *Fintech Score*, normalization and aggregation approach were adopted. This approach consisted of a two-step procedure. Initially, the min-max normalization method was applied to the raw scores of each dimension within the fintech score framework. This method standardized the scores across all countries, ensuring that each dimension's scores were transformed into a common scale. The normalization equation utilized was:

$$\text{Normalized Score} = \frac{\text{Raw Score} - \text{Min Score}}{\text{Max Score} - \text{Min Score}}$$

Here, the Raw Score represents the original score for a dimension, while the Min Score and Max Score denote the minimum and

maximum scores observed across all countries for that dimension, respectively.

This normalization process facilitated equitable comparison and interpretation of mobile money engagement across the diverse emerging economies studied, enabling a more robust analysis of their respective levels of engagement with mobile financial services. By aggregating these components into a single index, Fintech Score offers a comprehensive snapshot of the extent to which individuals within a population are engaged with mobile money services. The formula for can be expressed as:

$$FT_{Score} = \frac{w_1 \times M_1 + w_2 \times M_2 + w_3 \times M_3 + \dots + w_n \times M_n}{n}$$

Where:

- $w_1, w_2, w_3, \dots$  are weights assigned to each component, ensuring that the sum of weights equals 1.
- $M_1, M_2, M_3, \dots$  represents the respective percentages or proportions for each component.
- $n$ , is the total number of components

Higher Fintech Scores indicate greater levels of engagement and adoption of mobile money services, while lower scores suggest areas for improvement in promoting mobile financial inclusion. The index allows for comparisons across countries and over time to assess trends in mobile-based financial transactions.

Applying the Mobile Money Engagement Index (Fintech Score) approach to the Global Findex Database table-N yields the for 15 selected countries.

**Table. 2: for 15 Emerging Economies During (2011-21)**

Country	2011	2014	2017	2021
Argentina	0.485	0.543	0.592	0.618
Brazil	0.553	0.593	0.632	0.615
Chile	0.558	0.598	0.647	0.697
China	0.623	0.662	0.697	0.915
Colombia	0.558	0.598	0.647	0.697
India	0.553	0.593	0.632	0.615
Indonesia	0.558	0.598	0.647	0.697
Korea, Rep.	0.558	0.598	0.647	0.917
Malaysia	0.563	0.603	0.652	0.752
Mexico	0.558	0.598	0.647	0.697
Nigeria	0.558	0.598	0.647	0.697
Russian Federation	0.558	0.598	0.647	0.522
South Africa	0.553	0.593	0.632	0.667
Turkey	0.558	0.598	0.647	0.547
United Arab Emirates	0.495	0.553	0.602	0.765

The Fintech score for 15 emerging economies from 2011 to 2021 illustrate significant variations and trends in mobile money engagement over the past decade. Here's the interpretation along with the COVID-19 aspect:

Argentina, Brazil, Chile, Colombia, India, Indonesia, Malaysia, Mexico, and Nigeria show relatively steady Fintech scores over the period, with slight fluctuations but no clear upward or downward trend. Despite facing the COVID-

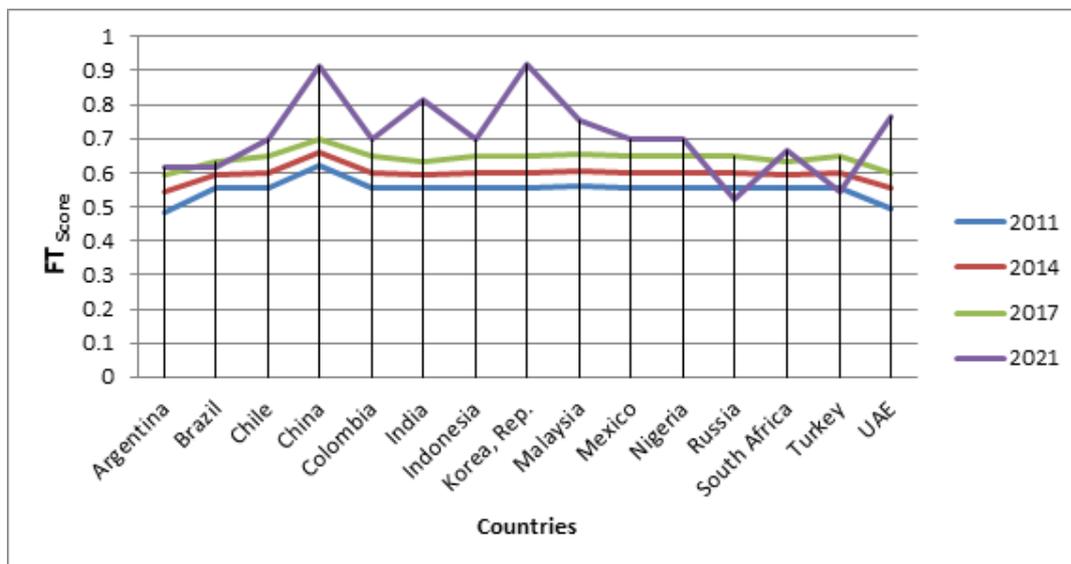
19 pandemic, their Fintech scores remained stable, suggesting that the adoption and engagement with mobile money services were resilient or possibly unaffected by the pandemic.

China demonstrates a substantial increase in fintech scores, particularly from 2017 to 2021, indicating significant growth in mobile money engagement. This trend could be attributed to China's advanced digital infrastructure, robust mobile payment systems, and widespread adoption of fintech solutions, which may have been further accelerated by the COVID-19 pandemic as people turned to contactless payments and digital financial services.

South Korea exhibits a remarkable surge in fintech scores, especially in 2021, suggesting a rapid increase in mobile money engagement. This sharp rise could be influenced by the country's innovative mobile payment platforms, strong Smartphone penetration, and perhaps the impact of the COVID-19 pandemic, which may have accelerated the shift towards digital payments and financial inclusion.

**Russian Federation:** Russia's fintech scores show a decline in 2021 compared to previous years. This could be due to various factors, including changes in consumer behavior, regulatory policies, or economic conditions. The impact of the COVID-19 pandemic on mobile money engagement in Russia is uncertain and would require further analysis.

**South Africa, Turkey, and United Arab Emirates:** These countries demonstrate mixed



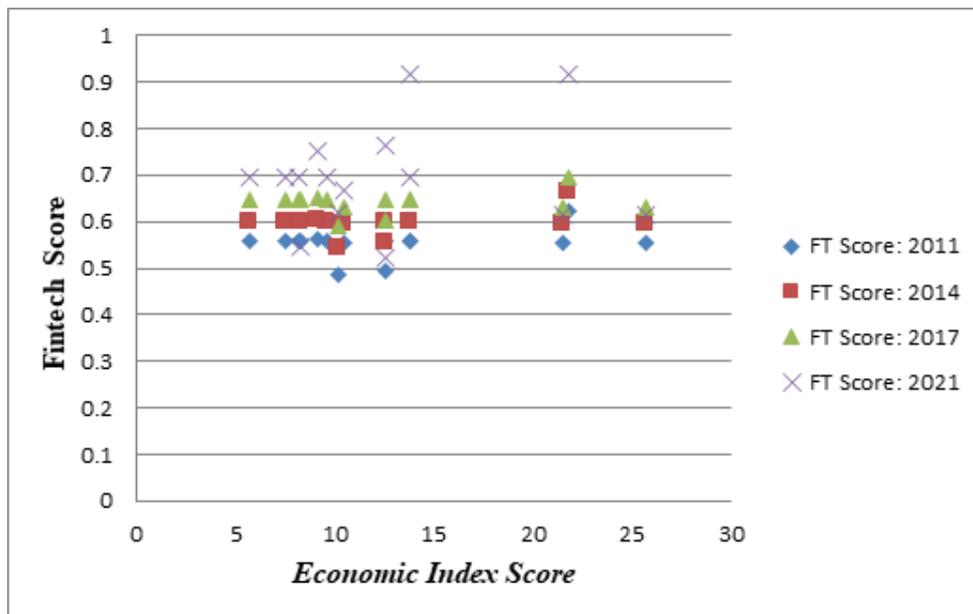
**Fig. 2: Country-wise Fintech Score**

trends in fintech scores. While South Africa and Turkey show relatively stable scores over the years, the United Arab Emirates experiences a notable increase in 2021. The COVID-19 pandemic may have influenced mobile money engagement differently in each of these countries, depending on factors such as digital infrastructure, financial policies, and socioeconomic dynamics.

Overall, the fintech scores reflect the diverse landscape of mobile money engagement across emerging economies during the past decade, with some countries experiencing significant growth, while others show stability or fluctuations. Understanding these trends in the context of the COVID-19 pandemic provides valuable insights into the resilience and adaptability of mobile financial services in response to global challenges.

#### **Economic Index Score vs. FT Score:**

The Economic Index Score vs. FT<sub>Score</sub> scatter plot serves as a visual representation of the relationship between a country's economic performance and its level of mobile money engagement over time. By plotting the Economic Index Score on the x-axis and the Fintech Score on the y-axis for each year, we can observe any patterns or trends that emerge. A positive correlation between these two variables would suggest that countries with higher economic prosperity, as indicated by their Economic Index Scores, tend to exhibit higher levels of mobile money engagement, reflected in their Fintech Score. This positive correlation implies that economic factors play a significant role in driving mobile money adoption and usage, highlighting the importance of economic development in fostering digital financial inclusion and promoting the use of mobile financial services.



