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PDUAMT BUSINESS REVIEW

An International Peer-Reviewed Annual Journal of Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya
Tulungia, Bongaigaon, Assam, India

Volume: VII **2025**

CONTENTS

Editor
Dr. Payal Dutta

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PATRON'S MESSAGE

It is indeed a great pleasure for me to extend my warmest greetings and heartfelt congratulations to the editorial body of **"PDUAMT BUSINESS REVIEW" an International Peer-reviewed Annual Journal of Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia,** on the eve of publication of the Journal of Eighteen selected articles from the writers across the country and abroad highlighting different aspects of Commerce and Economics.

It is well known that the Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya (PDUAM) Tulungia, is one of the premier higher educational institutes in the western part of Assam, which has the reputation of imparting quality education in different disciplines and has been instrumental in shaping the future of our young generation. I take this opportunity to compliment the editorial board as well as the contributors of articles to the journal.

On this special occasion of publication of the Journal, I extend my deepest appreciation to the editorial body for their meticulous efforts in bringing out this issue of "PDUAMT BUSINESS REVIEW". I urge the editorial body to continue their pursuit of knowledge, to embrace innovation and to actively thrive in the overall development of Commerce and Economic thoughts among the young generation.

(Dr. Phatik Chandra Kalita)

Principal
PDUAM Tulungia, Bongaigaon
Date: 10th December, 2025

Editorial

Dear Readers,

It is a matter of great privilege to present the seventh edition of PDUAMT Business Review. The journal continues to serve as a platform for the dissemination of original and innovative ideas, encouraging scholars and practitioners from across the globe to contribute their work in the fields of Commerce, Business, Economics and allied disciplines.

The current edition of the journal features diverse collection of review articles, exploratory research papers and case studies with themes ranging from international to local contexts. The articles included in this volume reflect the rapidly evolving landscape of Finance, Marketing, Corporate Governance, Technology and Socio-economic development from a global perspective. Collectively, the articles provide a rich blend of theoretical depth, empirical evidence and practical relevance focusing on analytical tools available for modelling complex business processes. The findings generated from the research studies are expected to offer valuable perspectives for researchers, policymakers and practitioners alike.

I express my heartfelt gratitude to our respected Principal, Dr. Phatik Chandra Kalita sir for his unwavering support and guidance in the successful publication of this journal. My sincere appreciation also goes to the members of the internal and external advisory boards of the journal for their invaluable cooperation throughout the editorial process. Special thanks are extended to the panel of reviewers who devoted their time to evaluating the manuscripts and providing timely, constructive feedback that ensured the smooth and efficient completion of the editorial work.

Above all, I convey my deep appreciation to the contributors whose scholarly work have enriched this edition. Their commitment to engaging with the review process and submitting revised manuscripts on time is truly commendable. I warmly encourage researchers and scholars to continue contributing to future editions of the journal.

Long live the PDUAMT Business Review!

Dr. Payal Dutta

Editor

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DETERMINANTS OF BANKING SECTOR CONFIDENCE IN ZIMBABWE

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Abstract

The Zimbabwean banking sector has been experiencing a prolonged confidence crisis, which commenced two decades ago; depositors are continually channelling funds through the informal sector, thereby disrupting the role of banks in financial intermediation. Deposits are increasingly becoming transitory, clearly manifesting low public confidence in the banking system. Using the Random Utility Theory, the research study critically assessed the main determinants of banking sector confidence in Zimbabwe. The Probit regression modelling approach was used as an estimation technique. Structured questionnaires were used to collect data from the central bank, bank managers, and clients. The study's findings revealed that deposit protection schemes, financial inclusion and corporate governance are crucial in building and maintaining public confidence in banks.

Keywords: Depositors, Determinants, Public confidence, Probit regression, Financial intermediation, Random utility theory, Banking system

JEL Classification: C01, C21, C50, G21, O16

Introduction

There is an element in the readjustment of our financial system more important than currency, more important than gold, and that is the people's trust (Roosevelt, 1993). This statement underscores the central role of confidence in maintaining a robust and stable financial system. The financial sector is inherently fragile, with its stability hinging on trust and confidence from all participants. Consumer trust is widely regarded as an anchor for a competitive and stable economy, forming the foundation of a strong financial system. Instances like the Great Depression of 1933 and the Global Financial Crisis of 2008 have repeatedly demonstrated the catastrophic effects of eroded confidence, as depositors and investors questioned the viability of financial systems (Gerali and Passacantando, 2007). Confidence is, therefore, a marker of stability and a critical determinant of financial resilience.

Globally, a lack of confidence in the banking sector has had profound consequences, including disruptions in financial intermediation and economic slowdown. Armstrong (2012) propounded that low confidence amplifies vulnerabilities, jeopardizes investments, and diminishes economic growth. This reality became particularly apparent in the aftermath of the 2008 financial crisis, during which confidence in banking systems plummeted to unprecedented levels. This crisis served as a wake-up call for financial institutions, highlighting the significance of consumer trust in economic systems and emphasizing the need for financial systems to deliver with integrity and transparency (Shim, Serido and Tang, 2013).

The Zimbabwean banking sector has not been immune to these challenges. For over a decade, it has grappled with a prolonged crisis of confidence, characterized by cash shortages, withdrawal limits, long queues, and bank failures (Mataranyika, 2015). These failures, often coupled with the closure of banks and placement under curatorship, have profoundly shaken public trust. Dhliwayo (2015) highlights that the banking public in Zimbabwe has endured

significant psychological, emotional, and financial trauma, with many depositors losing their life savings and some accounts being frozen.

A notable period of relief came in 2009 with the introduction of the multi-currency system, which curtailed hyperinflation and stabilized the economy (Kramarenko *et al*., 2010). This policy initially restored a measure of confidence, as evidenced by a 31.8% increase in deposits within six months (KPMG, 2012). However, new challenges emerged; including liquidity constraints, poor governance practices, and inadequate risk management, further eroding confidence (Dzomira, 2016). These issues were exacerbated by high bank charges, negligible interest on deposits, and punitive lending rates (Kupakuwana, 2018).

Efforts by the Reserve Bank of Zimbabwe (RBZ) to stabilize the sector, including the introduction of bond notes and increased capital requirements, have met with limited success. Instead, these measures have been met with widespread anxiety, as they reminded the public of the hyperinflation era (Worton, 2017). The persistence of cash shortages and the circulation of substantial sums outside the formal banking system ($6 billion as of 2018) signal deep-seated mistrust. Even internationally, Zimbabwe's banking system has faced scepticism, with high-risk premiums demanded for short-term funds (RBZ Monetary Policy Statement (MPS), 2018)

The challenges faced by Zimbabwe's banking sector have not only disrupted financial intermediation but also incentivized alternative financial solutions, such as mobile money services, further diminishing the sector's relevance. Despite these challenges, consumer trust remains a crucial area that requires focus. Without it, the banking sector cannot fulfil its role as a financial safety net or contribute meaningfully to economic recovery and growth (Sandada and Magobeya, 2016).

In this context, the study sought to critically assess the key determinants of confidence in the Zimbabwean banking sector. Ultimately, it sought to provide actionable insights to strengthen public confidence enhance the resilience of the banking system and provide a roadmap for rebuilding trust in Zimbabwe's financial system. The remainder of the paper is organised as follows: Section II presents a review of literature; Section III presents the main objective of the study. Section IV outline significance of the study. Section V describes the methodology. Section VI presents and discusses the findings of the study. Section VII presents the conclusion of the study. Finally, recommendations are presented in Section VIII.

Review of Literature

Banking sector confidence is a crucial determinant of the stability and efficiency of financial systems, particularly in economies like Zimbabwe's, which have experienced significant financial instability. Confidence in the banking sector is influenced by various factors, including macroeconomic conditions, regulatory frameworks, the quality of bank governance, and the level of trust depositors have in banks. Among the primary determinants are inflation rates, interest rates, exchange rate volatility, political stability, and public perceptions of financial institutions. High inflation, political instability, or a weak regulatory environment can undermine depositor confidence, while strong governance, transparency, and robust economic policies tend to enhance trust in the banking system (Guntara, 2020; Ascarya, 2020).

Theoretical Review

Several theories provide a framework for understanding confidence in the banking sector. First, the Information Asymmetry Theory, introduced by Akerlof (1970), suggests that confidence is diminished when depositors have less information than banks about the safety of their deposits,

leading to mistrust. This lack of information creates a knowledge gap that causes uncertainty, thereby affecting the willingness of depositors to trust the banking system. Second, the Signalling Theory, developed by Spence (1973), posits that banks can signal their strength and reliability through transparent reporting, adherence to regulations, and maintaining adequate capital reserves. This helps reduce depositor uncertainty by providing clear indicators of financial stability, thus boosting confidence. Third, the Trust-Based Theory of Financial Intermediation, as revised by Diamond (1984), highlights the critical role of trust in banking operations. Trust mitigates uncertainty and risk in financial transactions, facilitating smoother intermediation between depositors and borrowers, which in turn strengthens confidence in the banking sector.

Additionally, the Random Utility Theory, initially introduced by Thurstone (1927) and extended by McFadden (1974), provides a behavioural perspective on decision-making under uncertainty. This theory posits that individuals make decisions by weighing the utility or value of each available option, factoring in probabilities of outcomes influenced by personal preferences and available information. In the context of the banking sector, depositor confidence can be viewed as a function of perceived utility derived from engaging with a bank versus the perceived risks. For instance, depositors evaluate the benefits of services offered, transparency, and institutional stability against potential risks such as liquidity challenges or governance issues. This decision-making process underscores the importance of creating an environment where banks consistently signal reliability, reduce informational gaps, and build trust to enhance depositor confidence.

By integrating these theoretical perspectives, it becomes clear that restoring and maintaining confidence in the banking sector requires addressing both informational asymmetries and trust dynamics while ensuring that depositors perceive greater utility in engaging with formal banking institutions. This comprehensive approach provides a theoretical foundation for assessing determinants of banking confidence and crafting effective strategies for improvement.

Empirical Review

Several empirical studies have sought to understand and address confidence in the banking sector, both globally and within Zimbabwe, with varying methodologies and findings. Globally, Alamsyah *et al*. (2020) found that depositor trust in Indonesia is largely driven by perceptions of bank safety, governance, and macroeconomic stability. Similarly, Anbil (2018) emphasized that effective stigma management during crises and transparency can prevent panic withdrawals. Ascarya (2020) identified the critical role of exchange rate stability in bolstering banking confidence, while Gadzo *et al.* (2019) in Ghana highlighted credit and operational risks as primary determinants of depositor trust. Guntara (2020) explored the effects of interest rates and inflation, noting a strong link between inflation and reduced confidence.

In Zimbabwe, Munoangira and Kaja (2016) investigated strategies to enhance public confidence in the banking sector, focusing on regulatory frameworks and bank-specific factors like governance and service delivery. Their findings emphasized the importance of strengthening financial safety nets and enhancing depositor access to funds to rebuild trust. Similarly, Sandada and Magobeya (2016) identified structural assurances, service recovery, and benevolence as key determinants of consumer trust in Zimbabwean banks, with trust significantly eroded due to past economic instability and financial mismanagement.

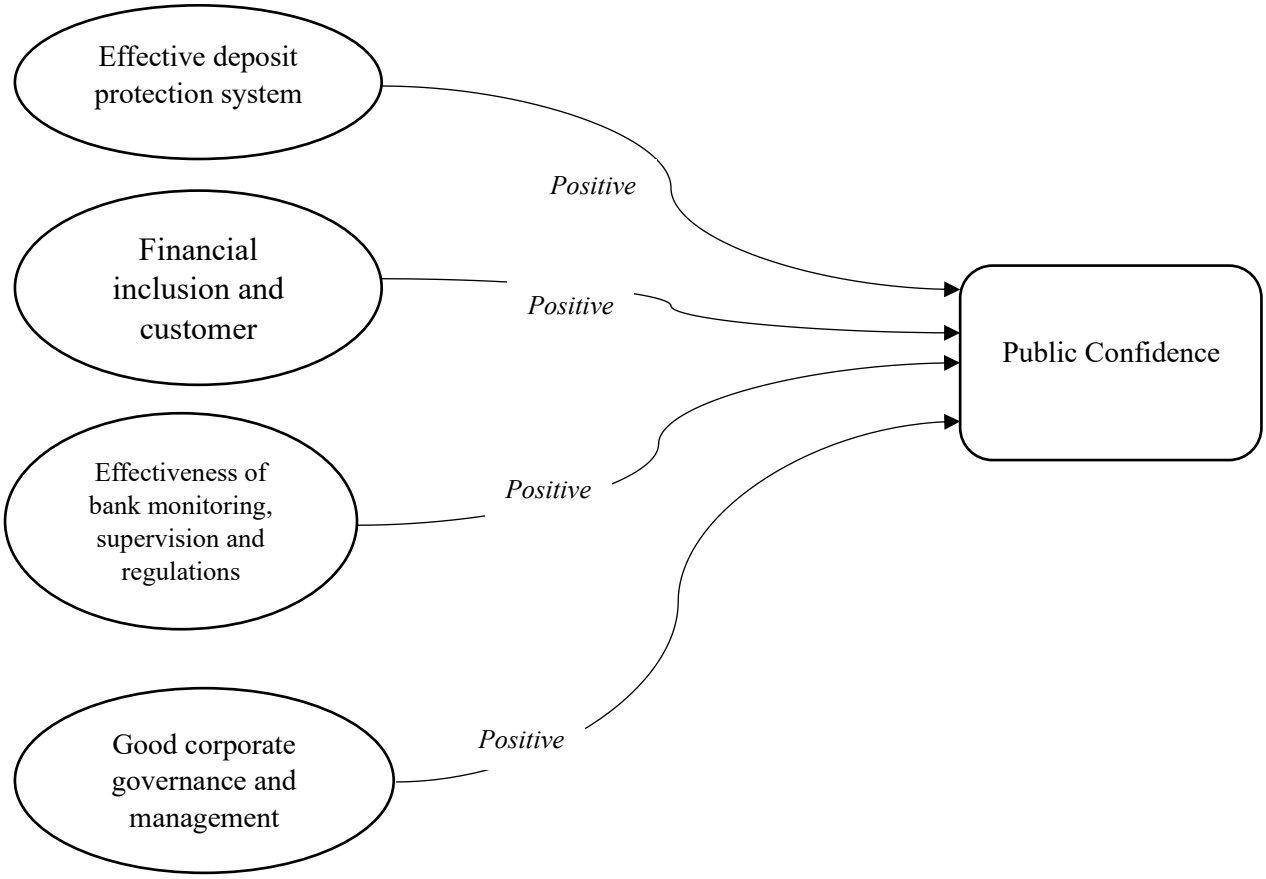
These empirical insights align with this study's focus on critically assessing the determinants of confidence in Zimbabwe's banking sector but differ in scope and methodology. For instance, while Munoangira and Kaja (2016) primarily analysed regulatory strategies, this study extends

to evaluating depositor behaviours and preferences, utilizing quantitative methodology. Additionally, the current study incorporates theoretical frameworks like Random Utility Theory to analyse consumer decision-making under uncertainty, providing a more nuanced understanding of the interplay between trust and banking sector policies.

Conceptual framework of the study

The conceptual framework of the study is shown in figure 1 below:

Figure 1: Conceptual Framework



Source: *Cull, Lemma and Sorge (2000)*

The conceptual framework in figure 1 draws upon the works of Cull, Lemma, and Sorge (2000) with adjustments made to fit Zimbabwe's banking system, as well as those of Kibirango (1999). They also asserted that by increasing depositor's confidence in the banking system, credible explicit deposit insurance could increase the level of deposits and number of depositors. Kibiriango (1999) also asserted that confidence levels could be measured in terms of increase in deposits on one hand and number of persons using the banking system on the other hand.

Many studies have investigated the concept of confidence in different contexts with varying conclusions on what factors can be regarded as influential in the development of confidence. However, empirical literature assert that majority of determinants of banking sector confidence hovered around effective deposit protection scheme, financial inclusion, good corporate governance and effective bank monitoring, supervision and regulations (Ameur and Mhiri, 2013). These variables are expected to have positive influence on the public confidence of the citizenry in the banking sector

Objective of the study

The primary objective of the study is to identify the key determinants of public confidence in the Zimbabwean banking sector.

Significance of the study

This study holds substantial relevance for the banking sector in Zimbabwe, which continues to grapple with challenges in establishing and maintaining public confidence. By identifying the determinants of banking sector confidence, the research aims to contribute to the development of a more resilient and trustworthy financial system. Given the limited empirical literature specific to Zimbabwe's banking environment, this study will enrich the body of knowledge with contextually grounded insights.

Furthermore, the findings are expected to guide banking institutions in prioritizing strategic areas that influence public trust, thereby enhancing product uptake and deposit mobilization. The study also seeks to illuminate the role of the Reserve Bank of Zimbabwe and the operational practices of commercial banks that can be leveraged to reinforce institutional credibility and systemic stability.

Methodology

This section presents the sources of data, and the variables chosen for the model and describes the probit regression model used to assess the determinants of banking sector confidence.

Probit Regression Model

In this study, the analytical model tied customer decision and utility maximization problems together. It is first assumed that customers choose on alternatives, by considering the expected comparative advantages from participating in the activity, which will be compared with respect to the other alternatives. This was analysed using the random utility theory described as follows:

The Random Utility Theory by McFadden (1974) posits that people generally choose what they prefer; however, when they do not, their choices can be explained by random factors. An individual chooses an alternative which maximizes utility. Suppose there is a customer and is being asked if s/he has confidence in the banking system, the dependent variable is defined such that:

$Y_i = \{^{1\ if\ yes}_{0\ if\ no}$ for person i ……. (i)

The linear model could be used to fit this model. In this case we would have:

$Y_i = \beta_0 + \beta_1 X_i + e_i$…….. ……(ii)

$Y_i \equiv E(y_i) = \beta_0 + \beta_1 X_i$…….. (iii)

Where X_i are factors that influence public confidence, $\beta_0;\ \beta_1$ are regression parameters and e_i as a random, independent error term.

By defining the probability that individual i chooses to be satisfied and the complement of this probability, the former will use the notation p_{i1} and the later p_{i2}. Given these notations, the predicted choice probabilities are:

$p_{i1} = \Pr[y_i = 1] = \Pr[Yes]$ and ……..... (iv)

$p_{i2} = \Pr[y_i = 0] = \Pr[No]$……... ……. (v)

It should be noted that $p_{i2} = 1 - p_{i1}$, given the definition of what is meant by expectation it should also be noted that:

$E(y_i) = (1)p_{i1} + (0)p_{i2} = p_{i1}$……... (vi)

Combining equation (vi) with equation (iii), it was concluded that

$P_{i1} = \beta_0 + \beta_1 X_i$…… (vii)

Equation (vii) is typical of a Probit regression model and thus the errors term should satisfy classical assumptions. To capture effects of different individual variables in the Zimbabwean entire financial system, the Probit regression model was presented as follows:

$P(Y_i = 1/0) = \beta_0 + \beta_i X_i + \mu$……. (viii)

Where P is the probability of an individual having confidence in the banking sector, $\beta_i\ is$ the vector of parameters to be estimated, $X_i\ is$ the vector of independent explanatory variables estimated to influence public confidence and $\mu\ is$ the error term. A Probit model states that the functional correlation between the probability of an increase in public confidence and the list of numerous explanatory variables assumed to affect public confidence. The deduced efficient association between the binary dependent variable (having confidence in the banking sector or not) and a list of regressors for the study is as follows:

$\Pr(\text{PC} = 1/0) = \beta_0 + \beta_1\text{DPS} + \beta_2\text{FI} + \beta_3\text{BMSR} + \beta_4\text{CGM} + \mu_i$ ……. (ix)

Where:

Pr - is the probability that an individual has been affected or not.

β_i - are the coefficients to be estimated

PC - Public confidence

DPS - Effective deposit protection system

FI - Financial inclusion and customer expectations of financial services and products

BMSR - Effectiveness of bank monitoring, supervision and regulations

CGM - Good corporate governance and management

μ_i - The error term.

The maximum likelihood estimation (MLE) method was used to estimate the Probit model. The MLE procedure yields unbiased, asymptotically efficient, and normally distributed regression coefficients (Tigist, 2010).

Choice of Variables

The variables in this study were selected based on availability of data and their relevance to understanding public confidence in the banking sector. The choice of the variables was also guided by theoretical and empirical literature on determinants of banking confidence and their interrelationship. The variables are explained below, along with their a priori expectations.

The dependent variable, public confidence (PC), captures the extent to which depositors trust and rely on the banking system. It was assessed using a five-point Likert scale, evaluating factors such as trust in financial institutions, perceptions of safety, and the willingness of depositors to engage with banking services. Public confidence is anticipated to increase with

improvements in governance, regulatory frameworks, financial inclusion, and safety nets (Sandada and Magobeya, 2016; Munoangira and Kaja, 2016).

The independent variables were measured based on their theoretical and practical influence on public confidence. Effective deposit protection systems (DPS) play a pivotal role in minimizing risks of bank runs and enhancing trust by safeguarding depositors' funds in the event of bank failures. When deposit insurance coverage is sufficient and pay-outs are prompt, public confidence is expected to rise (Munoangira and Kaja, 2016; Cull *et al*., 2000). Similarly, financial inclusion and customer expectations (FI) examine the accessibility of banking services and the alignment of these services with consumer needs. Greater financial inclusion and satisfaction with service quality are positively associated with increased trust (Demirguc-Kunt *et al*., 2015).