**Fig. 3: Scatter plot of Economic Index Score vs. FT<sub>Score</sub>**

The scatter plot of Economic Index Score vs. FT Score allows us to visualize the relationship between a country's economic index and its fintech adoption across various years. As we examine the data points, we notice a general trend where countries with higher Economic Index Scores tend to have higher FT Scores. This positive correlation suggests that as a country's economic prosperity increases, it is more likely to embrace fintech solutions.

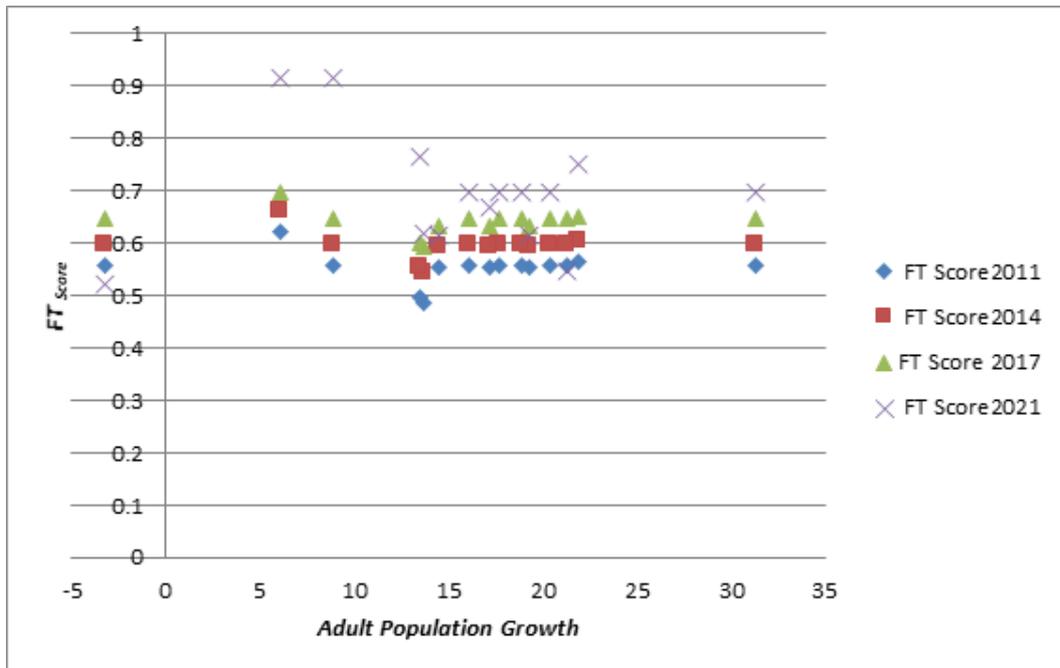
Analyzing the scatter plot over time (from 2011 to 2021), we can observe any changes or trends in this relationship. For instance, we may notice that some countries experience significant increases in both Economic Index Scores and FT Scores over the years, indicating a positive momentum in economic development and fintech adoption.

However, it's essential to identify outliers in the scatter plot. These outliers represent countries that deviate from the general trend. Understanding the reasons behind these deviations can provide valuable insights into the factors influencing fintech adoption in those specific countries.

Overall, the scatter plot helps us understand how economic development and fintech adoption are intertwined, offering insights into the global landscape of financial technology across different countries and time periods.

### **Adult Population Growth vs. FT Score**

The scatter plot illustrates the association between the rate of adult population growth and the FT Score for different countries over



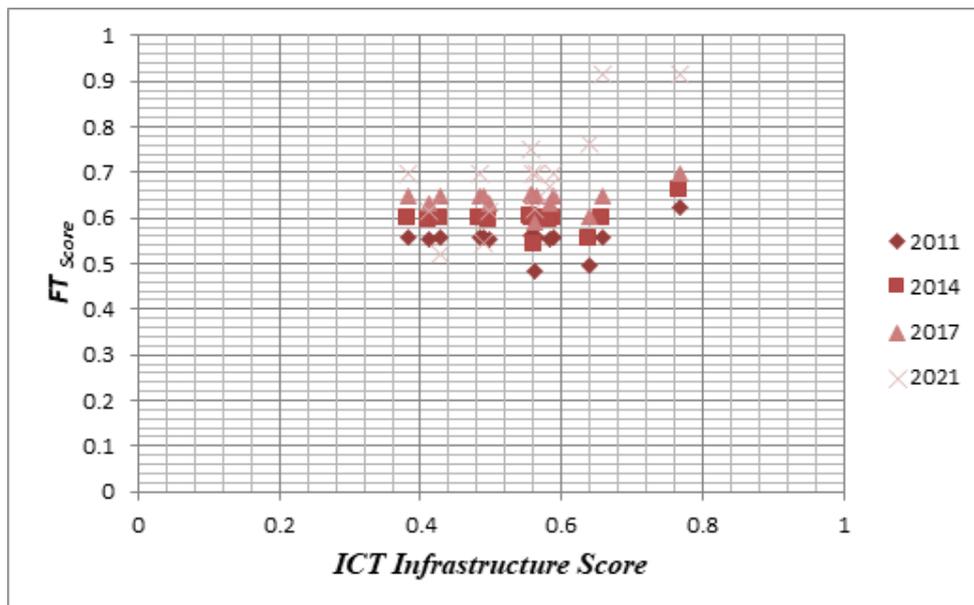
**Fig. 4: Scatter Plot for Adult Population Growth vs. FT Score**

the years 2011, 2014, 2017, and 2021. By examining the plot, we can discern diverse trends across nations, indicating a lack of uniform correlation between population growth and fintech adoption. While some countries with higher rates of population growth demonstrate correspondingly higher FT Scores, suggesting a potential positive correlation, others display no discernible pattern. The presence of outliers in the plot further underscores the complexity of factors influencing fintech adoption within specific countries. This complexity could stem from various socio-economic, regulatory, and technological factors unique to each nation. Hence, while the scatter plot offers valuable insights into how demographic dynamics might impact fintech adoption, it also emphasizes the multifaceted nature of this relationship,

necessitating a nuanced understanding of local contexts and conditions.

### ICT Infrastructure Score vs. FT Score

The scatter plot depicts the relationship between the ICT Infrastructure Score and the FT Score across different countries for the years 2011, 2014, 2017, and 2021. Analysis of the plot reveals varying patterns in the relationship between ICT infrastructure development and fintech adoption. Some countries exhibit a positive correlation between higher ICT infrastructure scores and increased FT scores, suggesting that nations with more advanced ICT infrastructure tend to have higher levels of fintech adoption. However, this correlation is not universal, as certain countries with relatively



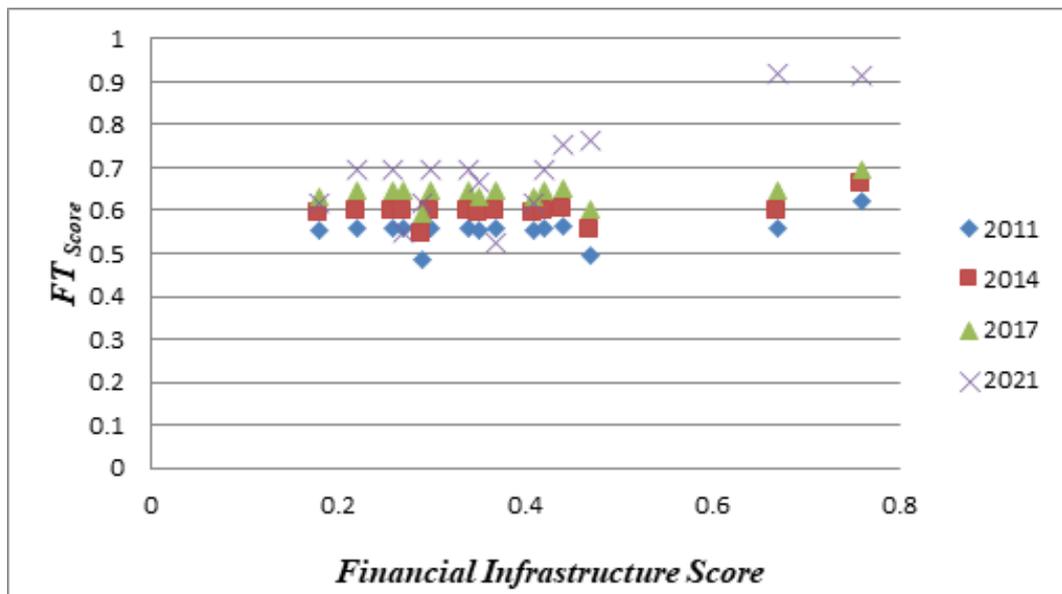
**Fig. 5: Scatter Plot for ICT Infrastructure Score vs. FT Score**

high ICT infrastructure scores display lower FT scores, indicating a disconnect between infrastructure development and fintech utilization. Additionally, the presence of outliers underscores the influence of other factors, such as regulatory frameworks, economic conditions, and cultural attitudes, on fintech adoption. Consequently, while ICT infrastructure serves as a critical enabler for fintech expansion, its impact on fintech adoption varies across different contexts, highlighting the need for a nuanced understanding of the interplay between infrastructure development and fintech utilization.

#### **Financial Infrastructure Score vs. FT<sub>Score</sub>**

The scatter plot illustrates the relationship between the Financial Infrastructure Score

and the FT Score across various countries for the years 2011, 2014, 2017, and 2021. Examining the plot reveals trends in the connection between financial infrastructure development and fintech utilization. Countries with higher financial infrastructure scores generally exhibit higher FT scores, indicating a positive correlation between the two variables. This suggests that nations with more robust financial infrastructure, including banking facilities and digital payment systems, tend to have greater adoption and integration of fintech solutions. Conversely, countries with lower financial infrastructure scores often display lower FT scores, implying that inadequate financial infrastructure may hinder fintech development and adoption. However, it's important to note that the relationship may not be linear for all countries, as other factors



**Fig. 6: Scatter Plot Financial Infrastructure Score vs. FT Score**

such as regulatory environment, technological readiness, and consumer behavior can also influence fintech adoption. Therefore, while financial infrastructure lays the foundation for fintech expansion, its impact on FT scores may vary depending on the specific context and dynamics within each country.

## DISCUSSION & CONCLUSION

The selection of 15 emerging countries for this study, including Argentina, Brazil, Chile, China, Colombia, India, Indonesia, Korea, Rep., Malaysia, Mexico, Nigeria, Russian Federation, South Africa, Turkey, and UAE, was based on their significant economic, technological, and demographic characteristics. These countries represent diverse regions across the globe, encompassing Latin America, Asia, Africa, and the Middle East. Additionally, they

are known for their growing economies, large populations, and increasing integration into the global financial and technological landscape.

The Economic Index Score, ICT Infrastructure Score, and Financial Infrastructure Score were computed for these selected countries using datasets prepared by multilateral agencies. The analysis revealed interesting insights into the demographic and technological trends shaping the fintech landscape in emerging economies.

When examining the Adult Population Growth rates alongside the Economic Index and Infrastructure Scores, no direct correlation was found between population growth and economic or infrastructure development. While some countries with high population growth rates also exhibited high scores in economic and infrastructure indices (e.g.,

Nigeria, Malaysia), others showed a mix of high and low scores. This suggests that while population growth may indicate market potential for financial and technological services, other factors such as regulatory policies and consumer behavior also play crucial roles in driving adoption and usage.

The analysis of Fintech scores over the past decade revealed significant variations and trends in mobile money engagement across the selected countries. While some countries demonstrated steady Fintech scores with slight fluctuations, others experienced substantial increases or declines, influenced by factors such as digital infrastructure, regulatory policies, and the COVID-19 pandemic. For instance, China and South Korea exhibited remarkable growth in mobile money engagement, attributed to their advanced digital infrastructure and innovative payment systems.

The scatter plots further illustrated the relationships between economic, demographic, and technological factors and fintech adoption. While a positive correlation was observed between Economic Index Scores and Fintech Scores, indicating that countries with higher economic prosperity tend to have higher levels of fintech adoption, the relationships between population growth, ICT infrastructure, financial infrastructure, and fintech adoption were more nuanced. While ICT and financial infrastructure serve as critical enablers for fintech expansion, their impact on fintech adoption varies across different contexts due to factors such as regulatory frameworks and consumer behavior.

The key findings of the study can be summarized as follows:

- It revealed that while demographic factors such as age, gender, income level, educational attainment, and geographic location intersect with technological trends to shape the Fintech landscape, other variables like economic prosperity and regulatory policies also play crucial roles.
- The analysis highlighted the complexity of factors influencing Fintech adoption, emphasizing the need for a nuanced understanding of local contexts and conditions.
- It found that while some demographic segments may show higher propensity for Fintech adoption due to factors such as digital literacy and access to technology, others may face barriers such as lack of awareness or trust in Fintech solutions.
- The research emphasized the importance of tailored strategies to address the specific needs and preferences of different demographic segments, thereby promoting greater inclusivity and adoption of Fintech services within the emerging economy context.

## CONCLUSION

In conclusion, the analysis of demographic dynamics and technological trends in emerging economies provides valuable insights into the factors driving fintech adoption. While population growth may indicate market potential, economic prosperity, digital infrastructure, and regulatory policies play equally crucial roles in shaping fintech

landscapes. The COVID-19 pandemic has further accelerated the shift towards digital financial services, highlighting the importance of resilience and adaptability in the face of global challenges.

Moving forward, policymakers, financial institutions, and fintech firms need to collaborate to foster greater inclusivity, address disparities, and harness the full potential of fintech to drive socio-economic development in emerging economies. By understanding the complex interplay between demographic factors, technological innovation, and regulatory environments, stakeholders can design tailored strategies to promote financial inclusion and digital transformation, ultimately leading to more equitable and sustainable economic growth.

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# CORPORATE SOCIAL RESPONSIBILITY AND OWNERSHIP STRUCTURE: ANALYSING THE IMPACT OF MANDATORY CSR

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## ABSTRACT

While extant scholarship examining the relationship between Corporate Social Responsibility (CSR) and ownership structure, no work has examined how Mandatory CSR impacts the CSR-Ownership structure nexus. Coercive pressure from law plays a crucial role in influencing how the ownership structure of companies can affect the CSR performance. Accordingly, it is crucial to understand the difference between CSR and ownership structure relationship before and after the implementation of Section-135 of the Companies Act, 2013 in the Indian context. In the present study, we draw on institutional theory to explore if the corporate sector responds to institutional pressures. Our analysis of a sample of NIFTY 100 index firms for the period 2010-2019 illustrates that the impact of ownership structure on CSR is higher in the period after the implementation of mandate. Our theoretical arguments and results

emphasize the value of multiple perspectives to evaluate the impact of Mandatory CSR on the link between CSR and ownership structure.

**Keywords:** Corporate Social Responsibility, Ownership Structure, Agency Theory, Institutional Theory, NIFTY 100, Panel Data

**JEL Codes:** C32, E31, E52, H62

## INTRODUCTION

Business organizations by using the economic, environmental, and social resources create debt, & Corporate Social Responsibility (CSR) is an obligation to repay such debt to society. The extant literature suggests numerous mechanisms through which corporate decision making is influenced by owners (Kochar & David, 1996; Oh et al., 2011). For instance, the agency theory proposes that in case the ownership of a company is widely distributed with no single owner holding a substantial percentage of shares, there will be little incentive for any owner to

devote time for monitoring and evaluating managerial decisions (Jensen & Meckling, 1976). Moreover, even if some minority shareholders are willing to oversee managerial decisions, they lack the voting power on the board to influence corporate decision-making. Consequently, the managers may prioritize their personal interest over what is best for the company (Fama & Jensen, 1983). On the flip side, when large shareholders hold a substantial amount of equity, they are more likely to actively monitor and intervene in corporate decision-making through shareholder activism (Smith, 1996) and directors' appointment on board (Admati et al., 1994). Accordingly, it seems arguably reasonable to assume that ownership is a stakeholder power aspect that can influence company CSR decisions (Ullman, 1985; Oh et al., 2011). Globally, a number of researches have explored the relationship between CSR and ownership structure (Halme & Huse, 1997; Haniffa & Cooke, 2002; Monteiro & Aibar-Guzman, 2010; Kansal et al., 2016; Madden et al., 2020). In India, traditionally, firms engaged in CSR through voluntary donations for environmental causes and community development, driven by philanthropic motives (Gupta & Kumar, 2022); however, the enactment of section-135 of the Companies Act, 2013 now mandates the corporate sector to allocate funds specifically for CSR activities (Gupta & Kumar, 2021). Interestingly, the institutional theory proposes that organizational practices are possibly guided by the broader environmental and social context. In this context, DiMaggio and Powell (1983) opined that companies exhibit similar practices, values, and structures as a

consequence of isomorphic pressures from law or regulation (coercive), stakeholder and general society (mimetic), and professional community (normative). This leads us to the question as to whether there is any difference between CSR and ownership structure relationship in the period of voluntary spending and period after the implementation of section-135 of the Companies Act, 2013?

Numerous studies have examined the impact of ownership structure on CSR, the findings are inconclusive with some studies suggesting positive relationship, for instance, executive ownership (Zahra, 1996), insider ownership (Kock et al., 2012), institutional shareholding (Johnson & Greening, 1999), and foreign ownership (Chapple & Moon, 2005). While others indicate a negative association, such as insider ownership (Oh et al., 2011), institutional shareholding (Arora & Dharwadkar, 2011), family ownership (Ho & Wong, 2001), and managerial ownership (Soliman et al., 2012). As a consequence of this empirical inconclusiveness, the study examines if there is a significant difference between CSR and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013. Further, as far as we are aware, this study is the first to examine if the coercive pressure from section-135 of the Companies Act, 2013 will influence how the ownership structure of companies impact the CSR performance. Following, Gupta and Kumar (2022), CSR is measured in terms of a CSR score obtained by aggregating scores on six themes viz community development, human resource, environmental activities,

development of rural areas, product and customer relation, & fair business. The score on each theme was obtained by examining the annual reports of companies for a period of ten years from 2009-2010 to 2018-2019 including five-years of the period of voluntary spending (2009-2010 to 2013-2014) and five-years from the period after the implementation of section-135 of the Companies Act, 2013 (2014-2015 to 2018-2019). Further, ownership structure was measured in terms of promoter ownership, government ownership, and foreign ownership (based on percentage of shares owned). To distinguish companies year-wise in both periods, a dummy variable POST was incorporated. The variable (POST) took the value of zero for the period of voluntary spending and one for the period after the implementation of section-135 of the Companies Act, 2013. The interaction terms (POST\*PROMOWN, POST\*GOVOWN, POST\*FOROWN) showed whether there is any difference between CSR and ownership structure relationship in the period of voluntary spending and period after the implementation of section-135 of the Companies Act, 2013. Since CSR performance of a company is a function of several other variables as well, the present study attempted to control the impact of some such variables. Therefore, leverage (LEV), age (AGE), size (SIZE), return on assets (ROA) were used as control variables.