Furthermore, good corporate governance and management (CGM) are critical for maintaining transparency, accountability, and ethical practices within banking institutions. Strong governance mitigates risks of mismanagement and fraud, thereby enhancing depositor confidence (Armstrong, 2012; Dzomira, 2016). Another key variable, effectiveness of bank monitoring, supervision, and regulation (BMSR), focuses on the role of regulatory frameworks in ensuring compliance, mitigating risks, and penalizing malpractice. Rigorous regulation fosters trust and minimize systemic crises (Ascarya, 2020; Gadzo *et al*., 2019).

The choice of these variables is determined by their significance to financial stability and public trust. For example, DPS addresses depositor safety, a critical variable in Zimbabwe's volatile financial environment. FI tackles the challenge of accessibility in an underbanked landscape, while CGM and BMSR focus on operational soundness and regulatory integrity. These variables, collectively, provide a robust framework for analysing and improving public confidence in Zimbabwe's banking sector.

Data sources

Secondary data was collected from journal articles, newspaper articles, the internet and textbooks. The primary data used to run a probit regression model was obtained from the bank officials, bank clients, Senior Executives at the Reserve Bank of Zimbabwe (RBZ), Deposit Protection Corporation (DPC) and the Bankers' Association of Zimbabwe (BAZ) for the period 2009-2020.

Sampling Technique and Procedure

The sample size for this study was determined based on the principle of adequacy for statistical analysis and relevance to the study objectives. Considering the diverse stakeholders in Zimbabwe's banking sector, the target population included corporate bank clients, retail bank clients, bank officials, regulatory bodies, and key institutions involved in financial stability. A total of 200 questionnaires were distributed, reflecting a balance between depositor perspectives and institutional insights. This approach ensured comprehensive coverage of opinions and experiences related to public confidence in the banking sector.

The sampling technique employed was stratified random sampling. The population was first divided into strata based on stakeholder categories, including corporate clients, retail clients, bank officials, and regulatory authorities. Stratified random sampling was chosen to ensure representation from each stratum, thereby enhancing the generalizability of the findings. Within each stratum, participants were randomly selected to minimize bias and capture diverse viewpoints.

Sampling Frame

The sampling frame consisted of corporate bank clients (32 respondents), retail bank clients (140 respondents), bank officials (16 respondents), and representatives from key regulatory and oversight institutions, including the Reserve Bank of Zimbabwe (4 respondents), the Deposit Protection Corporation (4 respondents), and the Bankers Association of Zimbabwe (4 respondents). The total sample size of 200 was deemed sufficient for achieving reliable and meaningful results in the context of this study.

Reliability and Validity

Pilot testing was used to check the reliability of the instrument. Questionnaires were pre-tested before use to determine the suitability of the questionnaire and improve it in terms of question content, wording, sequence, form and layout. The questionnaire was also tested to check if there were any difficult questions and instructions. This was done through the presentation of the instrument to a sample of Bankers and Central bank Staff. Necessary corrections were made before administering the research instrument to the targeted respondents

Estimation of the Probit Model

The probit model was estimated using Stata statistical software version 12, which is well-suited for handling binary outcome variables and provides robust tools for regression analysis.

The distribution of the questionnaires is detailed in Table 1 below.

Table 1: Questionnaire Distribution

Sampling Frame	Number of Questionnaires
Corporate bank clients	32
Retail bank clients	140
Bank officials	16
Reserve Bank of Zimbabwe	4
Deposit Protection Corporation	4
Deposit Protection Corporation	4
Total	**200**

Source: *Researchers' Own Computations*

Table 1 indicate that, out of the 200 questionnaires sent, 173 were returned completed giving an overall response rate of 86.5%. According to Mugenda and Mugenda (2008), a response rate of 50% is considered adequate for analysis and reporting, 60% is good, and a response rate of 70% or more is very good. Therefore, the high response rate of 86.5% in this study was sufficient to draw reliable conclusions.

Findings and Discussion

A Probit regression model with *four independent variables (deposit protection, financial inclusion, corporate governance, bank monitoring)* was regressed against the dependent variable *public confidence*; the results are presented in Table 2 below.

Table 2: Probit Estimation Results

Public confidence	Coef.	Robust Std. Err.	z	P>|z|
Deposit protection	0.0004	0.0002	2.5000	0.0120**
Financial inclusion	1.3254	0.6479	2.0500	0.0410**
Corporate governance	2.7376	0.5857	4.6700	0.0000***
Bank monitoring	0.9961	0.5605	1.7800	0.0760*
_cons	-4.4773	1.3308	-3.3600	0.0010***
Wald chi2(4)	43.0300			
Prob > chi2	0.0000			
Pseudo R^2	0.6853			

Source: *Researchers' own analysis using Stata 14*

Note: *= significant at 1%, **= significant at 5%, *= significant at 10%**

The findings of study indicate that deposit protection, financial inclusion and corporate governance are statistically significant at the 5% level whilst bank monitoring and supervision was weakly statistically significant at the 10% level. However, its true estimated coefficients are parameters of the latent model; therefore, interpretations cannot be ascertained from the Probit model coefficients. This led to estimation of marginal effects, which are essential in interpreting the true estimated coefficients.

Interpretation of Pseudo coefficient of multi-determination (R^2)

In Table 2, the Pseudo R^2 is 0.6853, which implies that about 68.53% of the variation in the public confidence is mainly explained by deposit protection, financial inclusion and corporate governance. The probability value of the overall model (Prob >chi^2 =0.0000) indicate that the overall model is statistically significant at 1% significance level. Moreover, the Wald statistic confirms that deposit protection, financial inclusion, corporate governance, and bank monitoring and supervision jointly explain the variation in public confidence.

Coefficients and Marginal Effects

The marginal effects results are presented in Table 3 below.

Table 3: Marginal effects results

Variable	dy/dx	Std. Err.	z	P>|z|
deposit protection	0.0002	0.0001	2.6900	0.0130**
financial inclusion	0.4839	0.1950	2.4800	0.0130**
corporate governance	0.8221	0.0961	8.5600	0.0000***
bank monitoring	0.3943	0.2247	1.7500	0.0790*

Source: *Researchers' own analysis using Stata 14*

Note: *= significant at 1%, **= significant at 5%, *= significant at 10%**

Marginal effects measure changes in the probability of the dependent variable following a change in the independent variables. They were calculated from predictions of a previously fit Probit model at fixed values of some covariates. The researchers interpreted parameter value using probabilities because Probit model works with maximum likelihood parameter.

Analysis of the Coefficients

The Deposit Protection Scheme

Deposit protection is positive with a coefficient of 0.0002 and statistically significant at the 5% level. The positive effect implies that if deposit protection scheme increases towards boosting public confidence, keeping other factors constant. This result suggests that an increase in deposit protection scheme by a 0.01 will result in a 0.0002 increase in the probability of increasing public confidence. The findings are in line with Safakali and Guryay (2007) who asserts that deposit insurance systems, are one component of the banking and financial systems safety net which seeks to promote banking sector stability and build confidence. Similarly, the results concur with the Diamond and Dyvbig (1983) who found that deposit insurance limits the negative effects of bank runs and subsequent bank failures in an economy.

Financial inclusion, new products and services

The study findings revealed that financial inclusion is positive and statistically significant at the 5% level. This implies 0.4839 increases in the probability of public confidence if financial inclusion increases by 0.01, ceteris paribus. The results concur with Ongore and Kusa (2013) who argued that innovation in financial services, products and mobile banking have the potential to improve the relationships between banks and consumers by reaching remote corners of the world where the majority of the under banked and the unbanked population reside.

Corporate Governance and Management on building Confidence

The results of the study indicated that corporate governance has a positive coefficient and statistically significant at the 1% level. This implies that a 0.01 increase in good corporate governance practice will lead to 0.8221 probability increase in public confidence. This conforms to Chowdhury (2009) who asserts that the management of a banking institution must exhibit impeccable integrity and professionalism in their conduct to engender public confidence in the safety of their deposits. Similarly, Enoch *et al*. (2002) asserts that in the establishment of the banker customer relationship, depositors look for a number of attributes such as corporate governance structures and risk management practices of the banking institution. Furthermore, these findings converge with Berger, Imbierowicz and Rauch (2012) who found out that defaults are strongly influenced by a bank's ownership structure.

Bank monitoring, Supervision and Regulations

Bank monitoring and supervision was found to be statistically insignificant at the 5% level of significance, which makes bank monitoring and supervision of less importance in bolstering public confidence in the Zimbabwean banking sector. This concurs with Gale (2010) who asserts that tougher bank regulations may have positive benefits as they may reduce the consequences of market freezes, however, they may encourage banks to become smaller to avoid systemic capital requirements, and they may reduce contagion, but they may not be relied on to reduce the risk of bank failure.

Conclusion

The study concluded that the main determinants of banking sector confidence in Zimbabwe are an effective deposit insurance system, financial inclusion and customer expectations of financial services and products, good corporate governance and management.

Recommendations

The study recommended that commercial banks should rebrand, provide high proficient technologies to client and seek external investors to enhance stability within the banking sector. The supervisory body should encourage insurance cover, closely monitor banks and conduct public awareness campaigns to restore public confidence.

The is need for future research on institutional and technological factors influencing banking sector confidence in Zimbabwe, such as the role of digital banking, fintech, and governance reforms. Additionally, there is a need for more country-specific research studies to better understand the interplay between local political dynamics and depositor behaviour. Comparative studies across similar emerging markets could also provide valuable insights into how Zimbabwean-banking sector can strengthen confidence amidst economic challenges. Expanding the research methodology to include personal interviews with key stakeholders in the banking industry may also offer a more nuanced understanding of trust dynamics in the sector.

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THE PSYCHOLOGY OF INVESTMENT: EXPLORING THE PARADIGM SHIFT FROM TRADITIONAL FINANCE TO BEHAVIOURAL FINANCE IN FINANCIAL MARKET

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Abstract

Financial management is considered the cornerstone of any economic system. It encompasses various theories and assumptions aimed at elucidating the means of investment decisions. However, the inadequacy of traditional finance theories in explaining numerous repeatable market anomalies prompted a departure from conventional assumptions, marking the advent of behavioural finance. The study aims to elucidate the transition from traditional finance theories to behavioural finance by exploring the conceptual developments and contributions in both fields. The present study uses existing literature from Google Scholar based on prominent keywords related to traditional finance, behavioural finance, and investment decisions. The findings of the study try to shed light on the significant behavioural biases influencing investors' investment decisions in the financial markets. The study concludes that behavioural finance theories contradict the rigid assumptions of traditional finance theories, arguing that real-world investors take investment decisions in the presence of psychological biases that significantly impact individual returns and the financial market as a whole.

Keywords: Behavioural Biases, Behavioural Finance, Investment Behaviour, Investment Psychology, Traditional Finance, Financial Market

JEL classification: G1, G4, G41

Introduction

In the realm of finance, the 1950s and 1960s are often regarded as the most innovative decades, marking a shift from finance as a descriptive discipline to a more scientific approach that integrated new concepts. During this time, researchers across the globe focused on harnessing the power of mathematical, probabilistic, and optimization models, which resulted in the development of key theories such as portfolio optimization, the capital asset pricing model (CAPM), and the efficient market hypothesis (EMH). However, contradictions in the applicability of these theories have begun to emerge within twenty years of their introduction. Researchers across the globe were prompted to re-evaluate the traditional finance theories based on the emerging market anomalies. This cognitive shift from age-old traditional finance theories to a new area of finance marked the beginning of behavioural finance (Andrikopoulos, 2005). Behavioural finance as a discipline was introduced through the critical evaluation of traditional finance theories. The principal objective of behavioural finance is to explain the reasons for investors' irrational behaviour in the financial market while making investment decisions. The present study showcases the inapplicability of classical and neo-classical theories in a real-world scenario based on existing literature of both traditional and behavioural finance theories. The following sections of the study cover research objectives, research methodology, an overview of traditional finance theories, and the transition from traditional finance to behavioural finance in the light of various behavioural biases.

Review of literature

The traditional finance theories explain the investment behaviour of investors under the umbrella of certain assumptions such as rational behaviour of the investors, efficiency of the market, risk aversion characteristics of investors, etc (Ritter, 2003). However, dissimilarity among investors' market returns and the existence of various market anomalies have questioned the assumptions and applicability of traditional finance theories (Hammond, 2015). Smith (2008) argued that market available information in the form of security prices is processed by investors, where they are prone to be affected by various psychological biases. Zahera & Bansal (2018) highlighted the role of investor emotions in explaining stock market volatility and returns. Singh (2019) emphasized the theories of behavioural finance, which offer a framework for understanding the stock market dynamics when rationality is absent. It also highlights various factors influencing the diverse behaviour of investors. Pompian (2006) categorizes behavioural finance into two subfields: behavioural finance micro, which focuses on the behavioral biases of individual investors, and behavioural finance macro, which investigates anomalies within efficient markets. Zahera & Bansal (2018) highlighted the importance of understanding the principles of behavioural finance and its associated biases, which can help investors better recognize the irrational aspect of stock market investing. Based on the findings from existing literature, the advancements in both traditional and behavioural finance can be witnessed globally; but a complete understanding on the shift from traditional finance theories to behavioral finance remains fragmented. Traditional finance theories assume the concept of market efficiency and perceive investors' rationality in the investment decision making. However, the occurrences of market anomalies caused by investors' irrational investment decision highlighted the limitations of traditional finance theories. Although, behavioural finance has evolved from the critical discussion of traditional finance by combining psychological insights into financial-decision making, existing studies often highlighted some market specific events or selected behavioral biases rather than comprehensively accessing the underlying transition between the two paradigms. Moreover, a limited research works has been documented identifying the presence of behavioral biases among investors and how they systematically shift their investment behavior from rational to irrational decisions. A conceptual exploration of this transition from traditional finance era to behavioral finance is essential to bridge the theoretical divide between rational and behavioural perspectives, offering a more holistic understanding of investor psychology in real-world markets. The present study seeks to address this gap by examining the evolution from traditional to behavioural finance, highlighting how psychological factors reshape investment decisions and market outcomes

Objectives

The present study aims to achieve the following objectives:

(i) To explore the paradigm shift from traditional finance to behavioural finance
(ii) To identify the relevant psychological biases influencing investment decisions in the financial market

Significance of the study

The theories of behavioural finance and their related biases have significant relevance in both industry and academia, strengthening the understanding of the financial market both by individual and institutional investors. From the industrial perspective, the insights from the field of behavioural finance allow market participants such as asset managers, financial advisors, and institutional investors to better understand and mitigate the behavioural biases that affect investment decisions. Behavioural biases such as overconfidence, anchoring,

herding behaviour, disposition effect, etc., can lead to market inefficiencies, mispricing of assets, and suboptimal investment decisions. By applying behavioural finance concepts, industry professionals can enhance decision-making processes, optimize portfolio management strategies, and develop effective risk management frameworks that account for human irrationality. In academia, the theories of behavioural finance challenge the classical assumptions of rational decision-making and market efficiency, prompting a re-evaluation of financial models and theories. It leads to the development of new research methodologies that integrate psychological factors with economic models, offering a richer understanding of market dynamics and investor behaviour. This interdisciplinary approach has widened the scope of financial research, encouraging researchers to explore the psychological underpinnings of economic decision-making and their impact on financial market outcomes.

Research Methodology

The study is descriptive and qualitative and aims to explore the available relevant literature to investigate the transition from traditional finance theories to behavioural finance theories. Pieces of literature in the form of books, review papers, and journal articles on the selected study area are located, identified, and surveyed through the Google Scholar database which is considered to be a large pool of peer reviewed data (Donthu et al., 2021). Literature was identified by using keywords that include: "Traditional Finance Theories", "Criticism of Traditional Finance Theories", "Behavioural Finance Theories", "Shift From Traditional Finance to Behavioural finance", "Investment and Behavioural Finance", "Psychological/Cognitive/Emotional/ Behavioural Biases and investment decision". The study used a variety of search terms by using Boolean operators (OR, AND, etc.). The research papers exhibited by the database in response to the search terms mentioned above were accessed based on availability. Data collected from Google Scholar with these search strings were prone to erroneous information which were further refined with certain criteria. An appropriate data set was extracted after implementing certain inclusion and exclusion criteria which included pondering the “title”, “keywords”, and “abstracts”. Further, filtration had been done based on the “subject area”, “type of documents”, “source type”, “language screening”, and “content screening”(Goodell et al., 2021). The accessed literature from different areas of behavioural finance and investment psychology is then investigated, analysed, and synthesized.

An overview of traditional finance

The foundation of traditional finance is believed to have been laid in 1844 by J.S. Mill, who introduced the concept of "homo economicus" where the concept of rationality serves as the foundation for many neoclassical economic theories (Hausman, 2007). In 1944, Von Neumann and Morgenstern introduced the “Theory of Games and Economic Behaviour”, which developed the concept of “expected utility theory”. This theory demonstrated that when an individual is offered various options, the optimal choice is always that option which accelerates the expected utility (Fishburn, 1989). Building on expected utility theory, Harry Markowitz laid the groundwork for “Modern Portfolio Theory” (MPT) in 1952. This model aids individuals in the creation of an optimal portfolio by selecting a mix of risky and risk-free assets to have maximum returns and minimum risk (Elton and Gruber, 1997). Expanding on “modern portfolio theory”, William Sharpe, Jack Treynor, John Lintner, and Jan Mossin developed the “Capital Asset Pricing Model” (CAPM), which transformed the algebraic framework of MPT into a testable model predicting the relationship between risk and expected return (Rossi, 2016). However, in the late 1970s, the CAPM theory faced criticism when research across the globe began identifying additional variables such as size, price ratios, and momentum effect that could explain the average returns beyond beta alone (Fama and French, 2004). To address these anomalies, Eugene Fama introduced the “Efficient Market Hypothesis”

(EMH) in 1965, proposing that stock prices react rapidly to new information. EMH classifies markets into three types: weak, semi-strong, and strong efficiency, assuming that information is immediately reflected in investment decisions.

A paradigm shift from traditional finance to Behavioural finance theories in the financial market

The Efficient Market Hypothesis (EMH), introduced by Eugene Fama in 1965, is a cornerstone theory of traditional finance. The theory defines financial markets as "efficient," meaning stock prices react too quickly to all the available information, making it nearly impossible to predict future movements based on past data. This led to the "random walk" theory, suggesting that changes in the stock prices are unpredictable and techniques like technical and fundamental analysis are considered ineffective. However, critical analyses of the theory have indicated that the connection between random stock movements, investor rationality, and market efficiency lacks statistical significance. Many economists have debated the real-world applicability of EMH, arguing that market prices do not always perfectly reflect all available information. If they did, arbitrageurs would not be compensated for their efforts (Singh, Babshetti and Shivaprasad, 2021). The critical analysis of the traditional finance theories gained attention when behavioural finance theorists argued that even if market prices reflect all significant information, investors' decision-making process is influenced by psychological biases (Smith, 2008). Hammond (2015) criticized EMH by highlighting the volatility caused by the stock market "bubbles," undermining the assumption of investor rationality. Shiller (2003) attributed excessive volatility to mass psychology rather than fundamental factors. This has led researchers to reconsider traditional finance assumptions and explore the influence of investors' psychological factors in the creation of stock market bubbles (Kapoor and Prosad, 2017). Behavioural biases play a crucial role in shaping key financial market outcomes such as volatility, herding, and asset mispricing. Investors influenced by cognitive and emotional biases often deviate from rational decision-making, leading to market inefficiencies. For instance, *overconfidence* and *representativeness biases* drive excessive trading and speculative behaviour, contributing to heightened *market volatility* (Barber & Odean, 2001). Similarly, *herding behaviour*, often rooted in *social proof and loss aversion*, intensifies during periods of market stress, causing investors to mimic collective trends rather than rely on independent judgment (Bikhchandani & Sharma, 2000). Moreover, persistent biases such as *overreaction* and *anchoring* lead to *asset mispricing*, where securities deviate from their fundamental values, resulting in bubbles or prolonged corrections (Thaler, 1985). These behavioural tendencies reveal that psychological factors are integral to understanding anomalies and inefficiencies within modern financial markets. Investment choices are frequently made in complex scenarios, prompting investors to simplify their decisions, sometimes at the cost of decision quality. Kartini and Nadha, (2021) emphasized the role of psychological factors other than logical and rational factors in leading deviations from the concept of rationality. Further, Zindel et al. (2014) identified the constraints in processing available information by investors, resulting in them opting for certain heuristics. While Yalcin (2010) examined the existence of market anomalies, Shleifer (2000) focused on the patterns of deviations from rationality. These instances encourage researchers to think beyond the assumptions of traditional finance theories and explore the presence of human psychology in shaping investment decisions.