The study makes several notable contributions, first, the CSR-ownership structure nexus has been examined previously primarily for the developed nations (Barnea & Rubin, 2010), and not for developing nations, particularly, India. Considering

the distinct socio-cultural factors between developed and developing countries & global economic trends, further research on CSR-ownership structure link from a developing economy perspective is justified. Second, the study categorized ownership structure into three groups (promoter, government, and foreign). Notably, prior work has not analysed the influence of ownership structure on CSR. Lastly, preceding research on CSR has been conducted in institutional environments where CSR is well established (Matten & Moon, 2008); however, by examining the impact of mandate in a developing country setting, the study finds that CSR-ownership structure link has distinct implications as compared to developed nations.

## LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Prior work suggests several theoretical perspectives to explain why companies disclose CSR and how owners and managers decide on the nature and extent of these disclosures (Muttakin & Subramaniam, 2015). Notably, the present study relies on the agency and institutional theories as decisions regarding CSR performance involve weighing costs and benefits by owners and managers operating within a principal-agent framework. Moreover, the dynamic socio-economic and regulatory landscape globally (particularly, India) is expected to exert diverse pressures on firms, compelling them to conform to and legitimize social activities (Sahasranamam et al., 2019).

The Agency theory (Jensen & Meckling, 1967) primarily focuses on principal-agent

link between managers and capital providers, where the separation of ownership and management leads to information asymmetry between principal and agents. Principal often employs bonding or monitoring mechanisms (management generated firm reports, boards, and board committees) to mitigate this gap, although both methods involve costs. However, these tools serve to align the interests of principals and managers, thereby reducing the cost of debt (Eisenhardt, 1989). Barako et al. (2006) noted that managers may choose to disclose information voluntarily to address agency issues with owners and demonstrate their commitment to acting in shareholders' best interests. Similarly, Barnea and Rubin (2010) articulated that managers who have lower level of ownership tend to invest excessively in CSR to gain personal reputational benefits.

The Institutional theory (DiMaggio & Powell, 1983) propounds that companies tend to adopt comparable practices, values, and structures due to isomorphic pressures from three sources: normative (influenced by professional communities), mimetic (driven by societal norms and stakeholders), and coercive (based on regulatory enforcement or law). Deegan (2009) contended that these pressures encourage firms to establish legitimacy and demonstrate compliance through formal disclosure. Likewise, Muttakin and Subramaniam (2015) predicted that mimetic pressure stemming from the National Voluntary Guidelines 2009, along with coercive pressure arising from the Department of Public Enterprises CSR Guidelines, are expected to significantly influence how the ownership structure of firms impacts the nature

and extent of CSR disclosure. In the same vein, Gupta and Chakradhar (2022) observed that as a consequence of CSR mandate management is likely to adjust company practices to enhance CSR spending, aiming to reap benefits (current and future) and gain legitimacy.

A summary of numerous research work investigating the CSR-ownership structure nexus is presented below:

**Halme and Huse (1997)** conducted a study to explore the relationship between environmental reporting and ownership concentration for forty companies from Scandinavian countries (Norway, Sweden, Spain, Finland) for the year 1992. The annual reports were subject to content analysis for collecting data on environmental disclosures. Further, the disclosures were categorized as: little or no information on environmental performance, a separate section (in annual reports) dedicated to environmental performance, and a separate section along with policy and future actions plans on environmental performance. The study concluded no significant relationship between corporate environmental reporting and ownership concentration. Moreover, the results also indicated industry as the most important factor influencing the environmental reporting by companies.

**Haniffa and Cooke (2002)** studied the relationship between extent of voluntary disclosures and firm-specific characteristics of one hundred and sixty-seven Malaysian companies for the year 1995. The annual reports of companies were content analyzed based on a disclosure index. Further, ownership structure was measured in terms of proportion

of shares held by top ten shareholders. The results of regression analysis indicated a significantly positive relationship between voluntary disclosures and ownership structure. Further, the study also concluded a positive and significant association between foreign ownership and extent of voluntary disclosures.

**Barako et al. (2006)** explored the impact of ownership structure on voluntary disclosure practices of fifty-four Kenyan companies from 1992-2001. The disclosure levels were measured using a forty-seven items-based disclosure index drawn from previous studies, representing the financial data, corporate social disclosure, general and strategic information, and forward-looking disclosures. Further, three dimensions of ownership structure (institutional ownership, shareholder concentration, and foreign ownership) were examined in the study. The results of regression analysis highlighted a negative relationship between shareholder concentration and voluntary disclosures while foreign and institutional ownership were positively and significantly associated with voluntary disclosures of companies.

**Monteiro and Aibar-Guzman (2010)** conducted a study to examine the impact of several corporate characteristics on the extent of environmental disclosure by one hundred and nine Portuguese companies from 2002-2004. The study developed an index of based on the content analysis of annual reports to examine the presence of environmental disclosures. The results reported no significant difference between the disclosure levels of foreign-owned and domestically-owned companies. Further, listing on stock market and firm size were

identified as having a positive relationship with the environmental disclosures level. The study also revealed no relationship between environmental certification and reporting.

**Soliman et al. (2012)** investigated the relationship between ownership structure and CSR disclosures for forty-two companies in Egypt for a period of three years from 2007-2009. The study used an unweighted CSR disclosure index drawn from previous studies to examine the extent of CSR related disclosures in annual reports of companies. Further, the study categorized ownership structure into foreign, managerial, and institutional ownership. The study highlighted a positive and significant association between CSR and foreign ownership & CSR and institutional ownership. The results also indicated that managerial ownership had a negative impact on CSR disclosures of companies.

**Muttakin and Subramaniam (2015)** studied the impact of firm ownership on CSR disclosures of top one hundred companies (market capitalization based) in India listed on the Bombay Stock Exchange for a period of five years 2007-2011. The annual reports of companies were content analyzed based on a seventeen items index adapted from prior studies representing four areas of CSR namely, human resource, community development, environment, and product/services for collecting CSR disclosure related information. Further, the study categorized ownership structure into promoter, foreign, and government ownership and the relevant data were collected from the Prowess database. The study mentioned a positive and significant

impact of foreign and government ownership on CSR disclosures but no significant effect of promoter ownership. Further, the results also indicated that government owned companies have responded actively to the new voluntary guidelines on corporate governance and CSR.

**Lau et al. (2016)** assessed the CSR-corporate governance relationship for four hundred and seventy-one companies in China in 2011. The study relied on Rankins composite CSR ratings to measure CSR performance of companies. Further, corporate governance mechanisms were represented by state-ownership of company, foreign experience of top management and board members, and board composition. The study reported a positive and significant CSR-corporate governance nexus. The study also indicated that state background serves as an incentive to companies to perform higher CSR relative to companies with lower state ownership.

**Lopatta et al. (2017)** examined the effect of different types of controlling ownerships on the CSR performance of one thousand five hundred and nineteen companies from multiple-country setting for a period of ten years from 2003-2012. The study relied on Global Engagement Services sustainability ratings for measuring companies' CSR performance. Further, ownership structure was categorized into state, institutional funds, individual, industrial, and banks & the relevant data were taken from the database of OSIRIS. It was found that state-government owned companies had better CSR performance while other forms of ownership structures had no significant impact on company's CSR performance.

The results also indicated that positive state ownership-CSR performance nexus was more noticeable in countries with higher stakeholder orientation.

**Huetal. (2018)** studied whether ownership type has any influence on the likelihood of publishing CSR report by one thousand eight hundred and thirty-nine companies in China for 2010. The study relied on a Whitepaper issued by the CASS-CSR for information on CSR. Further, the ownership data was collected from the database of Accounting Research and China Stock Market. It was found that state-owned companies were less likely to publish CSR-related reports compared with non-state-owned companies. Further, the study also mentioned that foreign ownership exerted a positive influence on the probability of issuing CSR reports.

**Sahasranamam et al. (2019)** studied the impact of ownership structure on CSR engagements of public companies in India listed on the National Stock Exchange and Bombay Stock Exchange for the period of eight years from 2008-2015. CSR was measured in terms of community engagement which was expressed as proportion of net sales spent on community and charitable donations. Further, the study explored the impact of three forms ownership structures namely, family ownership, government ownership, and business group ownership. Moreover, the effects of past financial performance, firm size, leverage, age, and financial slack were also controlled for investigating the relationship between two variables. The study reported that community engagements of companies were positively and

significantly impacted by family ownership while business group and government ownership had no significant effect.

**Madden et al. (2020)** studied the impact of ownership structure on CSR engagements of one thousand four hundred and thirty-six USA companies from 2007-2014. The MSCI ESG ratings were used to ascertain a CSR score for each company. Further, based on ownership structure companies were classified as family companies and non-family companies. The results of correlation and regression analysis indicated that family companies had higher CSR performance compared to non-family companies.

**Assaf and Saleh (2021)** explored the relationship between ownership (block-holder and managerial) and CSR for firms listed on Palestinian Security Exchange over 2009-2020. The study assessed CSR through content analysis across five categories: product, employees, value-added, environment, and community. The CSR level was quantified based on number of words identified in each category, reflecting the extent and specificity of disclosures made. The results implied a significantly positive CSR-blockholder ownership nexus, while a positive (not significant) link between managerial ownership and CSR.

**Lin and Ngyuyen (2022)** investigated the CSR-ownership relationship for sixty-five Vietnamese companies for the year 2019. Utilizing agency theory for the formulation of concept, the study relied on information sourced from annual reports, web sites, and CSRHub database. Further, based on ownership structure companies were classified as foreign, government, and managerial. The empirical

findings unveiled no significant relationship between government ownership and CSR performance, while a positive nexus between CSR and foreign and managerial ownership.

**Bataineh et al. (2023)** offered insights on the effect of corporate governance mechanisms (audit committee characteristics, board of directors, and ownership structure) on CSR disclosures practices of industrial Jordanian companies listed on Amman Stock Exchange over the period 2016-2021. The levels of CSR were assessed through the development of a CSR index. The results of panel regression confirmed the effects of diverse groups of shareholders on CSR engagement.

**Ramdhony et al. (2024)** explored the CSR-ownership structure nexus in an emerging economy context using a dynamic empirical framework. Data of over ten years were used to analyse how ownership structure, identity of controlling owners (block ownership, government ownership, and director ownership) influence CSR disclosure practices. CSR was assessed and scored using content analysis. The results of panel autoregressive model indicated a negative CSR-government ownership link highlighting the tendency for state investment in companies with limited transparency in disclosure practices. Further, CSR exhibited a weak negative response to block ownership. Lastly, the findings underscored that directors tend to hold shares in companies they manage particularly when CSR levels are low.

Despite extant research conducted in several countries, most of the evidence primarily consists of descriptions and anecdotes & lacks conclusivity and generalisability.

Moreover, prior work underscores the need to integrate the institutional and agency theory arguments for firms with diverse ownership structures, where key decision makers possess enhanced capabilities to navigate pressures from market and non- market actors, thereby balancing economic and social objectives within their institutional context (Kostova et al., 2008). Further, given that owners vary in their objectives and decision-making horizons, it is crucial to examine how these differences in ownership structures relate to a company's social performance (Hoskisson et al., 2022). The Indian economy ranks among the largest and swiftly-growing globally. Recently, India's GDP has surged by nearly 10% annually, approaching the growth rate of China and surpassing those of US. Interestingly, there has been significant momentum for Indian firms to embrace a business model-centric approach to CSR, evident in rapidly evolving regulatory landscape. Notably, the regulatory pressure may lead some owners to prioritize efficiency by reducing CSR efforts, while others may intensify their CSR activities to align with societal expectations and enhance legitimacy with stakeholders. Accordingly, it is crucial to examine the difference between CSR and ownership structure relationship in the period of voluntary spending and period after the implementation of section-135 of the Companies Act, 2013.

## RESEARCH METHODS

### Objective

The study aims to investigate the relationship between Corporate Social Responsibility

(CSR) and ownership structure in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013.

### Hypothesis

The agency theory propounds that with greater ownership concentration, there tends to be less information asymmetry and reduced potential for conflicts between principal and agents, thereby reducing the necessity for increased disclosure (Fama & Jensen, 1983). In this context, Muttakin and Subramaniam (2015) posited that in promoter firms where decision making power is highly concentrated, the costs of disclosure are likely to outweigh the benefits, since there is minimal need to appease other stakeholders. In the context of government owned firms, public disclosure of CSR performance serves as a crucial means to legitimise their activities (Ghazali, 2007). Mak (2003) argued that government owners pressurize companies to disclose more CSR information because government, being trusted by the public, needs to fulfil its obligation to stakeholders. Foreign owners are more attuned and responsive to the increasing expectations for business to demonstrate social accountability; therefore, they may succumb to coercive pressures by engaging in CSR disclosures as enforced by law (Oh et al., 2011). In this regard, Haniffa and Coke (2002) noted that foreign shareholders require greater corporate disclosure due to different values, better knowledge of market exposure, and geographic separation. Additionally, prior research underscores that coercive pressures

posed by regulatory guidelines explain the trend in CSR performance of companies (Muttakin & Subramaniam, 2015). For instance, Frost (2007) demonstrated a notable enhancement in the environmental performance of Australian companies following the implementation of section-299(1)(f) in the Corporation law (compulsory reporting of environmental performance). Similarly, Dong and Xu (2016) empirically validated that regulatory pressures surge the CSR levels of companies and are pivotal for improving corporate accountability and transparency. Accordingly, the study proposes that:

H1: There is a significant difference between Corporate Social Responsibility (CSR) and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013.

### **Sampling**

The present study sets out listed companies in India as the target population. Accordingly, the sample needs to be a good representative of listed companies in India. Moreover, sample selection should also consider the availability and accessibility of the requisite information. Hence, the sample of the present study comprised companies encompassing NIFTY 100 index. It includes 101 large market capitalization companies that represented about 76.8 per cent of the free float market capitalization of shares listed on the National Stock Exchange as on March 31, 2019 (NSE, 2019). Since the companies whose shares are traded on stock exchange are required to

disclose their audited financial statements to the general public every year, information on CSR and ownership structure of most sampled companies was available for the period of voluntary spending and after the implementation of the section-135 of the Companies Act, 2013.

Accordingly, NIFTY 100 index companies as on March 31, 2019 were taken as the sample in present study. Further, the sample was subjected to a systematic deletion process (Mir & Shah, 2018). Firstly, twenty-five financial services companies were dropped from the sample as such companies are guided by different regulations (Mir, 2019). Also, because these have lower direct impact on the environment relative to other sector companies (Mas et al., 2018). Secondly, one company with incomplete data was also deleted from the sample. This process provided a balanced panel data set of seventy-five companies for the study. In this regard, Gujarati and Porter (2009) suggested that a balanced panel data set offers the advantages of greater degrees of freedom and less collinearity among variables.

### **Period of the Study**

The idea of social responsibility is no stranger to the corporate sector in India. Starting over a century ago, many corporate groups voluntarily participated in various charitable and other activities that significantly benefitted society. However, global financial crisis of 2008 and corporate governance crisis in India in 2009 necessitated the implementation of somewhat radical efforts to provide greater recognition to the interests of stakeholders other than

shareholders. In this regard, “Corporate Social Responsibility Voluntary Guidelines” issued by the Ministry of Corporate Affairs (MCA) in 2009 bought the interests of stakeholders and its specific manifestations by way of CSR to the fore. It was the first time that company law in India pointed towards the interest of stakeholders (Dharmapala & Khanna, 2016). Later, in 2010, Ministry of Heavy Industries and Public Enterprises (MHI&PE) issued guidelines for public sector enterprises of central government to spend on CSR activities. Notably, both sets of guidelines were voluntary in nature. The concept of mandatory CSR found its place in section-135 of the Companies Act, 2013, which is a game-changer of sorts. The CSR provisions of the Companies Act, 2013 became effective from April 1, 2014. Hence, the period of study was 2009-2010 to 2018-2019 which included five years (2009-2010 to 2013-2014) from the period of voluntary spending and five years (2014-2015 to 2018-2019) from the period after the implementation of section-135 of the Companies Act, 2013.

### Data Sources and Instruments

The present study relied on secondary data sources. Since annual reports are the medium of communicating information about a company, the CSR practices undertaken by a company are also revealed in its annual reports. Accordingly, to ascertain the CSR score of companies in both periods, an attempt was made to construct an index based on the review of literature, activities in Schedule VII of the Companies Act, 2013, and recent initiatives taken by the Indian government for environmental and socio-economic

development of the country. The constructed index was used to collect information on the CSR practices of sample companies from their annual reports. The index contained forty-one items classified under six themes of CSR namely i) community development, ii) human resource, iii) environmental activities, iv) development of rural areas, v) product and customer relation, and vi) fair business. This is in line with several previous researches (Kansal & Singh, 2012; Gupta & Kumar, 2021). Further, the data on ownership structure, leverage, age, size, and return on assets were collected from the databases of ProwessIQ and Capitaline.