An overview of behavioural finance

Behavioural finance: history and development

During the neoclassical era, the existence of the psychological aspect disappeared from economic and financial theories. However, by the mid-20th century, several market anomalies

were observed, followed by the critical analysis of neo-classical theories (Singh, 2019). As a consequence, researchers across the globe reintroduced the concept of psychology by deviating from the concept of pure rationality to understand individual behaviour. In the mid-18th century, the origin of behavioural finance was traced in the Adam Smith's "Theory of Moral Sentiments" (1759), where the principles of human nature were explored (Wang, 2019). However, during the mid-20th century, the idea of rationality underwent critical analysis, giving rise to the concept of "Bounded Rationality," which acknowledges the impracticality of achieving complete rationality in decision-making. In 1957, Leon Festinger introduced the "Theory of Cognitive Dissonance", which explains that holding contradictory beliefs creates a state of discomfort, or dissonance, leading individuals to avoid information that exacerbates this tension (Hinojosa et al., 2017). In 1974, Daniel Kahneman uncovered the role of heuristics in human decision-making, showing that decisions made under complex and uncertain conditions are often influenced by cognitive shortcuts. This reliance on heuristics introduces biases, including representativeness, availability, and anchoring biases. Kahneman's research, alongside Amos Tversky, culminated in the development of "Prospect Theory" (1979), a descriptive model of decision-making that highlights how individuals perceive gains and losses asymmetrically (Kahneman and Tversky, 1979; Thaler, 2000; Pompian, 2006). The framing and processing of information by investors have been the point of argument between traditional and behavioural finance theories. Behavioural theorists argue that information is often presented ambiguously, where investors may struggle to process it effectively, giving disproportionate weight to initial impressions, which leads to anchoring bias (Kartini and Nadha, 2021). R. Thaler (1985) introduced Mental Accounting, a concept explaining how individuals categorize their wealth into distinct "mental accounts" based on superficial characteristics, each with varying levels of significance. Bondt & Thaler (1985) also investigated market overreaction, analysing monthly stock market returns and finding that investors tend to overreact to contrasting events and information, deviating from the Bayesian rule. Traditional finance theories assumed that investors behave rationally at the occurrence of any financial information while taking investment decisions. However, conceptual and empirical evidence of behavioural finance research works argued that the presence of psychological biases among financial market participants hinders the rational process of extracting accurate information. Stålnacke (2019) conducted a study on financial market participants to examine their behaviour of using financial information available in the market. The study found that unsophisticated investors tend to us filtered financial information while taking higher portfolio risk. On the other hand, sophisticated investors use unfiltered financial information more frequently and tend to make better financial decisions by earning higher risk adjusted returns. Similarly Mohammed Elwani (2016) found that investment experience factor negatively impact information seeking behaviour of the investors. On the other hand, risk tolerance attitude of the investors confirmed that investors' risk appetite increases the information seeking behaviour. The study also confirmed a positive relation between regret aversion and information seeking behaviour. Naveed et al. (2021) conducted a study where he tried to examine the role of information acquisition in moderating the role of behavioural biases and investment decisions. The study found that overconfidence bias and self-attribution bias were negatively related to rational decision making of the investors. The moderation effect ofg information acquisition behaviour in the association of behavioural biases and investment decisions confirmed that an increase in acquisition of better and relevant information will significantly reduce the loss of irrationality caused by overconfidence bias. However, the hypothesis which expresses that information acquisition moderates the relationship of self-attribution bias with investor decision was not supported. Gentile et al. (2015) conducted a study to analyse the perception of investors towards the presentation of financial information focussing on the "framing effect" in the realm of psychological biases. The findings of the

study suggested that the 'optimal' disclosure might not exist and the 'one-size-fits-all' approach couldn't be effective in ensuring a suitable level of investors' protection. Risk perception is context-dependent and mainly determined by the way financial information is disclosed. The study highlighted that simplifying financial disclosure was not sufficient to ensure correct risk perception and unbiased investment choices. A study conducted on the role of cognitive biases on investment decision documented that herding bias negatively impact investment decision, while disposition effect and mental accounting bias positively impact investment decisions. Further, the moderating role of financial literacy in the association of behavioural biases and investment decisions confirmed that rationality in investment decision making increases with increased level of financial literacy (Khan, 2020). A study conducted on analysing the impact of various factors on investment decision found that behavioural biases on experienced investors results different than on inexperienced investors. Demographic variables like profession, education, gender and culture play a significant role on investment decision. The study further claimed that the presence of investors' emotions at the time of making investment decision plays a significant role behind stock market volatility and stock market return. The decision to invest in any investment avenues is taken by individuals or a group of managers, and this can be influenced by some behavioural influences which results into suboptimal decisions (Zahera & Bansal, 2018). These findings collectively demonstrate the inadequacy of traditional finance theories in explaining financial market anomalies. In an increasingly globalized economy, behavioural factors are recognized as critical supplements to standard finance theories in understanding the dynamics of financial markets.

Conceptual framework of Behavioural finance

Behavioural finance considers psychological insights into the processes of judgment and decision-making, diverging from the rationality framework emphasized by traditional finance theories. Singh (2019) identifies behavioural finance as an interdisciplinary domain that merges psychology and economics to explore why investors sometimes make irrational investment choices. Pompian (2006) categorizes the field into two distinct branches: Behavioural Finance Micro, which examines individual investor Behaviour, and Behavioural Finance Macro, which focuses on broader market phenomena.

Behavioural Finance Micro (BFMI): BFMI focuses on analyzing the Behaviours and biases exhibited by individual investors that deviate from the rational decision-making framework outlined in classical economic theory.

Behavioural Finance Macro (BFMA): BFMA investigates and interprets anomalies within the Efficient Market Hypothesis, offering explanations through Behavioural models.

The concept of behavioural finance seeks to understand the irrational behaviour exhibited by market participants, which causes stock mispricing in the financial markets. This field rests on two foundational pillars: Limits to Arbitrage and Psychology (Pompian, 2006; Ricciardi, 2008; Singh, 2019). In finance and economics, arbitrage means the opportunity to make a profit from the differences in prices for the same asset across different markets (Singh, 2019). Eugene Fama once argued that the irrational behaviour in financial markets is offset by the rational actions of arbitrageurs. However, the practical implication of this process is subject to various risks. At the time of short selling an overpriced security with the object of making a profit at low prices, the lack of suitable substitutes can lead the prices to remain high, which can cause a loss to the arbitrageurs. Another significant risk can occur from the unpredictable actions of noise traders, which can disrupt the rational objectives of arbitrageurs. Another pillar of behavioural finance is the psychological aspect of market participants. Behavioural finance theories explained the causes of investors' irrationality in the light of psychological factors

(Kartini and Nadha, 2021). Individual differences in how information is perceived, interpreted, and applied exacerbate this issue (Hammond, 2015). Illusions of control, knowledge, and experience, combined with investors' inability to utilize their knowledge efficiently, often result in flawed judgments and irrational investment decisions (Andrikopoulos, 2005). Researchers have highlighted that emotions significantly influence investment decisions, contributing to stock market volatility and fluctuations in returns. This irrationality can be explained by biases rooted in personal beliefs and preferences, which behavioural finance defines as systematic judgment errors. Researchers categorize these biases as heuristics (rules of thumb), beliefs, judgments, or preferences (Singh, 2019). Pompian (2006) further distinguishes between cognitive and emotional biases. Cognitive biases stem from flawed reasoning and can often be mitigated through better information and guidance. In contrast, emotional biases are driven by intuition rather than deliberate calculation, making them more resistant to correction. From an extensive review of existing literature on behavioural finance, the prominent behavioural biases are discussed as follows:

Overconfidence Bias: Investors with overconfidence bias tend to overestimate their knowledge, overlook possible hazards, and exaggerate their capacity to affect results (Kartini & Nadha, 2021). Due to their great analytical skills, investors frequently become overconfident, believing that their information is superior and can be used in the best possible way (Naveed et al., 2021; Pompian, 2006; Ranjit Singh, 2019; Ritter, 2003; Zahera & Bansal, 2018).

Representativeness Bias: Investors' tendency to connect recent results to prior experiences, frequently establishing causation without enough evidence, is known as representativeness bias (Ritter, 2003). This bias causes suboptimal decision-making by placing too much focus on recent events while ignoring long-term trends (Ranjit Singh, 2019; Zahera & Bansal, 2018).

Herding Bias: Investors with a herding tendency frequently follow the crowd while making investment decisions without questioning their judgment (Zahera & Bansal, 2018). Instead of depending on independent analysis, these people are more likely to follow the decisions made by the bulk of market players (Ahmed et al., 2022; Kartini & Nadha, 2021)

Anchoring Bias: When investors prioritize arbitrary or psychologically significant reference points, they are engaging in anchoring bias and making essentially irrational financial judgments (Kartini & Nadha, 2021; Pompian, 2006; Ranjit Singh, 2019; Zahera & Bansal, 2018)

Cognitive Dissonance Bias: The mental stress people feel when presented with information that contradicts their preconceived notions is known as cognitive dissonance bias. Investors frequently disregard new information that contradicts their existing opinions to ease this discomfort (Pompian, 2006; Olsen, 2008).

Regret Aversion Bias: Regret aversion bias occurs when people focus too much on the possible regret that could result from their choices (Bhatt & Chauhan, 2014). This bias results from a strong reluctance to own up to one's faults, which drives decisions that aim to prevent regret (Pompian, 2006; Zahera & Bansal, 2018).

Mental Accounting Bias: Investors' propensity to handle various amounts of money differently depending on how they mentally classify them is known as mental accounting bias (Bhatt & Chauhan, 2014; Khan, 2020; Pompian, 2006; Ritter, 2003b; Zahera & Bansal, 2018).

Hindsight Bias: Hindsight bias causes investors to make poor decisions because they think they could have forecast the investment's outcome before it happened (Bhatt & Chauhan, 2014).

Additionally, they could misunderstand previous rulings and assert that they "knew it all along," even though the results were unclear at the time (Zahera & Bansal, 2018).

Availability Bias: Availability bias occurs when investors base their choices on the information which are available, frequently ignoring more complicated or difficult-to-access data (Pompian, 2006; Bhatt and Chauhan, 2014).

Conservatism Bias: Conservatism bias is the tendency of investors to largely depend on historical data and partially react when presented with fresh information (Bhatt & Chauhan, 2014; Pompian, 2006; Ritter, 2003; Zahera & Bansal, 2018).

Disposition Effect: The disposition effect is caused by investors' risk aversion, which causes them to hold onto loss-making investments in the hopes of a future comeback while selling profitable stocks too soon (Khan, 2020; Ahmed et al., 2022).

Loss Aversion Bias: Loss aversion bias, which has its roots in prospect theory, is an investor's propensity to fear loss more than comparable profits (Kahneman & Tversky, 1979). Because of this bias, they frequently make choices that are more concerned with preventing losses than with increasing possible gains (Kartini and Nadha, 2021).

Optimism Bias: Optimism bias has emerged from overconfidence bias, where investors are hopeful that their future performance will consistently outperform their expectations (Kartini and Nadha, 2021).

Confirmation Bias: Investors with confirmation bias ignore the facts that contradict their existing knowledge while taking into account information that confirms it. Their assumptions are strengthened by confirmation bias, which causes them to base decisions on inaccurate or biased information (Pompian, 2006; Bashir et al., 2013).

Framing Effect: The framing effect explains how different people react differently to the same information depending on how it is framed or presented (Kartini and Nadha, 2021).

House Money Effect: Investors tend to take higher risks after achieving a prior gain. The feeling of “free money” from a prior successful investment prompts investors to take more risks in the subsequent investments (Hsu & Chow, 2013; Zahera & Bansal, 2018).

Endowment Effect: Investors with the endowment effect tend to overvalue their possessed assets; investors overvalue those assets because they own them (Zahera & Bansal, 2018).

Self-Attribution Bias: It is the propensity of investors to consider their own abilities as the root cause of a successful investment (Naveed et al., 2021). On the other hand, failures from an investment are attributed to external factors. With this bias, investors take credit for their successful investments and blame others for any kind of loss or failure (Pompian, 2006; Zahera & Bansal, 2018).

Recency Bias: Investors with recency bias have the propensity to focus more on recent information rather than considering the past. It leads to a skewed decision making as investment decisions are taken based on the latest developments and events while ignoring the significant information that belongs to the past (Pompian, 2006; Zahera & Bansal, 2018).

Home Bias: Investors having a sense of cultural familiarity often consider making investments in the stock of a company that belongs to their own country, which is known to have home bias. The presence of this bias is underpinned by the comfort feeling of investing in their own country’s company whose operations and management align with their cultural norms (Ranjit Singh, 2019).

Findings

Theories under traditional finance attempt to explain the mechanisms of investment based on several key assumptions, such as investors' rationality, available market information, risk aversion characteristics, etc. However, these theories failed to explain the occurrence of market anomalies as well as the causes of irrational investment decisions. This gap marked the beginning of a new wing of finance, known as behavioural finance, which bridges the gap between two extreme points of rationality in investment decisions. Behavioural finance combines psychology with financial investment decisions and explains that investors are not completely rational; they are influenced by various psychological biases that influence their investment decisions. Such influence is not only limited to individual returns, but it has its wide impact on the financial market on a macro level. The origin of behavioural finance came as a response to the critical analysis of traditional finance theories. When the theories and assumptions of traditional finance fail to explain the unexpected variations in market returns, behavioural finance tries to explain them with the support of human psychology in combination with finance and economic theories. The concept of pure rationality was being wiped out by behavioural finance theories way back in 1759 with Adam Smith's "Theory of Moral Sentiments". Following which research across the globe on investors' investment decisions in the financial market has discovered a significant relationship between psychological biases and investment decisions. Further, many studies on identifying the category of psychological biases have confirmed the presence of cognitive biases among investors, which originate from flawed reasoning. These kinds of biases can be rectified with rational thinking and correct information. On the other hand, a set of biases is found under the emotional category of investors, where investment decisions are made based on intuition, rather than rational reasoning and logical thinking.

Conclusion

By the early twentieth century, the psychological dimension of human financial behaviour was largely overshadowed by classical and neoclassical economics. However, the existence of market volatility made it difficult to accept the notion that a stock's price accurately reflects the market information, as suggested by most finance theorists. This discrepancy raises two possibilities: either the foundational principles of finance regarding stock valuation are fundamentally flawed, or investors are not entirely rational. The critical analysis of the market points directly to the presence of irrational investment decisions, showing that not all market participants act rationally, and such irrational behaviour leads to volatility in stock prices. This realization has led researchers to turn to investor psychology to better understand the causes of these irrational behaviours. To answer this behavioural discrepancy, a new wing of finance, known as behavioural finance, has emerged, which studies the psychological factors influencing financial decision-making, challenges the assumption of perfect rationality posited by traditional finance theories. It explains that real investors are often guided by psychological biases, which in turn lead to suboptimal decisions. When these decisions occur on a large scale, they can result in market anomalies. Since these anomalies can have damaging effects on both individuals and the economy at a macro level, it is crucial to address them. The prevention of such anomalies requires increased awareness among practitioners of their own psychological and behavioural limitations. As such, a deeper understanding and exploration of this field are vital in the contemporary financial landscape.

Future implications

Future research in behavioural finance can move beyond identifying biases to developing quantitative frameworks and predictive models that integrate psychological variables with real-

time market data. With the advancement of artificial intelligence, machine learning, and neuro-finance, there is growing potential to empirically map how emotions and cognitive distortions influence trading patterns, volatility clustering, and market contagion during crises. Moreover, examining behavioural biases within digital investment platforms, algorithmic trading, and cryptocurrency markets can provide new insights into investor psychology in technology-driven environments. On the policy front, integrating behavioural insights into financial literacy programs, investor protection policies, and corporate governance practices could enhance market stability and informed decision-making. Such future-oriented investigations would not only extend the theoretical boundaries of behavioural finance but also translate its findings into practical interventions that foster more resilient and transparent financial systems.

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SERVICE QUALITY IN FINE DINING: A REVIEW OF DINESERV LITERATURE

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Abstract

DINESERV is understood as a framework for measuring service quality in fine dine restaurants and it highlights the evolution of the restaurants tracing back its origins to the French Revolution and the emergence of modern dining experiences. A restaurant may turn to fine dine restaurants provided it fulfils some characteristics. A review of existing literature shows that ambience, service quality, menu offerings are most significant contributors towards gaining customer satisfaction and loyalty. This study aims to analyse the application of the DINESERV framework in measuring service quality within fine dining restaurants. Employing a comprehensive literature review methodology, it synthesizes existing research on service quality dimensions, emphasizing the five key factors: tangibles, reliability, responsiveness, assurance, and empathy. Assurance, empathy, and tangibles are regularly found to be the most important factors in determining patron happiness and loyalty in the fine dining industry. The study finds that high service quality leads to increased customer satisfaction, positive in word-of-mouth and repeat patronage. This paper aims to contribute to the understanding of service quality dynamics in the fine dine restaurants and provide useful insights of practical implications for restaurant operators.

Keywords: DINESERV, Service Quality, Fine Dining Restaurants

JEL Classification: M31, L83, D12, D90

Introduction

Dining Restaurant: Restaurants are the part of food and beverage service industry. Usually, food served and consumed in the premises of the restaurant, conversely most of the restaurants provide facility of home delivery and take out services (Arora, 2011). Restaurant industry has gathered full of assessable conditions for its attractiveness because it is known as with four basic needs of human beings as "food-drink-accommodation-travel". Restaurants are one of the major food industries that have played a significant role in serving consumers with already prepared food. A restaurant prepares and serves food, drink and dessert to customers. Meals are generally served and eaten on premises, but many restaurants also offer take-away and food delivery services. Restaurants vary greatly in appearance and offerings, including a wide variety of cuisines and service models. The modern-day restaurant was born in Paris, France in 1766 when Mathurin Roze de Chantoiseau started a health food outlet which was effectively an elegantly decorated cafeteria; he sold a special type of bullion and named it “restaurants” (Spang, 2020).

While modern restaurants are believed to be a by-product of the French revolution, food services were available even in ancient times. Public eateries and street vendors were not an uncommon sight in ancient Rome, whereas travelers during medieval times often ate at monasteries, taverns, inns, and hostelries. But it was the French revolution that gave birth to restaurants as we know them today by abolishing the monopolistic cooks' guilds. The enterprising French chefs took advantage of the opportunity to serve a primarily middle-class customer base dishes that were prepared to order.

There are various categories of restaurants like fast food restaurants, casual dining restaurants, fine dining restaurants, take away restaurants etc. Dine-in visits tend to account the most positive guest experiences because the restaurant is able to provide the highest level of service, food and atmosphere.

Fine-dining establishments are those that offer complete table service in addition to an upmarket menu of food and drinks. There is frequently a dress code and appropriate eating etiquette for patrons, and these restaurants typically offer a more upscale atmosphere, high-quality dinnerware, and cutlery, educated wait staff, and more professional staff uniforms (Harr and Ko Lily King, 2008; Tlapa et al., 2011). As for the customers of fine dining, they often anticipate high-quality service, extravagant menus, and unique ambience (Rozekhi et al., 2016; Walker, 2022) and believe that attending fine-dining restaurants has an impact on their social status (Eliwa, 2006) therefore, they are more willing to pay a price premium for exquisite cuisine and flawless service (Harr and Ko Lily King, 2008). Fine dining is frequently related with luxury restaurants that provide upper-class experience including: high-quality food, an elegant atmosphere, and great service and are generally distinguished by their meticulous attention to detail, including multi-course menus emphasizing on high-quality, precise services and an impeccable atmosphere. Creating an experience in fine dining restaurants not only depends on the food quality, even though it plays one of the key roles. The atmosphere, the ambience of the restaurant as well as the high-level service quality is vital to define a fine dining experience (Kellam, 2019).

Key Characteristics of Fine Dining Restaurants

Fine Dining is distinct for several defining traits, setting it apart from the typical dining experience. Here are some of the defining characteristics:

- Ambience and decor: Fine Dining specializes in creating a serene and inviting environment, enhanced by the sophisticated and elegant decor. The effect is one of complete relaxation, comfort, and class.
- Service: The essence of a truly luxurious experience lies in the outstanding service provided by both servers and sommeliers, who will attend to every need of the customer with their expert knowledge and polished manner.
- Menu and cuisine: Classic cooking methods are employed to create exquisite fare, relying heavily on the freshest and most local seasonal ingredients.
- Table setting and etiquette: From the flourish of presentation to the minute attention to detail, the customer is guaranteed an immaculate setting for a truly memorable culinary experience.
- Dress code: Fine establishments typically impose a dress code for their guests, requiring them to dress properly.