### Baseline Specification

The following specification was developed in relation to the objective and hypothesis of the study:

In consonance with previous studies (Muttakin & Subramaniam, 2015; Malik et al., 2017) the relationship between CSR and ownership structure in the period of voluntary spending and period after the implementation of section-135 of the Companies Act, 2013 was examined by estimating the following model:

$$CSR_{it} = B_{0i} + B_1 PROMOWN_{it} + B_2 GOVOWN_{it} + B_3 FOROWN_{it} + B_4 POST_t * PROMOWN_{it} + B_5 POST_t * GOVOWN_{it} + B_6 POST_t * FOROWN_{it} + B_7 LEV_{it} + B_8 AGE_{it} + B_9 SIZE_{it} + B_{10} ROA_{it} + \epsilon_{it} \quad (1)$$

In the aforementioned equation:

### Analytical Tools

The collected data were analyzed using statistical software such as Stata version 15. The details of

**Table. 1:Decription of Variables**

Variable	Description
$B_{0i}$	Each firm's time invariant intercept.
$CSR_{it}$	Corporate Social Responsibility (score) of firm "i" in year "t".
$PROMOWN_{it}$	percentage of shares owned by promoters for firm "i" in year "t".
$GOVOWN_{it}$	percentage of shares owned by government for firm "i" in year "t".
$FOROWN_{it}$	percentage of shares owned by foreign investors (including corporate bodies, institutions, promoter qualified foreign investors, individuals, and other foreign promoters) for firm "i" in year "t".
$LEV_{it}$	indicates leverage of firm "i" in year "t"
$AGE_{it}$	indicates age of firm "i" in year "t"
$SIZE_{it}$	indicates size of firm "i" in year "t"
$ROA_{it}$	indicates return on assets of firm "i" in year "t".
Additionally, to examine the difference between CSR and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013, a dummy variable (POST) was used to distinguish between two periods.	
$POST_t$	0 for the period of voluntary spending
$POST_t$	1 one for the period after the implementation of section-135 of the Companies Act, 2013.
The interaction effect:	
$POST_t * PROMOWN_{it}$	Shows whether there is any difference between CSR and ownership structure relationship in the period of voluntary spending and period after the implementation of section-135 of the Companies Act, 2013.
$POST_t * GOVOWN_{it}$	
$POST_t * FOROWN_{it}$	
$\epsilon_{it}$	Cross- section error component and $\epsilon_{it} \sim N(0, \sigma_{\epsilon}^2)$ .

analytical tools used for analyzing the data to obtain results is as follows:

### Content Analysis

The present study used content analysis to estimate the CSR scores of sample companies. The information disclosed in the annual reports of companies was used to collect data on CSR. Content analysis has been widely used in previous studies in the field of CSR (Bowman & Haire, 1975; Gupta & Kumar 2022). Following (Abbott & Monsen, 1979; Gupta & Kumar, 2021) the study obtained

CSR score by aggregating scores on six themes viz community development, human resource, environmental activities, development of rural areas, product and customer relation, & fair business. In this regard, if an item of the index was disclosed in a company's annual report it was given a score of 1, and 0 otherwise. However, if a similar information was disclosed more than once, it was given score only one-time. Likewise, if any disclosure had information on more than one theme of the index then it was given score under both the themes. The study followed Parsa et al. (2007)

and each item of the index was given equal weightage.

### **Descriptive Statistics**

Descriptive statistics assist in identifying patterns and trends, as well as summarizing the data. They also facilitate the understanding and interpretation of the entire data set in the study. In the present study, descriptive statistics provides an overview of dependent (CSR score) independent (ownership structure), and control (leverage, age, size, return on assets) variables.

### **Panel Data Analysis**

The present study used panel data methodology to estimate the model specified in the above section. Panel data offers various advantages, first, it helps in controlling the unobservable heterogeneity by assuming that the items are heterogenous (Moulton, 1986; Hsiao, 2003). Such individual heterogeneity is not controlled in cross-sectional and time series studies; therefore, panel data methodology produces unbiased results (Moulton, 1986). Second, it is argued that cross-section distribution seems stable; however, a large number of changes are hidden in it. In this regard, panel data helps in studying the dynamics of adjustments (Mir, 2019). Third, complicated models can be constructed using panel data methodology in a manner that helps in attaining greater technical efficiency (Klevmarken, 1989). Lastly, panel data methodology enhances efficiency, gives more information, increases variability, and decreases collinearity among variables (Koop & Steel, 2001). Park (2011) suggested that if individual effects are not present ( $U_i=0$ )

then ordinary least squares (OLS) produces consistent results. However, when the individual effects are present ( $U_i \neq 0$ ) and individuals are heterogeneous, then panel data gives best linear unbiased estimates (BLUE). Panel data helps in controlling for unobserved heterogeneity (Hsiao, 2003). In the presence of unobserved heterogeneity, the Gauss-Markov's assumptions of homoscedasticity (having common error variance) and no autocorrelation (no relationship between error terms) are violated by the OLS estimator. Hence, alternative methods of panel data modeling should be employed to address this issue. Fixed Effects (FE) and Random Effects (RE) models are most commonly applied for estimating panel data (Bell & Jones, 2015).

### **Fixed Effects and Random Effects against Ordinary Least Squares**

To determine whether OLS will provide consistent estimates or if another panel methodology should be used, formal test are conducted. Primarily, the comparison between FE model and OLS is made using F-test for fixed effect. The test is used to determine whether the goodness of fit of the model can be improved using FE model. Similarly, the comparison between RE model and OLS is made using Breusch and Pagan Lagrange Multiplier test. This test evaluates whether employing the RE model enhances the model's goodness of fit in the study. Further, the decision between FE and RE model, is based on Hausman test.

### **Fixed Effects**

It is appropriate to use fixed effects (FE) model if one has to examine the significance

of variables that vary over time. It basically analyzes the relationship between dependent variable and explanatory variables within an entity. Therefore, FE is a within-group estimation. Each entity (company in the present study) is assumed to have its own specific characteristics and the dependent variable may or may not be affected by them. The use of the FE model assumes that the dependent variable is influenced or biased by factors specific to an entity, necessitating control of these factors. This assumption is based on the idea that the error term of an entity is correlated with explanatory variables in the model. Thus, FE model determines the net effect of predictors by eliminating the influence of time-invariant characteristics from the explanatory variables. Importantly, FE model assumes that these time-invariant characteristics are specific to each entity and are not correlated with other individual features. Each entity is assumed as distinct; hence, there is no correlation between the error term and constant of entities with each other. The representation of functional form of FE model is:

$$Y_{it} = B_{0i} + B_1 X_{1it} + B_2 X_{2it} + \dots + B_k X_{kit} + \varepsilon_{it}$$

Where,  $B_{0i}$  = Unit specific unobserved heterogeneity and  $\varepsilon_{it}$  = Conventional error term ( $\varepsilon_{it} = N(0, \sigma^2 \varepsilon)$ )

### Random Effects

Random effects (RE) is based on the assumption that entities (companies in the present study) are random and not correlated with the model's explanatory variables. It examines the variation across entities; therefore, is a between-group estimation. It is appropriate to use RE model

when the difference across entities impacts the dependent variable. A key advantage of the RE estimator is its ability to identify the coefficient of time-invariant predictor variable. It operates under the assumption that variation across cross-section entities is random and uncorrelated with the independent variables included in the model. The RE model is also known as error component model because the individual effects are considered as composite error term's part. The representation of functional form of RE model is:

$$Y_{it} = B_0 + B_1 X_{1it} + B_2 X_{2it} + \dots + B_k X_{kit} + V_{it}$$

Where,  $V_{it}$  = Composite error term ( $V_{it} = \varepsilon_{it} + U_{it}$ ) and  $V_{it} = \text{IID}(0, \cdot)$ . Further, here  $\varepsilon_{it}$  is the conventional error term and  $U_{it}$  is the unit specific error term.

### Diagnostic Testing

In order to select an appropriate model checking various assumptions of regression is important. This ensures that the results are reliable and accurate. In the present study, techniques used to check regression assumptions are as follows:

### Multicollinearity

The problem of multicollinearity may arise in a study involving several explanatory variables. Gujarati (2011) suggested that multicollinearity is a situation of more than one perfect linear relationship. In case of high collinearity between two variables segregating the individual influence of each explanatory variable on the regress becomes difficult; consequently, the statistical inference becomes biased. In order to check for multicollinearity,

the present study used variance inflation factor (VIF). Primarily, this technique ascertains the degree of inflation in the variance of the OLS estimator. VIF is an index that quantifies the increase in variance of an estimated regression coefficient due to collinearity. It is expressed as the “ratio of variance in a regression model with multiple terms, divided by the model with one term alone”.

$$\text{Variance Inflation Factor} = (1/1-R^2)$$

If any variable has a VIF value of one it shows no collinearity, between one to ten it shows moderate collinearity, while more than ten shows high collinearity and such variable requires further investigation (Field, 2005).

### **Heteroscedasticity**

In the classical linear regression model error terms are assumed to be homoscedastic across observations. However, the violation of this assumption causes heteroscedasticity (Gujarati, 2011). This problem may arise due to grouping of data, outliers in data, and wide range of explanatory variables (Greene, 2003). The presence of heteroscedasticity produces inefficient estimates because of inconsistent covariance matrix of regression coefficients. In the present study, Modified Wald statistic was used to check heteroscedasticity (Greene, 2003). In this, the null hypothesis asserts that the variance of error term is homogeneous. Therefore, if  $p$  value for modified Wald statistic is very small (less than the significance level) it indicates variance of error term is heterogeneous. Hence, we would have to accept alternative hypothesis.

### **Serial Correlation**

Another assumption of classical linear regression model is uncorrelatedness between error term at time ( $t$ ) and past error terms (no serial correlation). The problem of non-zero covariance in the error term can arise due to several reasons such as cobweb phenomenon, specification bias, inertia, lags, manipulation of data, data transformation, and non-stationarity. However, the presence of serial correlation produces inefficient regression coefficients. Moreover, the ‘F’ and ‘t’ statistics become unreliable and standard error becomes inaccurate. In the present study, Wooldridge test was used to check serial correlation (Wooldridge, 2003). The null hypothesis of test asserts no serial correlation between error terms. Therefore, if the  $p$  value of Wooldridge test is very small (less than significance level) it indicates that error terms are serially correlated. Therefore, we would have to accept the alternative hypothesis.