Three fundamental features in a fine dining restaurant also known as full-service restaurants which will affect the customer's impression are food quality, service of the restaurant and the atmosphere (Namkung and Jang, 2007). These serve the purpose of social gathering offering tempting food from local flavours to continental cuisines. Fine dining restaurant differentiates itself from casual dining in the form of finest food, upscale service and exotic ambience. Fine dining restaurants are known for using high-quality ingredients and have been commended for preparing complex dishes, and paying very close attention to the appearance of the plate. There have been several academic researches that have looked into how chefs and restaurants maintain this level of quality, such as through ingredient sourcing, cooking practices, and

plating methods. Service in the restaurant industry is equally crucial especially in a fine dining setting. Waiters are expected to frequently give every customer personalized attention while carrying various other practical expertise and are required to carry specific emotional elements/behaviour. Fine dining restaurants train their employees, manage customer interactions, and create memorable experiences for their customers. Atmosphere or ambiance in fine dining is also extremely important and is intended to provide a luxurious and sophisticated environment which simultaneously matches the high-quality food and service. Fine dining restaurants produce this environment, including various factors such as interior design, lighting, music, and other sensory indications

Today fine dining restaurant can be in any type of setting and feature a wide variety of cuisine, from ethnic to organic and local fare. These are mostly stand-alone outlets but some are attached to star category hotels too. As disposable incomes are rising, dining culture is on the rise indicating fine growth prospects for fine dining sector in India. As a result, this segment is high on competitive aspects attracting many international brands as well as local players. With people travelling more often, ease of internet, larger disposable income, popularity of blogs and tweets, people seek fine dining. Greater awareness of global cuisines combined with ease of availability of ingredients to prepare these dishes, fine dining is the new trend. With Fine dining slowly coming of age in India, restaurants are doing all they can to elevate the dining experience of the consumers by providing them with excellent customer service and a memorable dining experience. A fine dining restaurant can be characterized as a full-service restaurant. It is primarily because of the table service. (Spears and Gregoire, 2007). The expectations of guests toward the restaurant services depend on the type of the restaurant (Kim and Moon, 2009). Fine dining restaurants are expected to be exceptional from the regular restaurants, in terms of everything, i.e., utmost level of prices among restaurants with extraordinary standards, finest ambiance, operating procedures and atmosphere and above all excellent service. The restaurant image is recognized as an essential component of the customer satisfaction and therefore it is a cornerstone of the success of the fine dining restaurants. (Downs and Haynes, 1984) pointed out the relationship between the restaurant success and the effectiveness of its image management. A fine dining restaurant, therefore, must focus on its image using increased upgrades and improvements in décor, ambience and interior design to attract customers and to differentiate itself from its competitors (Downs and Haynes, 1984).

Service Quality in Fine Dining Restaurants

The main concern in a service firm is how its performance is judged and perceived by the customer (Abelson, 1989). The service industry is becoming highly competitive and high-quality customer service is essential for a firm's survival. Restaurants are the integral part of food and beverage service industry. Because of inherent diversity, services have traditionally been difficult to define. Complicating matters further is the fact that the way in which services are created and delivered to customers is often hard to grasp because many inputs and outputs are intangible. Quality is an essential and distinctive characteristic of a service that describes its degree of excellence. It has the ability to satisfy and delight the customers through its direct effect on performance. The consumer expects quality to be the basic constituent in the core offering of any services, offered at the market place (Kandampully, 1996). Service quality is in essence a vital ingredient in the services marketing which acts as the core requirement for satisfying customers. To maintain the economic competitiveness, it is essential for the service providers to induce sustainable competitive advantage through distinguishing quality that enables the creation of satisfied customer base (Culiberg et al., 2010). In case of restaurants quality is created during the process of service delivery. This fact requires that an instrument to measure service quality must have an effective means of assessing customer's perception of

service quality during service rendering (Diab et al., 2002). In spite of finest services, a customer will persistently expect services of still better quality (Fornell, 1992; Oliva et al., 1992). Although delighted, a customer still wants improvement in respect of better services and an endless positive change. While offering services to the customers, a marketer must be exceptionally cautious and deterrent as every augmented service soon becomes an expected service (Nanda and Khandai, 2017). Previous studies in the past have found that Service quality perceptions vary based on consumer attributes. Gender and age were found to be key attributes (Harrington et al., 2011) while (Ganesan-Lim et al., 2008) examined service quality differences based on income groups. Various studies have been conducted in the recent years where different attributes of restaurant service quality have been identified and studied (Bojanic and Rosen, 1994; Gupta et al., 2007; Ha and Jang, 2010; Iglesias and Guillén, 2004; Kivela et al., 2000). Food quality, service quality, atmosphere, convenience, price and value were recognized as six separate attributes of restaurant quality (Kim et al., 2009). Service quality, which may be the most studied restaurant quality attribute (Cronin and Taylor, 1992; Dabholkar et al., 2000; Ha and Jang, 2010; Mattila, 2001), has been defined as the customer's judgement of the overall excellence or superiority of the service (Zeithaml, 1988). Research on customer expectations and service quality perceptions in the food service industry highlights key attributes driving satisfaction, including affordable prices, high-quality and nutritious food, value for money, excellent service, convenient location, strong brand reputation, and positive image (Johns and Howard, 1998; Tam and Yung, 2003) Specifically, restaurant satisfaction stems from food quality (hygiene, nutrition, and healthiness), ambiance (layout, furnishings, and cleanliness), atmosphere (comfort and emotional experience), and service quality (speed, friendliness, and attentiveness), all contributing to a memorable dining experience (Johns and Pine, 2002).

Meaning of DINESERV

"DINESERV" which is a variation of SERVQUAL designed by Pete Stevens, Bonnie Knutson and Mark Patton in 1995 was proposed as a reliable, relatively simple tool for determining how consumers view a restaurant's service quality. The authors describe the DINESERV as "a tool for measuring Service Quality in restaurants". Similar to SERVQUAL the number of items in DINESERV was refined to 29 items from the original 40 items in SERVQUAL to increase reliability of the data collected. The 29-item DINESERV questionnaire comprises service-quality standard statements that fall into the same five dimensions of SERVQUAL: tangibles, reliability, responsiveness, assurance and empathy. The responses were on seven-point scale from Strongly Agree (7) to Strongly Disagree (1). The 29-item questionnaire includes 10 items representing tangibles, 5 representing reliability, 3 for responsiveness, 6 for assurance and 5 for empathy.

Table 1: DINESERV Dimensions and parameters

Dimensions	Parameters
Tangibles	1. Restaurant has visually attractive parking areas and building exteriors.
	2. Restaurant has a visually attractive dining area.
	3. Restaurant has staff members who are clean, neat, and appropriately dressed.
	4. Restaurant has a decor in keeping with its image and price range.
	5. Restaurant has a menu that is easily readable.
	6. Restaurant has a visually attractive menu that reflects the restaurant's image.

	7. Restaurant has a dining area that is comfortable and easy to move around in.
	8. Restaurant has rest rooms that are thoroughly clean.
	9. Restaurant has dining areas that are thoroughly clean.
	10. Restaurant has comfortable seats in the dining room.
Reliability	11. Restaurant serves you in the time promised.
	12. Restaurant quickly corrects anything that is wrong.
	13. Restaurant is dependable and consistent.
	14. Restaurant provides an accurate guest check.
	15. Restaurant serves your food exactly as you ordered it.
Responsiveness	16. Restaurant during busy times, has employees shift to help each other maintain speed and quality of service.
	17. Restaurant provides prompt and quick service.
	18. Restaurant gives extra effort to handle your special requests.
Assurance	19. Restaurant has employees who can answer your questions completely.
	20. Restaurant makes you feel comfortable and confident in your dealings with them.
	21. Restaurant has personnel who are both able and willing to give you information about menu items, their ingredients, and methods of preparation.
	22. Restaurant makes you feel personally safe.
	23. Restaurant has personnel who seem well trained, competent, and experienced.
	24. Restaurant seems to give employees support so that they can do their jobs well.
Empathy	25. Restaurant has employees who are sensitive to your individual needs and wants, rather than always relying on policies and procedures.
	26. Restaurant makes you feel special.
	27. Restaurant anticipates your individual needs and wants.
	28. Restaurant has employees who are sympathetic and reassuring if something is wrong.
	29. Restaurant seems to have the customers' best interests at heart.

Source: *The 29 Dimension scale of DINESERV were developed by Pete Stevens, Bonnie Knutson and Mark Patton and originally published in Dineserv: A tool for measuring service quality in restaurants. Journal of Restaurant & Foodservice Marketing, 1(2), 53-65*

Review of Literature

Kukanja et al., (2016) highlighted the marketing quality dimensions (7P) really matter in assessing the quality of the dining experience and influencing the development of guests' loyalty. In this study researchers designed to develop an understanding of the relationships among these variables. An integrative marketing-oriented model was developed and tested using data collected from guests in the restaurant industry. The finding of their study that guests perceive restaurant quality according to three marketing quality dimensions – (1) people, (2)

placement, and (3) product (food) and physical evidences – while only the 'people' dimension significantly influences post-purchase behaviour. Research results show that no other marketing dimensions are statistically significant in determining restaurant quality perception and guests' loyalty development.

Petzer Daniel and Mackay Nedia (2014) studied how dining atmospherics, food quality and service quality can be enhanced to improve customer satisfaction at sit-down restaurants. The study is quantitative and descriptive in nature. Data was collected through self-administered questionnaires from 250 sit-down restaurant diners in urban areas of South Africa's North-West Province. The results indicate that respondents' perceptions of food and service quality are significant predictors of customer satisfaction at sit-down restaurants. The study therefore measures these constructs and determines the extent to which they predict customer satisfaction.

Harr and Ko Lily King (2008) did an exploratory study of customer satisfaction of fine dining restaurants in Singapore. This paper seeks to find out the service dimensions of service quality, which lead to higher levels of customer satisfaction. This study suggested that the service dimensions of assurance, empathy and tangibles are the most important to customers' evaluation of service quality, and thus, may have a positive influence customer satisfaction. The service aspects of each of these dimensions were discussed and recommendations were made for restaurateurs to improve their service to ensure higher levels of customer satisfaction.

Tinakhat and Pooripakdee (2022), aimed to study ways to increase service quality of fine-dining restaurants in Phitsanulok by using the Performance-Priority Analysis (IPA) as a tool to assess service quality. Purposive sampling was conducted by distributing surveys to 200 Thai customers of fine-dining restaurant in Phitsanulok from October 2019 to November 2019. The result of the research shown that consumers place the most importance on Assurance, followed by Empathy, Reliability which was in Quadrant 2, Responsiveness was in Quadrant 4, and Tangibility was in Quadrant 1.

In another study by Vanniarajan and Meharajan (2012) the important DINESERV factors in the restaurant industry were identified along with measuring the impact of various DINESERV variables in each factor on the overall service quality in the restaurant industry. They concluded that confirmatory factor analysis confirmed the existence of six DINESERV factor in restaurant industry namely; Relationship benefits, Empathy, Communication, Food quality, Price fairness and Tangibles. Moreover, further analysis showed that food quality had the strongest influence on the overall service quality.

Kim et al., (2009) examined the reliability and validity of a modified DINESERV instrument fit specific establishments. The results of this study strongly suggest that the service quality of foodservice operations has a positive impact on customer satisfaction and ultimately contributes to positive word of mouth recommendations of the establishments. Overall, the results indicated that this instrument can be used in casual dining restaurants to measure the foodservice quality not only in the US, but also in Asian operations. In addition, the positive parameters provide evidence that better quality of products and service yield higher level of customer satisfaction.

Polyorat and Sophonsiri (2010) have reached similar conclusions when they examined how each dimension of service quality may exhibit different impacts on customer satisfaction and customer loyalty in the chain restaurant context. They surveyed 395 Thai undergraduate students. They found that the service quality dimensions of tangibles and empathy have significant influences on customer satisfaction and customer loyalty while the other three

dimensions (reliabilities, responsiveness and assurance) do not. In addition, customer satisfaction appears to mediate the influence of service quality dimensions on customer loyalty.

Mena et al., (2021) did a research work entitled, "Assessing the effect of Service Quality on Consumer Satisfaction a case of Selected Hotels and Resorts in Ethiopia". The specific objectives of this study were to assess the attitude of consumers and the level of consumers' satisfaction on selected resort and hotel service quality in Ethiopia. A sample size of 368 respondents was taken for the study. Purposive sampling technique was used to select Hotel and Resort. Convenience sampling method was used to select Hotel and Resort consumers. The results of research show that consumer satisfaction depends on all dimensions of service quality. It was also found that consumers of hotels and resorts are satisfied irrespective of their age group, gender, profession and marital status. As per the study findings, three most important contributors to overall service quality (in order of importance) include: tangibility, responsiveness, and assurance.

Objectives of the Study

1. To analyze existing research on DINESERV, a framework for measuring service quality in fine dining.

2. To determine the most important aspects of service quality dimensions in fine dining, as measured by DINESERV.

Significance of the Study

The restaurant industry, mainly the fine dining segment, plays a vital role in shaping a nation's hospitality and tourism industry. With increasing consumer expectations, competitive markets and the shift in customer priorities, service quality has become a decisive factor in influencing customer satisfaction, loyalty, and restaurant success and ensuring repeat patronage.

This study is significant as it helps in examining the applicability and relevance of the DINESERV model within the fine dining segment. The findings will assist restaurant managers in formulating targeted strategies to enhance service delivery and overall dining experience.

Methodology

This study examines how the DINESERV framework is used to measure service quality in fine dining restaurants by reviewing and summarizing prior research done in the same field.

Research Design

The present study adopts a descriptive and analytical research design aimed at exploring existing literature on service quality measurement in fine dining restaurants using the DINESERV model. The purpose is to understand the dimensions that most significantly influence customer satisfaction and loyalty in the fine dining sector.

Nature of the Study

This study is primarily qualitative in nature. The research involves collecting, reviewing, and analyzing previously published academic works that have utilized or discussed the DINESERV model in restaurant settings. Emphasis has been placed on identifying the applicability and adaptability of the model in the fine dining context.

Data Sources

The secondary data for this study were collected from reputable academic journals, books and chapters, conference proceedings, dissertations and hospitality management reports.

Findings and Discussion

Objective 1: Analysis of Existing Research on the DINESERV Framework in Fine Dining

One of the best-known methods for evaluating restaurant service quality is the DINESERV framework, which was created by Stevens, Knutson, and Patton in 1995. Tangibles, Reliability, Responsiveness, Assurance, and Empathy are the five essential SERVQUAL model dimensions that are modified for the dining environment. DINESERV has been utilized by researchers over the years to evaluate customer satisfaction and service quality in a variety of restaurant categories, such as full-service, fine dining, and casual dining.

Research has shown that DINESERV offers a trustworthy framework for assessing how patrons view the quality of restaurant service (Kim et al., 2009; Vanniarajan and Meharajan, 2012; Diab et al., 2022). According to these research, fine dining frequently necessitates extra elements including food quality, pricing fairness, and restaurant ambience in order to completely capture the luxury dining experience, even though the original five dimensions are still strong. The DINESERV paradigm, for example, can be modified to better reflect fine dining realities. Vanniarajan and Meharajan (2012) found six important aspects influencing service quality: relationship benefits, empathy, communication, food quality, price justice, and tangibles.

Additionally, research by Kukanja et al. (2016) and Petzer and Mackay (2014) shows that aspects of service quality are strongly related to marketing factors and customer loyalty. Particularly in the context of luxury restaurants, excellent service quality not only affects customer satisfaction but also encourages favorable word-of-mouth and repeat business. Even with this worldwide validation, DINESERV is still only used sparingly in Indian fine dining, especially in the northeast, which indicates a research need that has to be filled in subsequent studies.

Although fine dining necessitates a more comprehensive assessment that include emotional, sensory, and experiencing components beyond basic service delivery, the DINESERV framework is nevertheless a good starting point for evaluating restaurant service quality overall.

Objective 2: To determine the most important aspects of service quality dimensions in fine dining, as measured by DINESERV

The second objective is to ascertain which aspects of service quality, as determined by DINESERV, have the greatest bearing on exquisite dining. Although all five aspects are significant, their relative importance varies according on cultural context and client expectations, according to a review of previous research.

Assurance, empathy, and tangibles are regularly found to be the most important factors in determining patron happiness and loyalty in the fine dining industry. Customers of fine dining place the highest value on certainty, which is demonstrated by staff professionalism, competence, and confidence (Harr and Ko, 2008; Tinakhat & Pooripakdee, 2022). Customers demand personalized service in high-end settings, so empathy which is defined as personalized attention and understanding of consumer needs ranks highly as well. The opulent dining ambiance that characterizes fine dining experiences is largely created by tangibles, which include ambience, décor, cleanliness, and the actual presentation of the meal.

In contrast to casual or fast-food restaurants, fine dining places less emphasis on aspects like responsiveness and reliability, even if they are still important. According to Polyorat and Sophonsiri (2010), patrons of fine dining places a higher value on ambiance and interpersonal relationships than on speed of service. Further supporting the experience-driven character of fine dining, Vanniarajan and Meharajan (2012) and Mena et al. (2021) discovered that tangibles and food quality have the biggest effects on perceived service quality.

Table 2: Synthesized findings from major studies

Studies	Most Important Dimensions
Harr & Ko (2008)	Assurance, Empathy, Tangibles
Tinakhat & Pooripakdee (2022)	Assurance, Empathy, Tangibles
Vanniarajan & Meharajan (2012)	Food Quality, Empathy, Tangibles
Mena et al. (2021)	Tangibility, Responsiveness, Assurance
Polyorat & Sophonsiri (2010)	Tangibles, Empathy

Source: *Summary made from above studies*

According to the pattern, the most important aspects of service quality in fine dining are assurance, empathy, and tangibles. This implies that, in addition to operational effectiveness, staff conduct, atmosphere, and emotional ties to patrons are critical factors in the success of fine dining.

Summary of Discussion

This review achieves both goals by (1) examining how the DINESERV framework is used to gauge the quality of service in fine dining and (2) finding the most important aspects of service quality dimensions in fine dining, as measured by DINESERV. The paper also emphasizes the necessity of conducting context-specific research in India, especially in the Northeast, in order to gain a deeper understanding of dynamic fine dining industry.

Conclusion and Implications

The paper is an attempt to study the how DINESERV was used as a tool for measuring Service Quality in Fine Dine restaurants by various researchers over the years. DINESERV emerged as a novel perspective in the study of restaurant service quality. Several researchers made substantial contributions to this progressive line of research. Their valuable insights and findings greatly enriched the understanding of service quality in the context of dining experiences. Studies have shown that these five dimensions of DINESERV have a strong impact on customer satisfaction and customer loyalty. In today's highly competitive environment the restaurant services no longer sell exotic and tasty dishes. They sell experience to the customers. Customers simply don't come to eat food in a restaurant. They visit their favorite restaurants to enjoy and experience their typical urban lifestyle. Customers always reflect high expectations from service especially in restaurants' settings because they expect to get better quality of services in order to become a satisfied and build their revisit intentions. The results suggest that in fine dining restaurant, better quality of services helps in creating satisfied customers and build their post-dining behavioural intentions which create a positive word-of-mouth. In a restaurant employee's behaviour has a great effect on customer's satisfaction regardless of customer's gender, nationality and purpose of visit, number of visit and length of stay. Marketing quality dimensions (7P) also really matter in assessing the quality

of the dining experience and influencing the development of guests' loyalty. Dining atmospherics, food quality and service quality can be enhanced to improve customer satisfaction at sit-down restaurants. One such study has found that service dimensions of assurance, empathy and tangibles are the most important to customers' evaluation of service quality, and thus, may have a positive influence customer satisfaction while the result of another research shows that consumers place the most importance on assurance, followed by empathy and reliability. In another study the most important DINESERV factors in the restaurant industry were identified along with measuring the impact of various DINESERV variables and found that food quality had the strongest influence on the overall service quality. In another study it was found that the service quality dimensions of tangibles and empathy have significant influences on customer satisfaction and customer loyalty while the other three dimensions (reliabilities, responsiveness and assurance) do not. In one such study it was found that, "Food Quality Reliability", "Responsiveness-Assurance-Empathy" and "Tangibles" are the dimensions that are likely to influence customers' restaurant service evaluations. All these factors impact customer satisfaction and loyalty, offering insights for restaurant operators and researchers to improve and innovate.

This paper tried to shed light on existing research on DINESERV, identify key service quality dimensions, and determine the most important aspects of service quality in fine dining but scholars feel that more detailed studies need to be conducted in this regard.

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UNDERSTANDING THE ASSOCIATION BETWEEN PRINCIPLES OF CORPORATE GOVERNANCE AND THE ARTHASHASTRA: A THEORETICAL REVIEW

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Abstract

Corporate governance is the foundation of any successful organization. Corporate governance is a framework for guiding a business toward an ethical structure so that it can be held accountable to the board, employees, and investors. This study highlights the impact made by Kautilya in ancient India (4th Century BC) by examining the corporate governance principles included in his Arthashastra. Among the study's major findings is that Kautilya's focus on justice, moral obligation, and stakeholder welfare closely reflects the ethical standards and fairness of contemporary governance frameworks. Second, the ethical and structural norms that are now ingrained in contemporary corporate governance practices are reflected in his support for transparency, accountability, and responsibility among administrators. According to the study's findings, the timeless principles of the Arthashastra can successfully direct businesses toward stakeholder-oriented, ethical, and sustainable governance in the modern business environment. According to Swami Chinmayananda (2003), it is sometimes necessary to review and reexamine some of the older works in order to provide a perceptive interpretation that may be effectively used in the context of modern corporate management. Future research may examine the potential applications of Kautilya's Arthashastra to various facets of corporate management, including financial, human resource, and strategic management.

Keywords: Corporate Governance, Kautilya's Arthashastra, Moral obligation, Principles

JEL Classification: D02, G34, M14

Introduction

Arthashastra has a wealth of practical information. One well-known work on political economy is Arthashastra. The renowned Indian economist Kautilya wrote it. King Chandragupta Maurya had Kautilya as his guide. Vishnugupta and Chanakya are other names for Kautilya. In addition to being a Rajguru, he was also a Guru of Praja and the general public. He discussed effective territory management in his Arthashastra (Devi, 2024). In "Arthashastra," the term "Rajya" was used to refer to a type of institution or organization. The king, or Raja, was regarded as the entity's or organization's board of directors, and the ministers, or mantri, were regarded as the chief executive officer (CEO) who was an expert in their respective management fields. Therefore, "Arthashastra" was compatible with the present trend of management studies (Rongali, & Sinha, 2024).

A company's connection with its shareholders, or more generally, with society, is referred to as corporate governance. Simply stated, corporate governance is about encouraging corporate fairness, accountability, transparency, and responsibility. Thus, corporate governance is nothing more than the framework of morality, ethics, and values that guides business decisions. There is a good risk that actions that are regarded immoral or even criminal may be taken in the pursuit of achieving financial goals or company objectives (Sharma & Vora, 2024). In his

treatise known as "Kautilya Arthashastra," Kautilya provided a thorough understanding and explanation of these corporate governance challenges in ancient India. For a long time, these were regarded as part of the unwritten Indian business culture, and as such, business was conducted there (Sharma & Vora, 2024). The present study is conceptual in nature and is based on a review of relevant literature. It aims to explore the application of Kautilya's principles in the domain of modern corporate governance.

Objectives of the study

- To examine the principles of corporate governance from the perspective of Kautilya's Arthashastra.

The study takes into consideration 4 principles of corporate governance namely fairness, transparency, accountability, responsibility and their association in the Arthashastra.

Significance of the study

This work has important academic and practical value since it combines ancient Indian wisdom with modern corporate governance ideas. The study examines Kautilya's Arthashastra through the lenses of fairness (Yogakshema), transparency (Palana), accountability (Vriddhi), and responsibility (Raksha), demonstrating how time-tested governance concepts remain applicable in modern management systems (Santhosh, & Reji, 2016). The study contributes to the literature by demonstrating that Kautilya's ethical, administrative, and management concepts presented in the fourth century BCE serve as a solid foundation for modern governance frameworks that prioritize transparency, stakeholder welfare, and accountability. This connection broadens our understanding of how moral governance and ethical leadership can improve organizational performance, stakeholder trust, and long-term viability (Rongali, & Sinha, 2024). In order to improve corporate governance practices in developing nations like India, the study also emphasizes the necessity of reexamining traditional knowledge systems like the Arthashastra (Sihag, 2017). The study provides policymakers, business executives, and academics with important insights into attaining sustainable, equitable, and transparent corporate governance based on India's intellectual legacy by reinterpreting ancient texts through hermeneutic analysis, opening up new avenues for management, economic, and ethical research.

Methodology of the study

The present study is based on Hermeneutics, a qualitative research approach. Hermeneutic analysis is a subset of Content Analysis that attempts to interpret the subjective meaning of a particular text within its sociohistoric context (Devi, 2024). Hermeneutics is the study of ancient or prehistoric religious writings or literature. It can be defined as a way for interpreting and acknowledging ancient literature. It can also be found in numerous fields in the theories explored and the interpretational methods of all textual literature, including literary pieces composed or written in the past that survive and have been understood as an experience (Rongali & Sinha, 2024). Hermeneutics involves not only the study of literature, or ancient texts, but also human behavior, such as the various languages spoken and speech patterns that are common in the region under study, the institutions and social groups, and the customs that people follow (Muniapan & Dass, 2008).

Fairness Principle of Corporate Governance from the perspective of Kautilya's Arthashastra

Fairness is one of the principles of corporate governance. In terms of corporate governance, it is also important to demonstrate the concept of openness (fairness), focus on change, innovate

continuously, and establish collective leadership (Sadubun, 2020). Corporate governance leads management to carry out firm activities within the corridor of justice, based on the principles of equality and fairness. All parties are aware that private individuals control the majority of a corporation, while others have medium or minority shares. According to the principle of fairness, even if they are "caste " because to the differential in the number of shares they have invested in the company, management must treat them equitably and fairly (Sadubun, 2020).

According to Kautilya, the ultimate objective of wealth and profit accumulation is to satisfy all stakeholders, including owners, employees, consumers, suppliers, distributors, and even the government. However, he underlines that true happiness stems from moral behavior and the pursuit of justice in all activities (sukhasya moolam dharma), emphasizing the intimate connection between wealth and ethics. Kautilya's teachings emphasize the necessity of creating wealth in a fair and ethical manner, which they see as the foundation for reaching true and enduring contentment (Bhattarai, & D.C, 2024). *Yogakshema* (Fairness) literally means "welfare," and it has been used in Kautilya's Arthashastra to describe a social security system. The duty of *Yogakshema* is in harmony with the pillar of fairness. It refers to how business is run with regard for the interests of stakeholders, shareholders, employees, and the general public (Sridhar, 2011).

Table 1: Studies on Applicability of Fairness (*Yogakshema)* Principle of Kautilya Arthashastra in Corporate Governance

YEAR	AUTHOR	OBJECTIVE	METHODOLOGY	FINDINGS
2015	Kumar	This paper does not attempt to provide a summary of Arthashastra, but gives an historically constructed interpretive account of the structure of Kautilya's arguments relevant to the principles of modern public organization.	Based on Secondary data.	Kautilya's administrative state is not an ideal -type bureaucracy. It represents maturing of an analytical and prescriptive intellectual tradition in regard to the theory of organization in India. The growing concerns about ethics in organizational literature endorse Arthashastra's guidelines on establishing a framework for moral and ethical administration. The aim of Kautilya's statecraft was limited, for it consisted in ensuring the security and stability of the King's rule inside the kingdom. modernists.

2023	Debbarma	This paper looks at Kautilya's Arthashastra and how the idea of dharma fits into modern life.	Based on Secondary data.	This paper finishes by discussing Kautilya's Arthashastra and how the concept of dharma functions in contemporary society. According to the report, the tenets of dharma—such as justice, fairness, and compassion— continue to be significant today and offer a framework for moral government. Kautilya thought that morality belonged in the hands of the state. The state is responsible for making sure that laws and policies are implemented in a way that advances these objectives in an equitable and efficient manner.
2009	Sihag	Aim of the study is the presentation of Kautilya's principles of taxation during the fourth century BCE.	Modern tools of economic analysis are used to present Kautilya's principles on income taxation.	Throughout the study, it was discovered that Kautilya subtly advocates for a linear income tax. Fairness, tax stability, fiscal federalism, avoiding high taxes, assuring tax compliance, and capital formation subsidies are among his main points of emphasis.

Source: *Author's Creation, 2025*

Transparency Principle of Corporate Governance from the perspective of Kautilya's Arthashastra

Good governance requires stakeholders to be informed about the company's actions, future plans, and any risks associated with its business strategies. Transparency is openness and the company's readiness to give shareholders and other stakeholders precise information. For instance, being willing and able to reveal precise and genuine financial performance data is an example of transparency (*McGilloway, 2024).* Transparency involves making a situation clear,

understandable, and undeniably true. Transparency refers to making all necessary information available to relevant parties or the community. The open/transparent attitude is the willingness to tell and accept the other party's knowledge or information. Implementing transparency in a limited company can boost shareholder confidence and participation (Lumentut, L., & et.al., 2017). The principle of transparency concerns the quality of information supplied by the company. Investors' trust relies heavily on the quality of information provided by the company. Thus, companies must give transparent, accurate, and timely information (Lumentut, L., & et.al., 2017).

According to Kautilya, "*Just as fish moving inside water cannot be known when drinking water, so officers appointed to carry out works cannot be known when appropriating money*" (2.9.27). In the same breath, Kautilya stated that "*Just as it is not possible not to taste honey or poison placed on the surface of the tongue, so it is not possible for one dealing with the king's money not to taste the money in any small quantity*" (2.9.27) (Bharati, & Das, 2012). Kautilya most likely intended to convey the idea that there is always the possibility of a dishonest royal official. It is still very relevant today because we frequently witness cases of corporate corruption, insider trading, and other scams committed by the responsible officers. Kautilya has given careful thought to the issue of widespread corruption in all areas of public life. Therefore, in order to foster transparency among them and establish a robust public governance system, Kautilya enforced stringent ethical standards and a code of conduct for state officials, dealers, artisans, professionals, farmers, goldsmiths, and every other group of people, including the monarch (Bharati, & Das, 2012). *Palana* (Transparency) literally refers to "maintenance" or "compliance." The obligation of *Palana* was in perfect accordance with the transparency pillar, which states that corporate governance guarantees timely and accurate disclosure of all relevant information. High-quality disclosure regarding ownership, governance, and corporate performance should be made in compliance with accounting, auditing, and financial standards (Santhosh, & Reji, 2016).

Table 2: Studies on Applicability of Transparency (*Palana*) Principle of Kautilya Arthashastra in Corporate Governance

YEAR	AUTHOR	OBJECTIVE	METHODOLOGY	FINDINGS
2023	Jaiswal	To identify the association of Kautilya and good governance.	Based on Secondary data.	From the study it was found that the "problem of dirty hands," or corruption, is the result of a clash between morality and governance. The following characteristics of good governance were included in the Kautilya scheme: law and order, accountability, transparency, administration that cares for people, justice and reason as the foundation of decision-

				making, and corruption-free governance. Applying these characteristics to politics will lead to a rise in good governance and an improvement in society as a whole.
2018	Kinkhabwala & Gor	To understand the legal framework enforcing Corporate Governance practices in terms of disclosure, transparency, integrity and accountability in India as well some of the select countries.	This paper is based on the analysis of data from secondary sources. The nature of the research is descriptive and analytical.	All administrators, even the king, should be viewed as the people's servants, according to Kautilya's Arthashastra, for good government. Stability and good governance are inextricably intertwined. Stability results from having rulers who are recallable, removable, responsible, and responsive. In the absence of that, instability exists. These principles remain valid to this day. Integrity, accountability, disclosure, and transparency are the cornerstones of corporate governance.
2020	Student Company Secretary	The article aims to explore the roots of corporate governance in ancient Indian scriptures, highlighting how texts like the *Arthashastra*, *Ramayana*, and *Bhagavad Gita* emphasize ethics, responsibility, transparency,	Based on Secondary data.	According to Kautilya's Arthashastra, all administrators—including the king—should be viewed as the people's servants in order to ensure successful government. Stability and good governance are inextricably intertwined. Stability results from having rulers who are recallable, removable, responsible, and

		and fairness. It connects these timeless moral and governance principles to modern corporate practices, promoting ethical and effective leadership.		responsive. It places a strong emphasis on management accountability, honesty, and transparency.
2014	Pohekar	1)To look after whether there was corruption in the ancient days. 2) To look after the remedial measures of corruption in Arthashastra. 3) To examine whether those are existed and suitable in the present situation.	Based on Secondary data.	The study found that the extent of official authority was definitely limited in prehistoric and medieval cultures, and corruption was there but on a smaller scale than it is today. India's society will become less corrupt if Acts and Laws are strictly enforced and corrective actions are implemented. Kautilya Arthashastra therefore advises against corruption. It would usher in an era of a responsible, transparent, hygienic, and responsive administrative administration in India.

Source: *Author's Creation, 2025*

Accountability Principle of Corporate Governance from the perspective of Kautilya's Arthashastra

The accountability principle refers to the board of directors' protection of the company's management and shareholder interests, as well as the explicit articulation of governance rules and obligations (TÜSİAD, 2002). Furthermore, accountability entails the board of directors' objectively supervised oversight, voluntary assistance to guarantee the compliance of its management and shareholders, and the disclosure of governance roles and responsibilities (Millstein, 2000). According to this principle, a government or business must be able to fairly and transparently account for its performance (Damanik, 2021). As a result, the government needs to be run effectively and in compliance with current laws. According to Karsono (2023) accountability is a necessary condition for achieving sustainable performance. Obligations,

controllability, responsiveness, and transparency are the markers of accountability (Tjia, Y. (2020).

Kautilya regarded accountability to be a fundamental component of his philosophy since he thought it was necessary for good governance. In order to guarantee the effective operation of the state and the well-being of its citizens, Kautilya highlights the significance of accountability in the Arthashastra. He believed that the ruler could make sure that his acts and policies were in accordance with the welfare of the citizens and that he fulfilled out his responsibilities as a ruler by promoting accountability. According to Kautilya, the ruler should be accountable to the people, the ministers, and the god (Pandey, 2023). In Kautilya's ideology, accountability encompasses all levels of government and is not just reserved for the ruler. According to Kautilya, the state's administrative system needs to be accountable for its deeds and choices as well. Kautilya contends that administrators and officials need to be held responsible for their work and should be rewarded or penalized according to their abilities and deficiencies. This emphasizes how crucial accountability is to maintaining the effectiveness and efficiency of the state's administrative organization (Pandey, 2023). *Vriddhi* (Accountability) literally translates to "growth and development." As a result, the king has a duty to provide his kingdom with excellent resources and amenities in order to guarantee its development. In the current scenario, shareholder value enhancement has been matched with the *Vriddhi* obligation. Any business's goal is to maximize revenues in order to maximize wealth. This clearly coincides with the accountability pillar, which states that the CEO and the Board must use the company's resources to optimize its value. This means that creating the most wealth possible is crucial at the present time.

Table 3: Studies on Applicability of Accountability (*Vriddhi*) Principle of Kautilya Arthashastra in Corporate Governance

YEAR	AUTHOR	OBJECTIVE	METHODOLOGY	FINDINGS
2019	Sinha & Dheeraja	To describes the concept, process, and evolution of social audit in India.	The legal framework and the executive instructions for social audit have been analyzed. The status of social audit has been assessed in the context of coverage of social audit, findings and the actions taken on those findings, funding to Social Audit Units (SAUs), social audit process, personnel, and their capacity building, independence of SAUs, transparency, and accountability in SAUs.	From this study it was identified that in the Centre for Social Audit, NIRDPR, on the organization and methodology of social audits throughout India, certain States are succeeding while others are still having difficulties. Due to resource limitations, the majority of Social Audit Units (SAUs) are only able to conduct one social audit annually in each GP, according to the report. Since the results of over one-third of the Panchayats have not been input, the number of issues based on MIS data is less than the total issues found during the social audit.

2022	Pandey	Aims to critically analyze Kautilya's views on authority and accountability, and examine their relevance and applicability in the contemporary world.	This paper is based on the analysis of data from secondary sources. The nature of the research is descriptive and analytical.	In the modern world, Kautilya's emphasis on responsibility in government is extremely relevant and applicable. Modern leaders and policymakers should use Kautilya's accountability principles as a guide to ensure the smooth operation of the state and the welfare of the populace. Modern governance continues to place a high priority on the idea of accountability, and governments everywhere have taken a number of steps to guarantee it.

Source: *Author's Creation, 2025*

Responsibility Principle of Corporate Governance from the perspective of Kautilya's Arthashastra

The responsibility principle is to make sure the company's practices and actions adhere to applicable laws, societal norms, and ethical principles (TÜSİAD, 2002). According to Millstein (2000), the principle of responsibility pertains to the management's adherence to the law, partnership articles, and intercorporate norms in all of their business-related operations. Responsibility is the distinction between right and wrong, what is permissible and what is forbidden, what is recommended and what is prohibited, what is good and what is bad, and being aware that you must avoid all that is negative while striving to always use positive things (Karsono, 2023). Responsibility is the capacity to make wise and sensible choices. The qualities of awareness, love, and courage are signs of responsibility (Karsono, 2023).

The primary principles of Kautily's good governance were protection, oversight, and vigilance. Kautilya considered these to be responsibilities since he believed they were essential to successful governance. He also believed that enforcing punitive and preventive measures against dishonest officials is a sign of good governance. Kautilya established stringent guidelines for behavior and management (Debnath, 2019). In terms of finance, the following traits of Kaatilya's organizational structure have been identified: budget and activity planning preparation; revenue and expenditure reporting; responsibility for revenue, expenses, and profits; individual responsibility for going over budget; and appropriate authority delegation. This indicates that a great priority was placed on individual responsibility for state profit. (Nallisamy, & Muniandy, 2022). Furthermore, a strong and wealthy monarchy would be able to protect the interest of its people, since the king would have the means to invest in warfare to protect the borders (external) as well as to invest in public welfare during emergencies (internal), which shows Kautilya's concern on investment strategy management (Murthy, & Rooney, 2016). The following characteristics have been identified about kautilya's organisation structure with relation to finance: preparation of budget and activity planning; reporting the revenue and expenditures; responsibility for both the revenues, expenditures and profits;

personal responsibility for exceeding budget limits; and proper delegation of authority. This shows that individual responsibility for state profit was given a high place (Nallisamy, & Muniandy, 2022). *Raksha* (Responsibility) translates to "protection." As everyone knows, protection is being protected from risk or damage. Therefore, the king has a duty to keep his subjects (people) safe from harm. Comparing this (*Raksha*) to corporate governance, the CEO or Board of Directors (King) is in charge of defending and defending the interests of the company's shareholders. In addition, the corporate governance guidelines' risk management component is connected to the concept of *Raksha* (Santhosh, & Reji, 2016).

Table 4: Studies on Applicability of Responsibility (*Raksha*) Principle of Kautilya Arthashastra in Corporate Governance

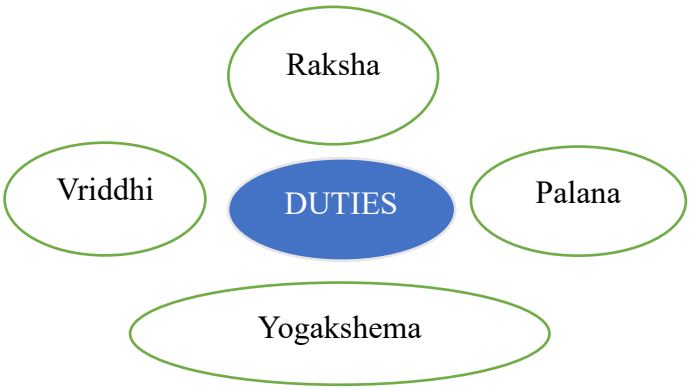
YEAR	AUTHOR	OBJECTIVE	METHODOLOGY	FINDINGS
2017	Manrai & Goel	This study tries to highlight the learnings for modern business organization from the teachings of Arthashastra to ensure welfare of all stakeholders. The study specifically focuses on corporate governance, training and group dynamics, corporate social responsibility and value base management.	The study proposes a new SHASTRA model which models the teachings of Arthashastra and acts as a guideline for effective business management based on ancient wisdom.	Through a discussion of corporate governance, corporate social responsibility, training, and value-based management, this study attempts to connect the teachings of Arthashastra on stakeholders' welfare to contemporary business management. The modern corporate world can immediately benefit from the use of Arthashastra and Chanakya Neeti's teachings in order to maximize revenues from multinational organizations without resorting to unethical or unhealthy business methods.
2024	Sharma & Vora	1. To study the legal framework of corporate governance 2. To highlight the relation between corporate governance and ancient business culture.	This study is based on secondary data. The information has been gathered from books, journals, magazines, newspaper, websites, research papers, Companies Act, 2013, SEBI Act, 1992, different business models, etc.	It is evident from the foregoing that the current corporate governance paradigm and our antiquated company cultures are related. The legal structure of corporate governance, which covers the many roles, obligations, and duties of stakeholders and is also referenced in the

				ancient Indian business culture, further supports this relationship. As a result, we can draw the important conclusion that contemporary business models and the business culture of ancient India are significantly related.
2014	De Vylder, G., & Mulla	To examine the Inspiration from Indian Ancient Classics for Ethics in Governance and Management	This study is based on secondary data.	According to Kautilya, the only way to change man's destructive tendencies for the sake of society is to transform him into a citizen who serves the ruler, who stands for the common good. Thiruvalluvar (as well as Rousseau) believed that Kautilya's method would denature man, remove his absolute existence and replace it with a relative one. Thiruvalluvar espoused the virtues of the original, or natural, inclinations and worked to create social structures that would allow the natural man to coexist. According to this viewpoint, the issue of an ethical deficit in governance, which includes corruption, could be resolved by reducing the size of the government.

Source: *Author's Creation, 2025*

As can be seen from the literature study above, Arthashastra clearly and concisely listed the duties of the king. According to Arthashastra, a king has four duties, which are illustrated Figure No. 1 below: Raksha, Vriddhi, Palana, and Yogakshema.

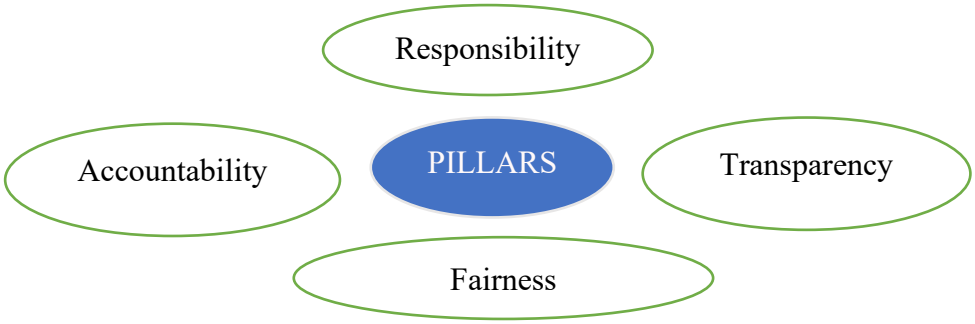
Figure 1: Duties of a king as per Kautilya's Arthashastra



Source: *Santhosh, & Reji, 2016*

The foundation of corporate governance is a set of principles. These guidelines are regarded as the primary tenet of the corporate governance discussed above. It is supported by four key pillars. Figure No. 2 below illustrates the four corporate governance pillars.