### **Robust and Cluster-Robust Standard Error**

Robust standards can be used to rectify the existence of heteroscedasticity (Imbens & Kolesar, 2016). These are also known as White’s heteroscedasticity corrected standard error. Moreover, robust standard error can be smaller and larger compared to normal (uncorrected) standard error.

Further, cluster-robust standard error can be used to rectify the problems of heteroscedasticity and autocorrelation (Petersen, 2009). These are also known Newey-West standard errors or HAC (heteroscedasticity and autocorrelation

consistent) standard errors. Notably, both these errors are valid in asymptotic (large) samples and not for small samples (Gujarati & Porter, 2009).

## RESULTS

### Descriptive Statistics

The descriptive statistics of variables used in the study are presented in Table II. This fundamental analysis paved the way for a more in-depth and elaborate investigation.

It was found that the mean CSR score of sample companies was 22.52 and the median CSR score was 24. Notably, the minimum CSR score of zero signified that virtually no CSR related activities were undertaken by companies in some year/s. Further, the maximum CSR score (36) was substantially higher than the mean CSR score implying that over the study period companies had emphasized on diverse themes of CSR. The standard deviation of 7.73 indicated a high variation in CSR scores. The result was also supported by large gap

between the maximum and minimum values vis-à-vis CSR score. This could be because companies had paid attention only to few CSR areas in the period of voluntary spending but the implementation of section-135 of the Companies Act, 2013 had compelled companies to focus on diverse CSR areas.

Further, for ownership structure, it was observed that the mean and median values for promoter ownership (PROMOWN) were 53.45 per cent and 54.97 per cent respectively. This denoted that on average 53.45 per cent shares in sample companies were owned by the promoters. Additionally, percentage of shares owned by the promoters varied from zero to 90 per cent. Also, with coefficient of standard deviation equals to 19.66 per cent the variation in promoter ownership had remained high. Similarly, for government ownership (GOVOWN), mean value was 9.39 per cent and median value was zero. The percentage of shares owned by government ranged from 0 to 90 per cent. Moreover, about thirteen sample companies had government ownership. Again,

**Table. 2: Descriptive Statistics**

Variable	Mean (Median)	Minimum (Maximum)	Standard Deviation	Skewness	Kurtosis
CSR	22.52 (24)	0(36)	7.73	-0.72	3.07
PROMOWN	53.45(54.97)	0(90.00)	19.66	-0.91	3.72
GOVOWN	9.39(0)	0(90.00)	23.49	2.25	6.43
FOROWN	13.78(0)	0(80.47)	23.24	1.46	3.62
LEV	0.15(0.09)	0(0.68)	0.15	0.86	2.75
AGE	42.18(35)	3(112)	24.25	0.77	2.83
SIZE	12.02 (11.92)	7.91(15.87)	1.41	0.06	2.63
ROA	0.16(0.15)	-0.39(0.57)	0.10	0.44	4.78

the high value of standard deviation (23.49 per cent) suggested greater variation in government ownership. Likewise, for foreign ownership (FOROWN), the mean and median values were 13.78 per cent and zero respectively. This signified that on average 13.78 per cent shares in sample companies were owned by the foreign investors. Further, the percentage of shares owned by foreign investors varied from zero to 80.47 per cent. Also, with coefficient of standard deviation equals to 23.24 per cent, the variation in foreign ownership had remained high. Overall, about thirty-nine companies had foreign ownership.

In relation to control variables, it was observed that the mean value of leverage (LEV) was 0.15 and the median value was 0.09. This denoted that on average a company had used 15 per cent debt in its capital structure. Notably, the minimum and maximum values of leverage were zero and 0.68. Overall, debt constituted a substantial part of the capital structures of companies in the study period. Further, low value of standard deviation (0.15) highlighted a smooth variation in the level of leverage used by companies. In addition to this, it was found that mean and median values of companies' age (AGE) were 42.18 and 35 respectively. This showed that on average sample companies were incorporated 42.18 years ago. The minimum value for age was 3 years and the maximum value was 112 years. This huge gap between the maximum and minimum values implied that sample encompassed heterogeneous age groups of companies. This was also supported by the large coefficient of standard deviation i.e. 24.25 years. Referring to the descriptive statistics for companies' size (SIZE) it was

observed that the mean value was ₹16604.27 crore and the median value was ₹15024.16 crore. Again, the large difference between the maximum value (₹780285.30 crore) and minimum value (₹272.44 crore) signified the heterogeneity among companies. However, the low value of standard deviation indicated that the variation in size was quite compact. Lastly, the mean and median values for return on assets (ROA) were 0.16 and 0.15 respectively. This denoted that companies had effectively utilized their assets during the ten-year study period. The negative minimum value (-0.39) showed that some companies failed to use their assets effectively. Moreover, the small coefficient of standard deviation signified steady ROA of companies over the period of study. In general, low variation suggests that the data are mean reverting i.e. data points eventually return to mean values over a period of time. Therefore, the low value of standard deviation implied that ROA of companies moved towards the mean value over the study period.

### Panel Regression Model

The difference between CSR and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013 was ascertained by estimating Equation (1). In order to determine the most appropriate model among ordinary least square (OLS), fixed effect (FE), and random effect (RE), different specification tests such as F test for fixed effects, Breusch and Pagan Lagrange Multiplier test (BP-LM), and Hausman test were used. In case of F test for fixed effects and BP-LM test, if the  $p$  value of test statistic is greater than the

level of significance, the null hypothesis is not rejected and OLS model is more appropriate model. Further, alternate hypothesis for F test is that fixed effect model is more appropriate (Hsiao, 2003), while for BP-LM test the alternate hypothesis is that random effect model is more appropriate (Breusch & Pagan, 1980). To determine the most appropriate model between FE and RE, Hausman test was performed. Accordingly, low  $p$  value counts against the null hypothesis i.e. individual effects are not correlated with regressors implying the consistency of FE model over RE model (Hausman, 1978).

Table III gives the regression results of difference between CSR and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013. It was observed that  $R^2$  of the model was 63 per cent which indicated that all predictor variables jointly explained 63 per cent of variation in the dependent variable. Further, F statistic for the specification was significant at 1 per cent level. This implied that goodness-of-fit of the model could be improved significantly using FE model over OLS. Additionally, the test statistic of BP-LM test for random effects was also significant at 1 per cent level signifying that heterogeneity could be dealt better using RE model. Overall, the results suggested use of alternate panel data model (FE and RE) over OLS to produce better estimates. Therefore, Hausman test was used to choose between FE and RE models. The results revealed that the Hausman test statistic was significant at 1 per cent level, indicating preference of FE over RE model to produce BLUE estimates. Panel data

modelling also raises concerns for the presence of multicollinearity, heteroscedasticity, and serial correlation. Multicollinearity is a situation of significant correlation among two or more explanatory variables (Kalnins, 2018). It causes the likelihood of obtaining unexpected signs of variables and increases the standard errors and variance. Therefore, it is necessary to check for the presence of multicollinearity. Variance Inflation Factors (VIFs) were used to examine if an independent variable was explained by other independent variables (Akinwande et al., 2015). It was observed that multicollinearity was not a cause of concern as VIFs for all independent variables were less than 10. Further, heteroscedasticity occurs when the variance of distribution from which the observations of the error term are drawn is not constant and is shown to surge as variable X increases (Studenmund, 2015). This leads to the violation of a classical assumption and therefore the estimates turn inefficient. The presence of heteroscedasticity was checked using Modified Wald Statistic. This test runs under the null hypothesis that variance of the error term is constant for all observations in the sample (Greene, 2003). It was found that the test statistic was significant at 1 per cent level. Hence, the null hypothesis was rejected in favour of the alternate hypothesis which implied presence of heteroscedasticity in the model. In addition to this, serial correlation refers to the situation of linear correlation between the error terms of two distinct time periods (Watson, 1955). In the presence of serial correlation estimates do not remain BLUE. Therefore, to examine the presence of serial correlation Wooldridge

**Table. 3: Difference Between CSR and Ownership Structure Relationship in the Period of Voluntary Spending and after the Implementation of Section-135 of the Companies Act, 2013.**

Variable	Coefficient	Standard error	VIFs
PROMOWN	0.0666**	0.0275	1.65
GOVOWN	0.0842**	0.0344	2.69
FOROWN	0.1120***	0.0359	2.71
POST*PROMOWN	0.0786***	0.0123	2.40
POST*GOVOWN	0.0796***	0.0234	2.40
POST*FOROWN	0.0300*	0.0181	3.06
LEV	-5.8742**	2.4770	1.46
AGE	4.0797***	0.9650	1.15
SIZE	4.4573***	0.3709	1.64
ROA	2.1806	2.7844	1.47
CONSTANT	-50.9070***	5.2167	
F-stat	13.36***		
BP-LM Test	669.57***		
Hausman Test	120.02***		
R <sup>2</sup>	0.63		
Hetttest	3005.11***		
Serial correlation	122.17***		
Observations	750		

**Notes:**

- The table reports empirical results after the estimation of:  

$$CSR_{it} = B_0 + B_1 PROMOWN_{it} + B_2 GOVOWN_{it} + B_3 FOROWN_{it} + B_4 POST_t * PROMOWN_{it} + B_5 POST_t * GOVOWN_{it} + B_6 POST_t * FOROWN_{it} + B_7 LEV_{it} + B_8 AGE_{it} + B_9 SIZE_{it} + B_{10} ROA_{it} + \epsilon_{it}$$
- The results were obtained using Fixed effects model.
- Standard errors are HAC (heteroscedasticity and autocorrelation corrected).
- The variables are same as defined in section-3.7 of chapter-3.
- \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

test was used. The null hypothesis of the test is of no autocorrelation (Wooldridge, 2003). The test statistic was found significant at 1 per cent level indicating presence of serial correlation. Therefore, cluster-robust standard errors were used to allow for the problems of heteroscedasticity and serial correlation (Petersen, 2009).