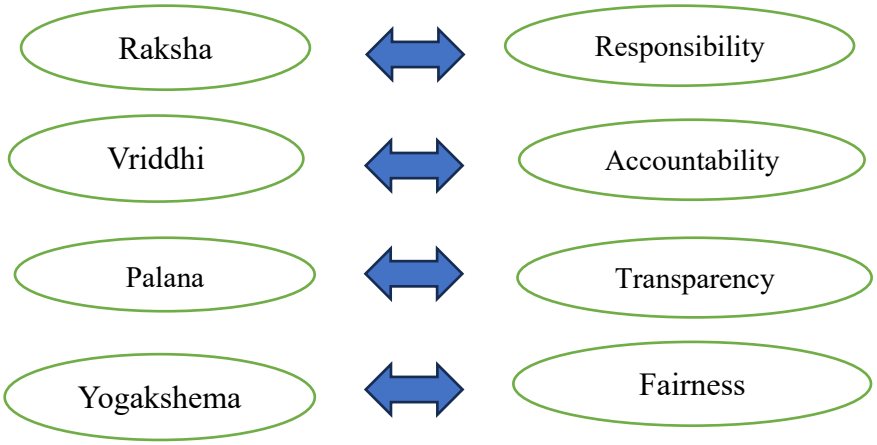
Figure 2: Pillars of Corporate Governance



Source: *Santhosh, & Reji, 2016*

The four pillars of corporate governance can be understood as the fourfold responsibilities of a king according to Arthashastra. The fundamentals of corporate governance are shown by the pillar. Figure No. 3 below illustrates the connection between corporate governance standards and a king's duties.

Figure 3: Alignment of the duties of a king and Corporate Governance principles



Source: *Compliance from Santhosh, & Reji, 2016*

Conclusion

The process of corporate governance makes sure that the company operates in everyone's best interests. It assigns duties and responsibilities to the directors regarding the management of company affairs. From the standpoint of Kautilya's Arthashastra, it addresses the concepts of fairness (yogakshema), transparency (palana), accountability (vriddhi), and responsibility (raksha), all of which are quite identical to the present corporate governance tenets. The purpose of the current study is to examine how the ancient Indian text Arthashastra has influenced India's corporate governance system. According to the study, there is clear evidence that several facets of Arthashastra can be applied when creating a corporate governance framework. The study also implies that the influence of ancient and antiquated texts is overpowering, both in the corporate governance structure and in the development of different management principles. According to the study, its selected text, Arthashastra, has also influenced the growth of other corporate management disciplines, including marketing, finance, human resource management, and strategic management. This influence underscores the timeless nature of the principles outlined in Arthashastra, illustrating how historical wisdom can inform contemporary practices. As organizations navigate the complexities of modern business, integrating these age-old strategies may provide a competitive advantage in achieving sustainable growth and ethical governance.

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NAVIGATING FARM SIZE DYNAMICS: CHALLENGES AND STRATEGIES FOR AGRICULTURAL SUSTAINABILITY IN INDIA AND BEYOND

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Abstract

This study aims to investigate the dynamics of farm size in India within the context of global trends and challenges associated with agricultural land use. By drawing on a diverse array of literature, including research on farm size dynamics, agricultural performance and land-use planning, this study elucidates the complexities and implications of shifts in farm size. The changing Indian agricultural environment, characterised by shifts in farm size and distribution, presents both challenges and opportunities. Through a comprehensive review, this study provides a framework to understand the interconnection between farm size dynamics, agricultural challenges, and land-use planning strategies. The key findings emphasise the significance of farmer participation, market-driven reforms, and sustainable land management practices in addressing agrarian challenges and enhancing sector performance. This study contributes to the discourse on agricultural sustainability by offering insights into the Indian context and proposing strategic approaches to effectively navigate farm size dynamics through improved land use planning.

Keywords: Agricultural Challenges, Farm Size Dynamics, Indian Agriculture, Land Use Planning, Sustainability

JEL Classification: L10, L25, Q01, Q15

Introduction

The dynamics of farm size globally reflect a diverse landscape of trends and challenges. A predominant trend from 1960 to 2000 has shown a decrease in global farm size, especially in regions such as Sub-Saharan Africa and Asia, where farm sizes are diminishing (Lowder et al., 2014). Conversely, farm sizes have generally increased in Europe and North America since 1950, whereas Sub-Saharan Africa has witnessed declining farm sizes, with approximately 80% of family farms being small (Ellis, 2005; Djurfeldy and Jirstrom, 2013). South Africa exhibits a dualistic agricultural nature, with commercial farms growing larger and small-scale operations that dominate subsistence lands (Greyling et al., 2015). North America has seen significant increases in farm sizes, with average sizes in the USA and Canada surpassing 170 ha and 314 ha, respectively (Ikerd, 2016). South America, particularly countries such as Brazil, Argentina, and Chile, are characterised by large farmers holding the majority of land holdings (FAO 2014). The European Union shows wide variations in farm sizes, with countries such as the Czech Republic having the largest farms and Romania the smallest (EU, 2018). The Asian and Pacific regions typically have small farm sizes, with China and India representing the majority of small farms (Lowder et. al., 2014; Thapa, 2010).

Farm-size dynamics significantly influence both the economic and environmental performance of agricultural production (Ren, 2019). Smaller farms typically have lower overall profitability and efficiency but higher productivity per acre. (Fan and Chan-Kang, 2005; Sen, 1962). Conversely, larger farms may demonstrate greater profitability and efficiency because of economies of scale (Bojnec and Latruffe, 2013; Bardhan, 1973). However, this relationship is

not universally applicable, as factors such as non-labour use and cooperative movements can affect productivity and efficiency (Rudra, 1968; Rudra and Sen, 1980). Positive correlations between farm size and productivity have been observed regardless of labour scarcity or land availability (Dorward, 2007; Manjunatha et. al., 2013). Additionally, nonlinear relationships exist, where efficiency may initially decrease with farm size before improving (Bhatt and Bhat, 2014). Moreover, a U-shaped relationship has been identified, where farm size affects land productivity differently, based on labour productivity (Savastano and Scandizzo, 2017). Understanding these dynamics is crucial for addressing the related challenges and promoting agricultural sustainability through targeted interventions and strategies.

Building upon the global backdrop of farm size dynamics and their impact on agricultural performance, it becomes evident that challenges emerge with farm size dynamics, significantly impeding agrarian performance. Therefore, addressing these dynamics is essential to enhance agricultural performance and sustainability. This understanding leads to the hypothesis that managing farm size dynamics effectively can mitigate agricultural challenges, thereby improving the overall sectoral performance. Hence, our study aims to explore strategic approaches to navigate farm size dynamics, illustrating the Indian scenario. Understanding farm size dynamics across India is crucial because of its predominantly agrarian economy and diverse agro-climatic zones. While the Asian and Pacific regions typically feature small farm sizes, India stands out for its significant agricultural presence (Thapa, 2010). Therefore, the present study focuses on investigating farm size dynamics in India, along with the associated challenges and potential solutions.

This study contributes to the literature on agricultural sustainability in three ways. First, it offers an analytical framework emphasizing the importance of studying farm size dynamics and providing guidance for controlling the same to address the agricultural challenges of the 21st century. Second, it provides insights into the context of farm size dynamics and associated challenges within India. Third, it explores land-use planning approaches as potential solutions to address the challenges arising from farm-size dynamics, focusing specifically on the Indian context.

Literature Review

The change in farm size, also known as the size structural change within farms, represents a significant spatiotemporal event affecting the agricultural sector. This event brought forth various agricultural challenges (Happe, 2007; Dawe, 2015; FAO, 2017). Presently, farms are expected to perform efficiently to ensure food security and sustainable agricultural development under the constraint of limited land resources. At the same time, strong arguments in favour of balancing equity and efficiency also represent a major challenge in agriculture. This eventually produces long-lasting debates on small versus large farms (Dutta 2021).

Balancing efficiency and equity in agriculture, particularly concerning farm-size dynamics, presents a global challenge (Eastwood et al. 2010, Persson and Tabellini, 1994). Developed nations tend to favour large farms, while agrarian societies often have a prevalence of small farms, leading to socio-economic and environmental consequences (Paulino, 2014). Debates surrounding small and large farms center on key agricultural metrics, such as profitability, efficiency, and productivity (Sen, 1962; Salami et. al., 2010). While experts emphasise the productivity of small farms, which is essential for food security and cultural value, others contend that larger farms demonstrate favourable profitability and growth potential (Macdonald et al., 2013; Eves and Painter, 2008). Furthermore, limited cultivable land, influenced by physical, social, urbanization, population growth, and political factors, poses formidable challenges for agriculture (FAO and UNEP, 1999). This scarcity of land, with only

29% of the Earth's surface available for agricultural use and over 60% designated for non-agricultural purposes, is further compounded by the projected 70% increase in food production by 2050 owing to population growth (FAO, 2009; Alexandratos and Bruinsma, 2012). Additionally, excessive land fragmentation exacerbates agricultural challenges by escalating costs and diminishing yields (Latruffe and Piet 2013; Jha et al. 2005).

In the above discussion, as we delve deeper into the intricate connection between size structural change, evolving challenges, and performance of the agricultural sector, an analytical framework has emerged, thereby substantiating the following hypothesis:

H_0: Agricultural challenges arising from farm-size dynamics can hinder agricultural performance. Thus, addressing farm size dynamics could potentially alleviate these challenges and enhance agricultural performance.

Additionally, Dutta (2021) suggested that proper land use planning can control farm size dynamics and thereby overcome the challenges of agriculture. Addressing issues such as equity, efficiency, and the debate between small and large farms can be facilitated through efficient land-use mechanisms (Cotula et al., 2006; Deininger and May 2000; Osberg, 1995; D'Souza and Ikerd, 1996). Salami et al. (2008) advocated proper land-use planning as a tool to alleviate physical land scarcity. With urbanization and industrialization leading to land scarcity in India, there is a pressing need for rational and judicious land use to meet future demand (Nukala and Muntz, 2015). Land use management significantly impacts environmental sustainability, economic growth, and social inclusion (OECD, 2017). Sustainable land management practices are essential for mitigating environmental issues, such as land degradation, deforestation, desertification, and water quality degradation (INTOSAI, 2013), as well as for achieving global food security (FAO, 2015). In light of these considerations, the following hypothesis was formulated:

H_0: Effective land use planning can control farm size dynamics and address agricultural challenges.

Therefore, the primary objective of this study is to comprehend the dynamics of farm size and develop a viable strategy for land-use planning, with a particular focus on the Indian agricultural landscape. This strategy incorporates an analysis of nation-specific socio-political dynamics, economic conditions, and the unique challenges confronting the agricultural sector. By adopting this approach, we aim to devise a roadmap for sustainable land use that optimises agricultural productivity, fosters social equity, and preserves environmental sustainability.

Methodology

The primary research methodology utilised in the study predominantly relies on descriptive analysis, with a specific focus on India. Analytically, it involves exploring strategies aimed at managing farm size dynamics to mitigate agricultural challenges and enhance agricultural performance and sustainability.

The study draws upon existing literature, including articles, working papers, discussion papers, reports, etc., to achieve its objectives. Secondary data on farm size dynamics are obtained from sources such as the Agricultural Censuses of India, Agricultural Statistics at a Glance, 2022, and other documents released by the Ministry of Agriculture & Farmers Welfare, Government of India (MoA&FW, GoI). This involves analyzing trends, patterns, and variations in farm size across different contexts and over time.

Farm size is a multifaceted concept, as proposed by Ahearn and Yee (2004), and encompasses both output-based metrics, such as real cash receipts per farm or total production per farm, and

input-based metrics, such as acres operated per farm or total labour deployed per farm. Each metric is significant within its specific context (Yee & Ahearn, 2005). Among these metrics, "area operated per farm" is regarded as the most traditional and is commonly adopted as an alternative definition of farm (FAO, 2007; Thapa, 2010; Yee and Ahearn, 2005), which is why this study adheres to the same interpretation of farm size.

Discussion and recommendation

Farm Size Dynamics and Challenges in Indian Agriculture

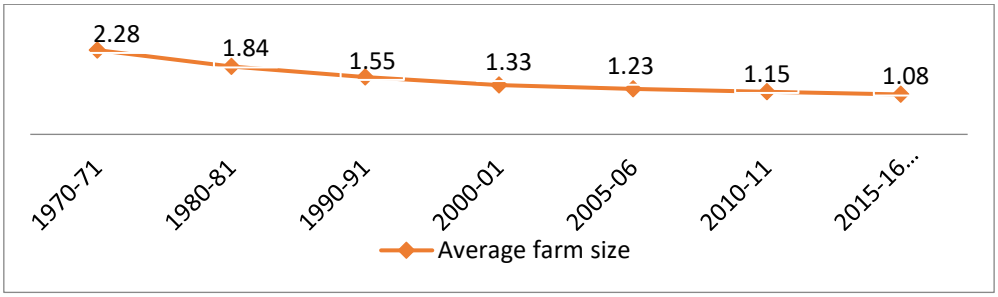
According to data from the Department of Agriculture & Farmers Welfare, Directorate of Economics & Statistics MoA&FW, GoI report (2021), the farm size dynamics of India have undergone significant changes over the past five decades (Table 1). The total number of farm holdings has consistently increased from 71,011 thousand in 1970-71 to 146,454 thousand in 2015-16. However, this growth in farm holdings coincided with a decline in the total agricultural area from 162,178 thousand hectares to 157,817 thousand hectares during that period. Consequently, there has been a steady reduction in the average farm size, dropping from 2.28 hectares in 1970-71 to 1.08 hectares in 2015-16 (Figure 1). This indicates a 6% decrease in the average farm size compared to 2010-11 when it was 1.15 hectares. The data highlight a notable shift in India's agriculture towards smaller farm sizes, which may be attributed to factors such as population growth, land fragmentation, and changes in cultivation practices.

Table 1: Number, Area, and Average farm size in India during 1970-71 to 2015-16

Year	Total		Average farm size (ha.)
	No. of holdings ('000)	Area ('000 ha.)	
1970-71	71011	162178	2.28
1980-81	88883	163797	1.84
1990-91	106638	165507	1.55
2000-01	119931	159435	1.33
2005-06	129222	158323	1.23
2010-11	137757	159181	1.15
2015-16 (Provisional)	146454	157817	1.08

Source: *Author's compilation from the reports of MoA&FW, GoI, 2021*

Figure 1: Decline in average farm size during 1970-71 to 2015-16



Source: *Author's self-construct*

Additionally, the data presented in Table 2 reveals a clear and consistent trend of decreasing average farm sizes across all farm size groups in India from 1970-71 to 2015-16. The average farm size for marginal farms decreased from 0.40 hectares in 1970-71 to 0.38 hectares in 2015-16, while small farms saw a decrease from 1.44 hectares to 1.40 hectares during the same period. Similarly, the average size of semi-medium, medium, and large farms also decreased.

Table 2: Average farm size for the farm size groups during 1970-71 to 2015-16 (in ha.)

Size groups	1970-71	1980-81	1990-91	2000-01	2010-11	2015-16 Provisional
Marginal	0.40	0.39	0.39	0.40	0.39	0.38
Small	1.44	1.44	1.43	1.42	1.42	1.40
Semi-Medium	2.81	2.78	2.76	2.72	2.71	2.69
Medium	6.08	6.02	5.90	5.81	5.76	5.72
Large	18.10	17.41	17.33	17.12	17.38	17.10

Source: *Author's compilation from the reports of Agricultural censuses in India*

Table 3 presents the distribution of states across the different farm size groups in India from 1970-71 to 2015-16. A notable trend emerged, indicating an increasing number of states with smaller farm sizes over the years. In 1970-71, fewer states fell into smaller farm size categories, with more states having larger farm sizes. However, as time progressed, there was a shift towards smaller farm sizes, evident by the rise in the number of states with less than 1 ha and 1 to 2 ha farm sizes. By 2015-16, the majority of states had a significant proportion of farms falling within the less than 1 ha and 1 to 2 ha categories. Conversely, the number of states with larger farm sizes (above 4 hectares) decreased substantially over the years, with no states having farms above 10 hectares by 2015-16. This trend suggests a gradual fragmentation of landholdings and a shift towards smaller-scale agriculture across states in India over the specified period.

Table 3: Number of states across different farm size groups during 1970-71 to 2015-16

Size Groups	1970-71	1990-91	2000-01	2010-11	2015-16 (Provisional)
Less than 1 ha.	5	8	8	9	12
In between 1 to 2 ha.	10	9	12	12	10
In between 2 to 4 ha.	8	8	6	5	4
In between 4 to 10 ha.	3	2	1	1	1
Above 10 ha.	0	0	0	0	0

Source: *Author's compilation from the reports of Agricultural Censuses of India*

Over the past five decades, India has witnessed a rapid increase in the number of small and marginal farmers in states, such as Uttar Pradesh, Bihar, Assam, West Bengal, and Andhra Pradesh, accompanied by a proportional decrease in large farm areas. However, the expected low level of skewness in operational holdings compared with ownership holdings is not always

accurate, as noted by Mearns (1999). Reverse tenancy, in which relatively large farmers lease land from smallholders, is observed in states such as Haryana and Punjab. However, these states also show a declining trend in average farm size according to the agricultural census of India.

Among the states in India, Nagaland boasts the highest average farm size of 5.06 hectares, followed by Punjab (3.62 hectares), Arunachal Pradesh (3.35 hectares), Rajasthan (2.75 hectares), and Haryana (2.22 hectares) as of 2010-11. Gujarat maintained an average farm size between 2 to 4 hectares until 2010-11, but this decreased to 1.88 hectares by 2015-16. Similarly, other states have also witnessed an increase in the number of farms but a reduction in average farm size over time. Currently, 22 out of 27 states in India (excluding Telangana) have farm sizes below 2 ha, indicating that small-scale farming is a predominant feature of Indian agriculture.

Challenges in Indian Agriculture: Small farms in India face numerous challenges in accessing inputs, increasing production, and marketing products (Dev, 2012; Sing et al., 2014; Sivagnanam and Murugan, 2015). Pandey (2009) emphasises the urgent need to boost the productivity of small farmers to increase their marketable surplus and attain reasonable income. Furthermore, marginal and small farmers are increasingly becoming part-time, absentee, peri-urban, and wage earners on part-time or full-time bases. Consequently, these farms become less financially attractive (ag-decision, 2013) and inefficient in resource use (Amodu et al., 2011). To address these challenges in the Indian agricultural sector, experts highly recommend sustainable land use planning and management (Pandey, 2009; Singh, 2016; Nukala and Mutz, 2015).

Land Use Planning for Farm Size Dynamics-Driven Challenges

The analytical framework of this study underscores the significant impact of farm size dynamics on agricultural performance, stressing the importance of understanding these dynamics. After examining farm size dynamics and associated challenges in India, it is essential to explore potential solutions. Experts have suggested addressing farm size dynamics through effective land-use planning. Consequently, the framework hypothesises an approach for proficient land use planning, proposing that it can regulate farm size dynamics and address agricultural challenges. Thus, this section aims to devise a tailored land-use planning strategy suitable for the Indian context to alleviate challenges and enhance agricultural performance and sustainability.

Agrarian reform, a component of broader land reform efforts, aims to modernise rural institutions, although its long-term impact remains uncertain (Deininger et al., 2007). Meanwhile, land use planning, which is critical for optimizing agricultural and rural economies, involves maximizing land utilization for various purposes (Ziadat et al., 2017; Lambin & Meyfroldt, 2011). Despite often involving state intervention, critics argue that it may disregard land user preferences (Walker 2005).

According to FAO (1993), land use planning is a systematic assessment of physical and socio-economic factors, empowering land users to choose options that enhance productivity, sustainability, and societal needs. In contrast to regulatory approaches, FAO's method prioritises land user interests, fostering individual decision-making (FAO, 1976). This aligns with the participatory principles of AGENDA 21 of the United Nations Sustainable Development Goals (SDGs), promoting informed decision-making for sustainable development. Various scholarly works (Happe, 2007; Gali et al., 2000; Eastwood et al., 2010) have illuminated the factors influencing agricultural land use, predominantly managed by farm households (FAO, 1993), thereby shaping regional land-use patterns. Specifically, in

agriculture, these factors impact farm household decisions regarding farm size, contributing to regional farm size dynamics.

In contemporary times, agricultural activities are increasingly viewed as business endeavours rather than traditional ways of life (Lekhi & Singh, 1996), fostering a shift towards capitalist modes of production in the agricultural sector. By the late 1980s, most countries had transitioned from socialist or planned economies to market economies, granting individual farmers greater decision-making power over farming practices. This shift has prompted closer collaboration between agricultural economists and business schools since the 1950s, fostering global growth in farm management practices (Ruttan, 1969). Farm management approaches recognise farm size dynamics as a consequence of farmer decisions, which in turn influence agricultural land use (Johl & Kapur, 2000). The World Bank (2009) underscores the significance of the "willing seller-willing buyer" mechanism in agricultural reforms, particularly in addressing longstanding land issues through voluntary transactions rather than expropriation. This approach encourages socially acceptable land-use patterns and promotes food security, employment, and income security in rural areas. It emphasises the participation of farm households in land use planning (Fresco et al., 1999) and highlights the role of farmers and communities in providing information to governments for land use decision-making (FAO, 1997; Deininger et al., 2004).

Land Use Planning for Farm Size Dynamics in India

Post-independence reforms in India aimed to address the issue of land concentration among large farmers to promote equity. However, the effectiveness of such land-use policies has been mixed. While some anticipated equity gains are caused by increased demand for labour rather than direct land transfers to the poorest in India (Lipton, 1985), analyses by Sharma (1994) reveal that inequality persists despite varying degrees of reduction in land concentration. Land reform laws have resulted in extremely low and non-viable holdings in the country along with increased land fragmentation, degradation, and redistribution of resource ownership (Niroula and Thapa, 2005).

In response to evolving market dynamics and regulatory frameworks, planners have begun to explore alternative approaches to land-use planning, particularly in the agricultural sector. Sen (1977) stressed the importance of farmers navigating market dynamics while considering the advisory and regulatory controls imposed by various administrative bodies. This recognition underscores the need for a nuanced understanding of the interplay between market forces and policy interventions in shaping agricultural land use decisions. Banerjee (1999) introduced the concept of a market-assisted land reform approach, advocating a demand-driven model that prioritises the needs and preferences of land users over traditional top-down reforms. This approach aligns with empowering farmers to make informed decisions about their land use practices and integrating market dynamics into the reform process to create more flexible and responsive policies. Dutta (2021) proposed a model illustrating the relationship between the determinants influencing the decision of farm size changes and the financial performance of farms in Assam. The model aided policymakers in achieving the desired farm size pattern by considering the determinants influencing farm size changes on farmholders. The study suggested that revisiting land rental market arrangements includes favouring variable rental arrangements over fixed rentals to enhance financial efficiency. Additionally, promoting a regulated land exchange market can ensure equilibrium in land supply and demand, reduce information asymmetry, and enable farmers to adjust farm size according to their preferences (Dutta, 2022).

Furthermore, initiatives such as integrating farm management studies into agriculture and food management policies since the 1950s (Mehta, 2011) signify a broader recognition of the importance of integrating economic and managerial principles into land-use planning. This integration allows a holistic approach that considers both the economic viability and sustainability of agricultural practices. The introduction of the new National Land Reform Policy (2013), which encourages farmer participation in land banks for credit access in the land sales market, reflects a shift in the approach of policymakers in India. This policy emphasises the involvement of farmers in decision-making processes related to land use and highlights the role of land banks in facilitating access to financial resources for agricultural development.

This study underscores the importance of participation by land users in planning and supports the "willing seller-willing buyer" mechanism over expropriation in agricultural reforms. Overall, these developments indicate a growing recognition of the need to support and assist land users in achieving desired changes in land use, marking a shift towards more participatory and market-driven approaches to land use planning in India.

Conclusion

In conclusion, the intricate dynamics of farm size and their influence on agricultural performance present both challenges and opportunities for the Indian agrarian landscape. As evidenced by the data and analyses presented, the shift towards smaller farm sizes poses significant challenges such as limited access to inputs, decreased productivity, and fragmented land holdings. However, through strategic land use planning and market-driven approaches, there is immense potential to overcome these challenges and foster sustainable agricultural development. By empowering farmers to make informed decisions about land use, promoting equitable access to resources, and integrating economic and managerial principles into policy frameworks, India can navigate farm size dynamics effectively. This study emphasises the importance of participatory approaches, market mechanisms, and policy reforms in shaping the future of Indian agriculture toward greater productivity, equity, and sustainability.

This study contributes to the discourse on agricultural sustainability by providing insights specific to the Indian context and suggesting strategic measures to navigate farm size dynamics through efficient land use planning. Furthermore, the study encompasses future research directions to address the identified limitations and expand knowledge in the field. Longitudinal analysis tracks farm size dynamics over time, while comparative studies assess the efficacy of different land-use planning strategies across regions. Policy evaluation will examine the effectiveness of existing interventions, while technological integration with remote sensing and GIS will enhance land-use planning accuracy. Enhanced stakeholder engagement aims to ensure inclusive, sustainable land use planning for agricultural development. These avenues aim to deepen the understanding and inform policy formulation for more effective agricultural management.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ADOPTION ON CONSUMER TRUST AND SOCIO-ECONOMIC OUTCOMES: AN EXPLORATORY DATA ANALYSIS

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Abstract

The implementation of Artificial Intelligence (AI) is rapidly increasing across various sectors and regions, transforming economic frameworks while also affecting how consumers perceive and trust these technologies. This study examines the effects of AI implementation, employment reductions, collaboration, and regulation on consumer trust through a worldwide dataset from 2020 to 2025. The research employs exploratory data analysis (EDA) and correlation methods to investigate how patterns of adoption relate to socioeconomic results. The findings indicate that consumer trust in AI does not have a strong correlation with the rate of adoption, implying that public confidence is influenced more by governance and social context than by the level of usage. Tighter regulations are linked to increased consumer trust but result in lower adoption rates, suggesting a trade-off in governance. Furthermore, while job losses from AI are correlated with increased revenues, this economic advantage does not lead to higher consumer trust. Variations across industries indicate that certain sectors are at the forefront of adoption and revenue growth but still encounter consumer scepticism. These results underscore the intricate relationship between technological adoption, economic effects, and consumer trust, providing valuable insights for policymakers and industry leaders.

Keywords: Artificial Intelligence, Consumer Trust, Regulation, Job Displacement, Exploratory Data Analysis, Socio-economic Outcomes

JEL Classification: O33, M31, C38

Introduction

Artificial Intelligence has swiftly become a key technology of the twenty-first century (West, 2018). Its uses span various fields including healthcare, finance, media, retail, and manufacturing, and it is widely recognized for its ability to enhance efficiency and foster innovation (Acemoglu & Restrepo, 2018). However, the adoption of AI involves more than just technical or economic aspects; it is fundamentally a social process that is closely connected to consumer perceptions and trust levels (Floridi et al., 2018). Trust in AI systems is crucial because it influences how willing consumers are to embrace AI-enabled services, interact with AI-driven products, and endorse their extensive integration into a regular basis (Commission, 2019). Even though it's crucial, the connection between the adoption of AI and trust among consumers is unclear. Does an increase in adoption necessarily lead to greater public trust? Or does swift automation, with its related dangers such as job displacement and ethical issues, undermine confidence? Additionally, how does regulation influence consumer attitudes towards AI? These queries form the foundation of this paper, which aims to explore the effects of AI adoption and its socioeconomic impacts on consumer trust. By examining a well-structured dataset using descriptive statistics, correlation analysis, and

visual representations, this research offers empirical insights into the ongoing discussions regarding the societal effects of AI.

Review of Literature

The implementation of artificial intelligence (AI) has been extensively explored in both academic and industry literature, with researchers examining its applications in business, the challenges organizations face, and its wider social implications. (Davenport & Ronanki, 2018) point out that companies are increasingly utilizing AI for automating processes and enhancing customer engagement, yet they also observe that the financial outcomes of such adoption can differ greatly. In a similar vein, (Brynjolfsson & McAfee, 2017) suggest that while AI can drive growth for firms that are digitally advanced, industries lacking strong technological foundations often find it difficult to achieve substantial benefits. These findings imply that the adoption of AI is inconsistent and influenced by context, highlighting the importance of assessing its effects across various sectors and regulatory environments.

Another significant topic in the literature addresses consumer confidence in AI technologies. (Shneiderman, 2020) highlights that trust is inherently linked to how safe, reliable, and accountable individuals perceive human–AI interactions to be. Evidence from the service industry provided by (Gursoy et al., 2019) indicates that consumers are hesitant to embrace AI-driven tools unless there are transparency and clear advantages. (Wirtz et al., 2021) build on this research by showing that consumer trust is heightened in hybrid systems where human oversight enhances machine intelligence, demonstrating that trust relies on both the technology itself and the context in which it is utilized.

The importance of regulation and ethics is thoroughly examined in the existing literature. (Jobin et al., 2019), in their comprehensive review of AI ethics guidelines, highlight transparency, accountability, and fairness as key principles within regulatory frameworks. Although strict regulation can impede the pace of innovation (Ransbotham et al., 2017), it has been shown to significantly contribute to enhancing legitimacy and consumer trust. Therefore, governance appears to be a double-edged sword: while it may hinder adoption, it also establishes conditions that foster greater public acceptance.

Moreover, the socioeconomic implications of AI adoption are a significant concern. Research indicates that while automation results in observable increases in productivity and revenue, it also leads to considerable job displacement (Brynjolfsson & McAfee, 2017). This dual aspect is essential for understanding consumer trust, as mere economic efficiency does not automatically ensure favourable public perceptions. Consumers might perceive AI-driven profits as separate from their own well-being, which can lead to scepticism regarding the technology despite its advantages for organizations.

Collectively, the literature highlights four key areas: the diverse nature of AI adoption, the conditional development of consumer trust, the legitimizing yet moderating impact of regulation, and the socioeconomic trade-offs associated with automation. However, there is a lack of studies that systematically investigate these elements together utilizing empirical data across various countries and industries. This gap underscores the need for the current study, which uses exploratory data analysis to examine how adoption, regulation, and the outcomes of automation influence consumer trust on a global scale.

Objectives of the study

The objectives of the study are-.

1. To evaluate the socio-economic trade-offs of automation, including both benefits and challenges and its impact on consumer trust.
2. To investigate how AI adoption, regulation, and automation collectively influence consumer trust in a global context.

Rationale of the study

Artificial Intelligence (AI) is significantly revolutionizing global sectors, economies, and societal frameworks by reinterpreting organizational functionalities and influencing the manner in which consumers interact with technological advancements. Despite the rapid global proliferation of AI and its potential to yield substantial economic advantages, ambiguities remain concerning its extensive social repercussions - particularly regarding the degree to which AI assimilation impacts consumer assurance and socio-economic equilibrium. The research is anchored in the examination of the interplay among technological progress, economic efficacy, and societal trust within a context increasingly characterized by automation. It highlights the necessity of synchronizing innovation with ethical governance and social accountability to foster equitable, transparent, and sustainable integration of AI across various domains.

Hypotheses of the study

For the present study, hypothesis has been formulated in alignment with the research objectives. This hypothesis serves as a guiding statement that anticipates the relationship between the key variables under investigation. Moreover, the hypothesis reflects the core purpose of the research, facilitating a systematic examination of the phenomena under consideration and enabling meaningful interpretations of the results.

H1: Higher levels of AI adoption are not significantly associated with higher levels of consumer trust.

H2: Job displacement resulting from AI adoption is positively correlated with revenue growth but negatively correlated with consumer trust.

H3: The impact of AI adoption on consumer trust varies significantly across industries due to contextual and sector-specific factors.

Data and Methodology

The dataset utilized in this research consists of 200 observations spanning various countries and industries from 2020 to 2025 extracted from Kaggle datasets. It features both numerical and categorical variables. The numerical variables encompass AI adoption rate, volume of AI-generated content, job displacement attributed to AI, revenue growth resulting from AI, the rate of human–AI collaboration, consumer trust in AI, and the market share held by AI companies. The categorical variables consist of country, industry, regulatory status, and the primary AI tools employed. The analysis is divided into three phases. Initially, descriptive statistics are calculated to offer an overview of AI adoption, consumer trust, and associated variables. Next, correlation analysis is conducted to uncover the strength and direction of the relationships between consumer trust and other variables such as the adoption rate, job loss, and regulation. Finally, various

visualizations, including heatmaps, scatter plots, boxplots, and bar charts, are used to present the results in a clear and understandable way.

To ensure statistical robustness, all correlations were evaluated for significance using two-tailed p-values at the 0.05 level and complemented by 95% confidence intervals derived through a bootstrap resampling approach (2,000 iterations). This procedure validated the stability of observed relationships and reduced potential bias from random sample variation. Although the present analysis is exploratory, future studies may employ hierarchical or causal frameworks to generalize these results across larger and more diverse datasets. The analysis has been conducted using python.

Results and Discussions

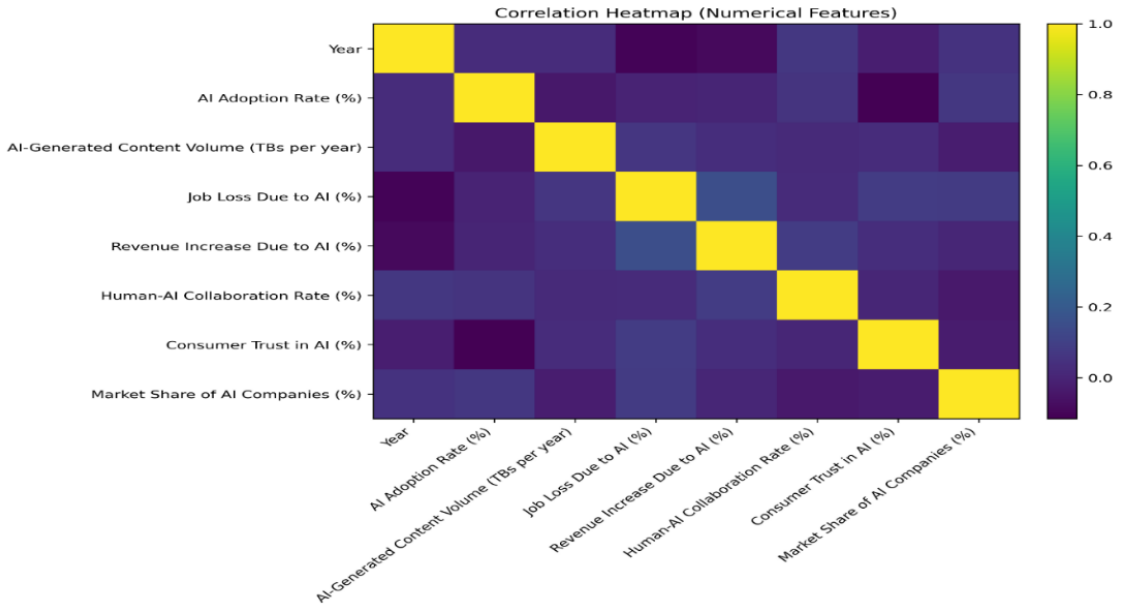
The summary statistics offer a succinct insight into the distribution of key variables within the dataset. The average rate of AI adoption is 54.27%, accompanied by considerable variability among observations (standard deviation 24.22%), with values spanning from 10.53% to 94.76%. The mean volume of AI-generated content is 46.07 terabytes annually, with extreme figures ranging from 1.04 to nearly 99.06 terabytes. Job displacement attributable to AI stands at an average of 25.79%, with some instances reporting nearly 50%, underscoring the degree of automation in specific sectors. The average revenue growth resulting from AI is 39.72%, although the range is broad, showing some regions or industries experiencing increases below 1% while others near 80%. The mean rate of human–AI collaboration is 54.10%, with values fluctuating from 20.21% to 88.29%. Average consumer trust in AI is 59.43%, but the distribution reveals both doubt (30.12%) and high levels of confidence (89.88%) in certain situations. Lastly, the average market share of AI companies is 26.57%, displaying variation between 1.18% and 49.28%, indicating an uneven distribution of AI firms on a global scale.

Table 1: Descriptive statistics of the key variables

	AI Adoption Rate (%)	AI-Generated Content Volume (TBs per year)	Job Loss Due to AI (%)	Revenue Increase Due to AI (%)	Human-AI Collaboration Rate (%)	Consumer Trust in AI (%)	Market Share of AI Companies (%)
Count	200	200	200	200	200	200	200
Mean	54.26585	46.0726	25.78825	39.71945	54.10215	59.42515	26.56955
Std	24.21806673	29.1612196	13.901105	23.8295453	19.2470786	17.319668	14.0237285
Min	10.53	1.04	0.09	0.14	20.21	30.12	1.18
25%	33.2225	20.3225	14.995	17.9075	37.77	44.755	14.0525
50%	53.31	44.32	25.735	42.1	54.515	59.215	27.39
75%	76.22	71.62	37.4175	58.6975	69.4025	74.885	38.4325
Max	94.76	99.06	49.71	79.55	88.29	89.88	49.28

Source: *Author's self-computation using python and data extracted from https://www.kaggle.com/datasets*

Figure 1: Correlation heatmap to illustrate the relationships among the numerical variables



Source: *Author' self-construct*

The correlation analysis (Table 2) provides statistical confirmation of relationships among the key variables. Most associations were weak and statistically non-significant ($p > 0.05$), indicating that AI adoption, collaboration, and trust operate largely independently. A notable exception was the positive link between job loss due to AI and revenue increase ($r = 0.153$, $p = 0.031$), suggesting that sectors experiencing higher automation tend to report modest economic gains. To test the stability of these findings, a bootstrap resampling procedure (2,000 iterations) was applied. The bootstrap-estimated confidence interval for this correlation remained positive (95% CI = [0.01, 0.29]), confirming its robustness, while other relationships fluctuated around zero, indicating non-significance. These results reinforce that consumer trust is not linearly tied to adoption or revenue metrics but is instead context-dependent.

Table 2: Correlation and Significance Matrix of Key Variables

n.s. = not significant (p > 0.05)

Variable Pair	Pearson's r	p-value	Significance	Interpretation
AI Adoption – Consumer Trust	-0.115	0.104	n.s.	Weak negative, not significant
Job Loss – Revenue Increase	0.153	0.031	*(p < 0.05) *	Positive and significant
Revenue Increase – Consumer Trust	0.028	0.688	n.s.	Very weak, not significant
AI Adoption – Revenue Increase	0.002	0.979	n.s.	No relationship
Human–AI Collaboration – Revenue Increase	0.081	0.253	n.s.	Weak positive, not significant

Source: *Author's self-computation using python and data extracted from https://www.kaggle.com/datasets*

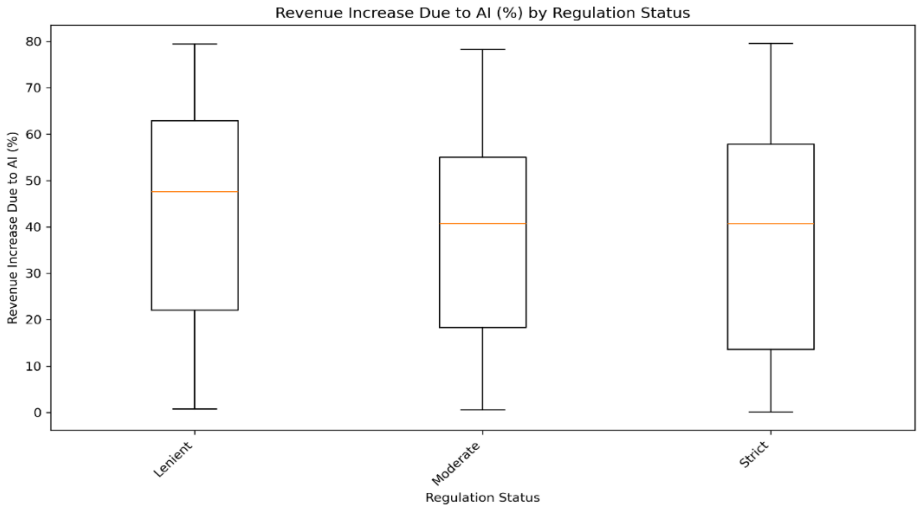
Table 3: Bootstrap Validation of Key Correlations

Variable Pair	Mean r	SD r	95% CI (Lower–Upper)	Interpretation
AI Adoption – Consumer Trust	-0.115	0.066	[-0.24, 0.02]	Stable, not significant
Job Loss – Revenue Increase	0.153	0.071	[0.01, 0.29]	Positive, robust
Revenue Increase – Consumer Trust	0.028	0.069	[-0.10, 0.16]	Weak, unstable

Source: *Author's self-computation using python and data extracted from https://www.kaggle.com/datasets*

The impact of regulation on revenue results is demonstrated in Figure 2, which shows revenue growth based on regulatory classification. The findings indicate that nations with more lenient regulations experience the greatest median revenue increases, albeit with considerable variability in outcomes. Countries with moderate regulations yield slightly lower median revenues, while those with strict regulations exhibit the smallest overall revenue growth. This suggests that although regulation may foster trust and offer protections, it can also suppress the short-term financial benefits of AI implementation by restraining aggressive utilization.