Overall, the results of regression analysis denoted that coefficients of POST\*PROMOWN, POST\*GOVOWN, and POST\*FOROWN were 0.0786, 0.0796, and 0.0300 respectively, which were positive and significant at conventional levels. Therefore, alternate H1 was accepted i.e. there is a significant difference between Corporate Social

Responsibility (CSR) and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013. Further, the nature of difference was positive i.e. the impact of ownership structure on CSR was higher in the period after the implementation of section-135 of the Companies Act, 2015.

## DISCUSSION

The findings could be explained in the light of Chiu and Sharfman's (2011) argument that owners of companies are concerned about CSR because it is considered a way to improve their visibility, reputation, and image. The results were also substantiated by Roberts (1992) who opined that strategic decisions of a company related to CSR performance are influenced by its ownership structure. Moreover, owners consider CSR as a tool for creating, optimizing value, and managing risk. Therefore, ownership structure is relevant for CSR (Crisistomo & Freire, 2015). This view was also supported by Hossain et al. (1994) & Chau and Gray (2002). Further, results of the present study were also corroborated by Hoskisson et al. (2000), who argued that coercive pressures play a crucial role in compelling companies to behave in a socially responsible manner. Likewise, Scott (2002) indicated that institutional constraints imposed on companies give rise to isomorphic practices and pressures. Therefore, companies have to adopt these to secure a legitimate role in society. The results were also in consonance with the Institutional theory, which posits that social behaviour of a company is influenced by the institutional requirements such as public

awareness, laws, regulations, and industry standards (Campbell, 2007). Further, Godrick and Salancik (1996) revealed that ownership structure exerts a differential influence on responsiveness and receptivity to CSR related institutional pressures. The same was supported by Eisenhardt (1988), who asserted that presence of regulatory institutional pressure compels companies' owners to increase CSR performance to conform to expected social behaviour and enhance organizational legitimacy. For promoter ownership, the results were in tune with Zellweger and Nason (2008) who proposed that promoter owned companies respond to CSR related institutional pressures in a substantive manner in order to preserve their high social status and identity in community. Similarly, for government ownership, Mohan (2001) documented that in India historical factors lead government companies to be seen as social and economic providers of local communities. Therefore, it is highly likely that government companies will be more attuned to regulatory pressures for providing social benefits. Also, Subramaniam et al. (2017) noted that greater receptivity of government companies to rising regulatory pressures for CSR results in higher prioritization of social goals by government owners. In this context, Muttakin and Subramaniam (2015) suggested a positive impact of 2009 CSR guidelines and National Voluntary Guidelines on corporate governance on CSR performance of government owned companies. In regard to foreign ownership, Haniffa and Cooke (2005) highlighted that foreign owners are more sensitized to growing CSR expectations from business in order to please ethical investors and assure continuous

inflow of capital. Therefore, foreign owners are more likely to concede to regulatory pressures. Moreover, greater foreign ownership generally signifies powerful influence of foreign practices (Jeon et al., 2011). Consequently, demand for CSR will be higher (Bradbury, 1991). Nevertheless, the results contradicted Swandari and Sadikin (2016) who indicated that a company's ownership structure is incapable of promoting CSR performance. However, the study conducted by Walsh and Seward (1990) confirmed that major stakeholders and concentrated ownership have a positive impact on CSR engagements. Despite above, the results of the study differ from Halme and Huse (1997) & Prado Lorenzo et al. (2009) who found no association between ownership structure and CSR. Also, the results downplayed the trend witnessed in previous studies that denoted a negative relationship between ownership concentration and CSR (Li & Zhang, 2010; Ghoul et al., 2016).

The findings vis-à-vis control variables revealed that leverage (LEV) had a negative and significant impact on CSR. The results were in consonance with Branco and Rodrigues (2008) & Swandari and Sadikin (2016). The negative leverage-CSR relationship could be attributed to the fact that highly leveraged companies are associated with higher interest expenses. Thereby, reducing the availability of funds to spend on CSR activities (Ogolmagai, 2013). Also, high debt companies focus more on dealing with borrowing related problems than CSR investments (Tarek, 2019). Notably, age (AGE) was found to have a positive and significant impact on CSR. Numerous researchers such as Roberts (1992) & Al-Gamrh

and Al-Dhamari (2016) have suggested a positive relationship between company age and CSR. In this regard, Withisuphakorn and Jiraporn (2015) documented that older companies have more stability, predictable cash flows, and performance. On the other hand, younger companies experience more growth and unpredictable cash flows; therefore, they are left with less cash to spend on CSR. Moreover, mature companies can afford to spend more on CSR activities than younger companies. In line with Gantowati and Agustine (2017), the study showed a positive and significant relationship between company size (SIZE) and CSR. In this context, Sembiring (2005) opined that bigger companies share a complex relationship with their stakeholders, as a result, they face more requirements. Thereby, creating more pressure on bigger companies to invest in CSR activities. Further, return on assets (ROA) was found to have a positive impact on CSR. However, the results were not statistically significant. As per the slack resource theory, profitable companies are more likely to be committed to CSR participation because they have more financial slack (Shahzad et al., 2016). Moreover, high profitability makes management free to exhibit concern towards CSR (Giannarakis, 2014). However, the statistically insignificant impact could be attributed to the managerial opportunism hypothesis proposed by Preston and O'Bannon (1997) which posits that corporate managers consider their personal goals of primary importance to the detriment of stakeholders. Therefore, in case of higher profits they "cash in" to enhance their personal short-term gains and reduce expenditure on CSR. Consequently, the positive impact of

ROA on CSR is neutralized by the pursuit of private goals by corporate managers.

Overall, it can be concluded that there was a significant difference between CSR and ownership structure relationship in the period of voluntary spending and after the implementation of section-135 of the Companies Act, 2013.

## **CONCLUSION, IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH**

The study directs theoretical focus towards examining CSR-ownership structure nexus within an underexplored emerging market context-India. Drawing on agency and institutional theories, the study contends that there is a difference between CSR and ownership structure relationship in the period of voluntary spending and period after the implementation of section-135 of the Companies Act, 2013. The study examines a highly representative sample of listed companies i.e. NIFTY 100 index companies. Further, the period of study ranges from 2009-2010 to 2018-2019 including five years from the period of voluntary spending (2009-2010 to 2013-2014) and five years after the implementation of section-135 of the Companies Act, 2013 (2014-2015 to 2018-2019). The results indicate that the impact of ownership structure on CSR was higher in the period after the implementation of above stated mandate. In light of recent work by Gupta and Chakradhar (2022), we believe that presence of regulatory institutional pressures compels companies' owners to increase CSR performance to conform to expected

social behaviour and increase organizational legitimacy (Gupta & Chakradhar, 2022). Notably, the findings depart from evidence in other countries such as USA (Matisoff, 2013) and UK (Baboukardos, 2017) where mandatory CSR was observed to reduce the CSR engagement and disclosure. Accordingly, the study underscores the importance of considering variations across countries in terms of their institutional environment and economic development while exploring the impact of mandate.

The study contributes several theoretical insights to the existing literature. First, it expands the CSR literature (Lau et al., 2016; Madden et al., 2020) by investigating how different types of ownership structure are linked to CSR practices in firm. Second, our research investigates how institutional factors influence CSR. The findings build upon recent studies (Muttakin & Subramaniam, 2015) by proposing that institutional theory provides complimentary and promising explanations for the CSR practices of corporate sector in emerging markets. Therefore, external influences should be taken into account while analysing the varied impact of dominant shareholders on CSR performance. Lastly, through its examination of CSR practices among Indian firms, the study bridges the corporate governance and international CSR literature, responding to the calls from corporate governance scholars (Strange, 2013) and IB scholars (Brammer et al., 2009) for enhanced interaction between CSR and IB research.

Furthermore, the findings have practical implications. First, the study reinforces the legitimacy of mandatory CSR implemented by the Indian government. Second, the study

offers valuable insights for government policies on foreign ownership restriction. In consonance with prior work (Haniffa & Cooke, 2005), the study highlights the potential positive impact of foreign ownership on CSR. Therefore, increasing foreign ownership in domestic companies might encourage social investments and promote socially responsible management.

Despite the contributions mentioned above, this research has some limitations. First, the study was conducted within a single institutional context (India); hence, the results reflect specific characteristics of Indian business environment. Thus, subsequent studies could employ can employ this empirical approach to revisit the issue raised in this paper, utilizing data from diverse economies. Further, a longer time series would enable further analysis that was not feasible in this study. Second, the study concentrates only on examining how mandatory CSR has impacted the relationship between CSR and ownership structure. However, to garner a thorough understanding of CSR-ownership structure link, other factors (such as gender diversity, board independence, and board size) need to be explored. Accordingly, further research is warranted on various aspects of board diversity and their influence on CSR performance.

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