Figure 2: Boxplot of consumer trust by regulation status

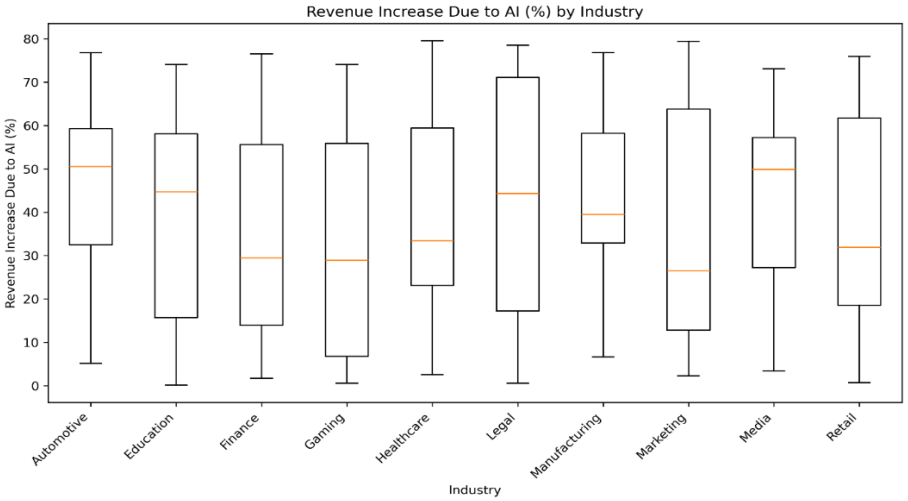


Source: *Author's self-computation using python and data extracted from https://www.kaggle.com/datasets*

Analysis across different industries highlights the varied economic effects of AI. As illustrated in Figure 3, the automotive and media industries experience the most significant revenue increases, characterized by both high median figures and broad ranges. The legal and manufacturing sectors also show considerable growth, whereas the gaming and finance sectors see the least revenue gains. The variability of results within each sector suggests that although AI implementation yields

advantages across various fields, the extent of economic returns is highly dependent on the specific context.

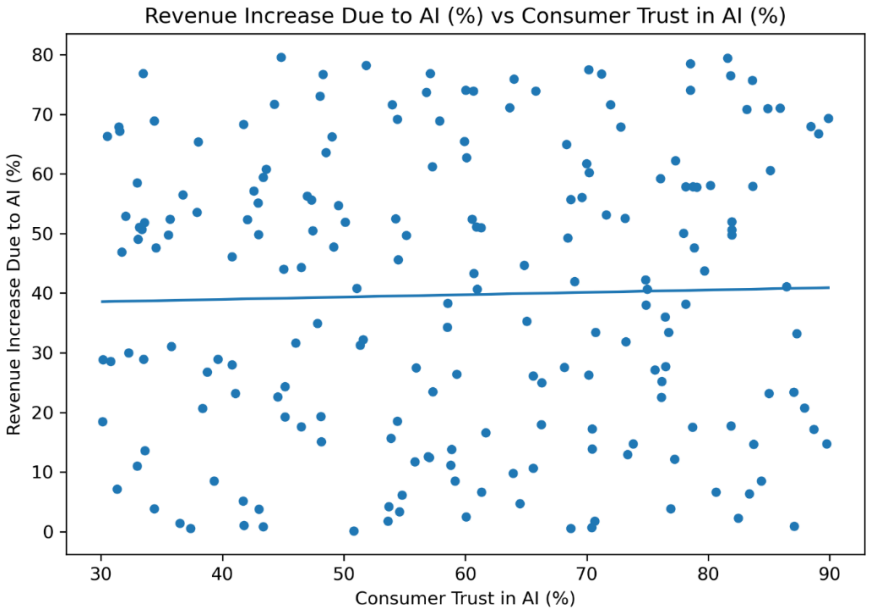
Figure 3: Boxplot showing consumer trust by industry



Source: *Author's self-computation using python and data extracted from https://www.kaggle.com/datasets*

Finally, scatter plots exploring relationships between job loss, revenue, and consumer trust suggest that while automation boosts revenue, it does not directly foster consumer trust. In fact, in some cases, industries with high job loss and revenue growth report relatively stagnant or even lower levels of consumer confidence.

Figure 4: Scatter plot of consumer trust versus job loss and revenue increase



Source: *Author's self-computation using python and data extracted from https://www.kaggle.com/datasets*

Results of Hypothesis Testing

H1 is supported. The empirical analysis indicates only minimal or insignificant correlations between the rate of artificial intelligence adoption and consumer trust, thereby implying that the mere act of adoption does not inherently foster public confidence.

H2 is validated. The data reveals a moderate positive correlation between job displacement and revenue expansion; however, this economic advantage fails to manifest as enhanced consumer trust, often remaining stagnant or even declining within highly automated industries.

H3 is accepted. An industry-level examination uncovers disparities: sectors such as automotive and media attain substantial revenue growth while concurrently encountering consumer scepticism, whereas sectors like finance and gaming exhibit lower revenue increases but comparatively stable levels of trust.

In summary, all three hypotheses are affirmed through exploratory data analysis. The findings underscore that consumer trust is more profoundly influenced by regulatory frameworks, governance structures, and social contexts than by the rates of adoption or the economic benefits derived from automation.

Discussion

The results indicate that consumer confidence in AI is primarily influenced by contextual and regulatory elements rather than the level of adoption itself. Although high adoption rates indicate technological progress, they do not ensure greater consumer comfort with AI systems. Instead, trust seems to be developed through structures that promote accountability, transparency, and fairness. The correlation between stringent regulations and increased trust supports the notion that governance can significantly facilitate consumer acceptance.

The statistical validation using both p-value testing and bootstrap confidence intervals further supports these interpretations. The weak but consistent positive correlation between job loss and revenue growth remained robust across resampled datasets, implying an underlying productivity–displacement dynamic. In contrast, the associations of consumer trust with adoption or collaboration rates were statistically insignificant and unstable, suggesting that trust arises from ethical and contextual factors rather than from quantitative adoption metrics.

Simultaneously, the positive link between job losses and revenue increases illustrates the dual effects of AI adoption: while it boosts economic efficiency, it can also lead to social disruptions. However, this economic advantage does not appear to enhance consumer trust, implying that individuals may see AI's profitability as separate from their personal well-being. This emphasizes the need to align AI implementation not just with financial metrics but also with social accountability.

Conclusion

This initial analysis sheds light on the intricate dynamics of AI adoption, socioeconomic effects, and consumer trust. Three primary conclusions are drawn. First, consumer trust in AI shows only a weak correlation with adoption rates, indicating that technological deployment alone does not instil confidence. Second, while regulatory frameworks can enhance trust, they may simultaneously constrain adoption rates, reflecting a governance trade-off. Third, although automation yields economic gains, it is often accompanied by job losses, and these gains do not

translate into higher consumer trust. The findings suggest that building consumer trust in AI requires more than technological advancement—it demands transparent regulation, ethical accountability, and strategies that mitigate public concerns regarding fairness and employment displacement.

To ensure analytical robustness, significance testing and bootstrap resampling were conducted, confirming the stability of key correlations such as between job loss and revenue increase. As this study uses aggregated cross-sectional data, hierarchical (mixed) modeling could not be directly applied. However, future research should employ hierarchical or multilevel models to account for variations across industries or countries and adopt causal inference frameworks (such as Difference-in-Differences) to strengthen generalizability. Furthermore, future investigations could complement the quantitative findings with qualitative insights, including expert interviews and consumer sentiment surveys, to provide a more comprehensive understanding of how trust, regulation, and socioeconomic outcomes interact in the evolving landscape of AI.

Recommendation for future study

- Governments and industry regulators should implement transparent, accountable, and ethical AI governance frameworks.
- Future research should employ multi-level models FOR understanding factors - like culture, policy, and industrial maturity, influence of consumer trust and economic outcomes.

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EXAMINING THE PROFITABILITY DYNAMICS OF SMALL FINANCE BANKS IN THE INDIAN FINANCIAL LANDSCAPE

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Abstract

This study aims to examine the profitability dynamics of Small Finance Banks (SFBs) in the Indian financial landscape and identify the key determinants of profitability specific to this emerging sector. The study utilizes panel data regression models to analyse the impact of various factors, including bank size, credit risk, liquidity, capital adequacy, priority sector lending, and operating efficiency, on the profitability of SFBs. Balanced panel data were collected for six SFBs for five years (2018-2022). The empirical results indicate that bank size and non-performing assets significantly influence the profitability of SFBs. Larger banks within the sample tend to be more profitable, highlighting the advantages of economies of scale. Moreover, a higher proportion of non-performing assets relative to advances adversely affects profitability, emphasizing the importance of effective credit risk management. This study contributes to the existing literature by providing original insights into the profitability dynamics of SFBs in India, which have received limited attention in previous research. The findings of this study provide valuable insights for policymakers, regulators, and SFBs in making informed decisions and developing strategies to enhance the profitability and overall financial health of SFBs. The findings of this study have social implications as the profitability of SFBs can lead to increased financial inclusion and access to credit for underserved sections of society, fostering economic development and social welfare.

Keywords: Small Finance Banks (SFBs), Profitability, Performance, Panel Data Regression, Return on Assets, Return on Equity, Net Interest Margin

JEL Classification: G21, G39

Introduction

A key characteristic that sets apart the Indian banking sector from banking sectors in many other nations is the promotion of multiple differentiated banking institutions that meet the varied requirements of various economic sectors(Jayadev et al., 2017). Differentiated banks, in contrast to universal banks, provide specialized banking services within specific verticals, thus distinguishing themselves from the broader range of services offered by universal banks. In September 2015, RBI granted provisional licenses to ten organizations for the establishment of a new category of differentiated banks known as Small Finance Banks (SFB).

SFBs are niche banks that offer affordable services to the unserved population with the goal of providing an institutional framework to mobilize funds from rural and semi-urban areas and give loans to viable economic entities in local areas. In India, SFBs are mandated to lend a significant portion (75%) of their loan portfolio to priority sectors, including agriculture, small businesses, microenterprises, and other sectors that contribute to economic development. This ensures flow of credit to sectors that often face challenges in obtaining finance from traditional banks. The majority of SFBs have contributed significantly to developing sustainable livelihoods, disseminating financial literacy, and promoting digital financial inclusion in India

(Srikanth et al., 2021). The performance evaluation of SFBs is of critical importance to assess their effectiveness in achieving their social and economic objectives.

In the pursuit of financial inclusion, the profitability of Small Finance Banks remains a critical concern. While the primary objective of SFBs is to serve the underserved, sustainable profitability is essential for their long-term viability, operational efficiency, and ability to fulfil their social mandate effectively. Therefore, understanding the profitability dynamics of SFBs is paramount for various stakeholders, including policymakers, investors, researchers, and the banking industry. This study seeks to provide valuable insights into the overall financial health of SFBs and their ability to generate sustainable profits by delving into the key determinants of profitability, such as asset quality, liquidity, capital adequacy, and operational efficiency. The findings of this study will not only contribute to the existing literature on banking profitability but also provide valuable insights for policymakers and regulators to fine-tune the operational framework of SFBs.

Literature Review

The literature review section aims to establish a theoretical foundation and highlight the knowledge gap that exists in relation to Small Finance Banks operating in India.

Small Finance Banks (SFBs) in India

SFBs have been introduced in India as a means to achieve financial inclusion and address the challenges faced by existing differentiated banks. Kishore (2015) argues that the establishment of SFBs is necessary due to the failure of existing banks in producing the anticipated results. However, implementation of SFBs comes with its own set of challenges. Jayadev et al. (2017) highlights the immediate hurdles faced by SFBs, including the development of liability products, regulatory compliance, digital connectivity with rural customers, and the creation of affordable banking solutions. Despite the challenges, SFBs have shown promising financial positions over time. Ravikumar et al. (2020) indicate that SFBs have demonstrated sound financial positions as reflected in their NPA ratio and capital adequacy ratio (CAR). Additionally, Srikanth et al. (2021) highlight the positive developments brought about by SFBs in terms of financial inclusion, rural development, and providing loans to priority sectors. In terms of overall performance, Ray & Shantnu (2021) used the CAMEL rating to evaluate ten SFBs. While there were variations in capital adequacy, asset quality, management efficiency, and liquidity among the banks, Fincare SFB emerged as the best performer while Jana SFB was identified as the worst performer. Ali &Kaveri (2021) provided a comprehensive analysis of SFBs, highlighting the factors that influence their Return on Assets (ROA). The study reveals that the NNPA ratio and CIR have an inverse relationship with ROA, while the non-interest income ratio and bank size have a direct relationship.

Profitability Analysis of Banks

Bansal et al. (2018) conducted a panel regression analysis to examine the relationship between net profit margin and ROA along with various independent variables and opined that that Interest Expended, Interest Earned and Credit Deposit Ratio have a negative impact on profitability. Mehzabin et al. (2023) examined how capital structure, operating efficiency, and non-interest income impact profitability measured by ROA and ROE of the banking sector in 28 Asian countries. The results indicate that debt financing and effective management of operating expenses and costs contribute to higher profitability. Sinha & Sharma (2016) measured profitability using the ROA metric and found that bank-specific variables such as the capital-to-assets ratio, operating efficiency, and diversification have a significant and positive impact, while, credit risk, as indicated by provisions for bad debts, has a negative effect. Pervez

& Ali (2022) found that the size of banks and cost inefficiency did not have a significant impact on the performance of public sector banks. Al-Homaidi et al. (2018) used Net Interest Margin (NIM), in addition to ROE and ROA, as a measure of the profitability of commercial banks in India. The results revealed that bank size, assets management ratio, assets quality ratio, and liquidity ratio all had a noteworthy positive influence on NIM.

It is important to note that the results of studies conducted on banks' profitability determinants provided mixed results and literature specific to SFB is very limited, which creates a notable gap in our understanding of the profitability dynamics unique to this emerging sector. Accordingly, the current study seeks to analyze the profitability of Indian SFBs by empirically assessing bank-specific drivers.

Objectives of the Study

The following research objectives are framed for the study:

i. To investigate the key determinants of ROA of SFBs operating in India.

ii. To explore the key determinants of ROE of SFBs operating in India.

iii. To examine the key determinants of NIM of SFBs operating in India.

Significance of the Study

Small Finance Banks (SFBs) are new banking segment which lacks longitudinal researches, thus by exploring profitability drivers of SFBs over a 5-year period, this study fills a huge research gap in the banking literature. Delving into financial health of SFBs which are gaining recognition worldwide, this study makes significant contribution to the academic understanding of this model's financial performance.

The study stands significant considering the niche banking segment that the authors delve into, which is Small Finance Banks. SFBs are innovative banks, created for the purpose of increasing financial inclusion by catering to the needs of that section of the population which remains unserved like the farmers, unorganized sector, micro or small businesses. Also, SFBs are coupled with significant priority sector lending norms. Assessing their financial health helps to analyze the effectiveness of this differentiated banking model. Also, this study is important to understand whether the pursuit of financial inclusion is sustainable from a profitability perspective.

The study also stands significant considering it offers regulators like Reserve Bank of India and other policymakers' significant insights on how various factors interact with the profitability of SFBs as the regulators including the government have a keen interest in the success of Small Finance Banks. This study will also assist the regulators by offering empirical evidence in assessing the effectiveness of various policies framed for SFBs.

Conceptual Framework

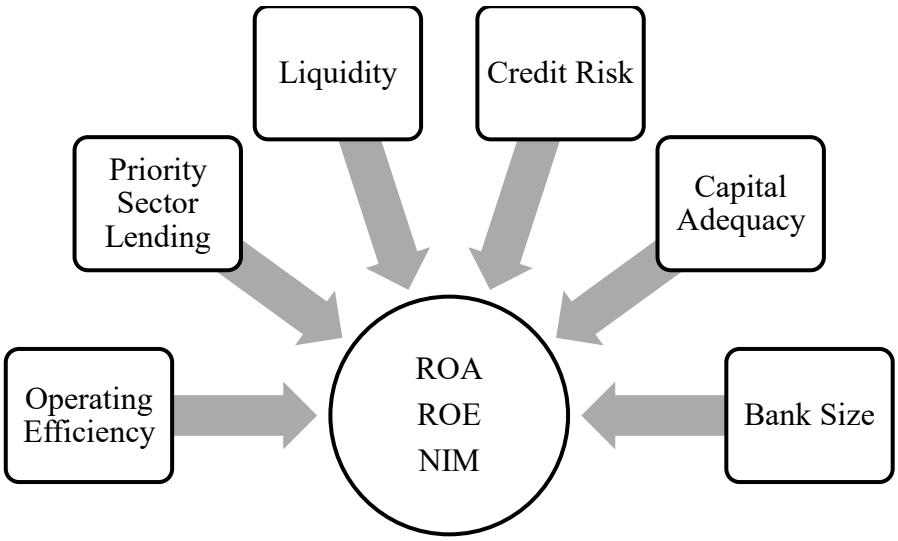
The profitability of banks is influenced by both internal factors (such as size, capital ratio, etc) and external factors (such as inflation, interest rates, and economic growth). This study specifically examines how internal factors affect profitability of SFBs as external factors are common across different bank categories (Seenaiah et al., 2015). The study employs different performance indicators to evaluate the profitability of SFBs which are listed below:

Table 1: Description of Selected Variables

Variable	Acronym	Description	Source
Dependent			
Return on Assets	ROA	Percentage of net profit to the total assets	Al-Homaidi et al., (2018)
Return on Equity	ROE	Percentage of net profit to the total equity	
Net Interest Margin	NIM	Net interest income to total assets	
Independent			
Bank Size	LogBS	Natural logarithm of total assets	Chaudhary & Kaur (2021)
Capital Adequacy	CAR	(Tier I capital + Tier II capital)/Risk-weighted assets	Bansal et al., (2018)
Credit Risk	CRI	Net Non-Performing Assets to Net Advance (NNPANA)	Pervez & Ali (2022)
Liquidity	CDR	Cash Deposit Ratio	Authors' Own
Operating Efficiency	OE	Operating expense to total assets	Pervez & Ali (2022)
Priority Sector Lending	PSL	Percentage of priority sector advances to net advances	Seenaiah et al., (2015)

Source: *Compiled by the authors*

Figure 1: Conceptual Framework of the Study



Source: *Authors' self-construct*

Variable Definition

Dependent Variables: Commonly used proxies to measure profitability in the majority of prior profitability studies of banks are ROA, ROE, and NIM. This study uses the following proxies for profitability:

- *Return on Assets (ROA)*: ROA provides insights into a bank's efficiency in generating profits from its assets.
- *Return on Equity (ROE)*: ROE provides valuable insights into how effectively a bank utilizes its shareholders' investments to generate earnings.
- *Net Interest Margin (NIM)*: NIM shows how much money a bank earns in interest on loans compared to how much it pays in interest on deposits.

Independent Variables

- *Bank Size:* The impact of bank size on profitability is influenced by a combination of factors such as economies of scale, diversification, market power, etc. But excessive growth can hinder a bank's profitability due to increased complexity, diminishing returns, regulatory constraints, and systemic risks.
- *Capital Adequacy:* It is measured by Capital Adequacy Ratio (CAR). CAR represents the proportion of a bank's capital to its risk-weighted assets and serves as a measure of a bank's ability to absorb potential losses.
- *Credit Risk:* Credit risk is the likelihood that a borrower would default on a loan, causing a financial loss for the bank. In this study, Net NPA to Net Advances (NNPANA) is used to measure the credit risk of banks.
- *Liquidity:* The present study used Cash-Deposit Ratio (CDR) as a measure of the liquidity position of banks. While a higher CDR can enhance a bank's liquidity and stability, it may hurt profitability due to reduced lending capacity.
- *Priority Sector Lending (PSL):* The PSL framework mandates banks to lend to sectors that may have difficulties accessing credit, such as small farmers, rural artisans, and entrepreneurs from economically weaker sections of society. Lending to priority industries is thought to have a negative effect on bank profitability (Seenaiah et al., 2015), however, it contributes to overall economic growth (Gaur & Mohapatra, 2021b).
- *Operating Efficiency:* Operating efficiency is measured by dividing operating expenses by total assets. Thus, the lower the ratio, the better it is. Operating efficiency refers to the ability of a bank to generate revenue while effectively managing its operating expenses.

Research Methodology

Data Source and Sample

Data is collected from RBI database called the "Database of Indian Economy". It is regarded as India's most reliable database for banking information (Al-Homaidi, et al., 2018). The present study covers 6 SFBs out of 12 SFBs (as of March 31, 2022) and a period of 5 years from 2018 to 2022. The reason behind this is thata balanced panel of data was aimed for the study. Balanced Panel data is generally considered to be better asthe availability of uniform

data reduces heterogeneity in the data (Stack Exchange Inc, 2013). The names of the sample banks are stated below in Table 2.

Table 2: Sample Banks

1. Au Small Finance Bank Limited	4.Suryoday Small Finance Bank Limited
2.Capital Small Finance Bank Limited	5.Ujjivan Small Finance Bank Limited
3.Equitas Small Finance Bank Limited	6.Utkarsh Small Finance Bank Limited

Source: *Compiled by the authors*

Model Specification

To achieve the study's objectives, the study constructs the following econometric model using panel data estimations:

$$Profitability_{it} = \alpha + \beta_1(CAR_{it}) + \beta_2(LogBS_{it}) + \beta_3(CRI_{it}) + \beta_4(CDR_{it}) + \beta_5(OE_{it}) + \beta_6(PSL_{it}) + \varepsilon$$

Where, Profitability is the Dependent variable, 'i' refers to the banks, t refers to the period. Profitability includes Return on Assets (ROA), Return on Equity (ROE) and Net Interest Margin (NIM), CAR is capital adequacy ratio, LogBS is natural logarithm of bank's total assets, CRI is credit risk, CDR is cash deposit ratio, OE is operating efficiency, PSL is percentage of priority sector lending to net advances is the independent variable, ε is the error term,α is the constant term, and $\beta_1$to β_6 are the coefficients of determination.

Econometric Tools

The data used in the study is panel data and hence Panel data analysis is done. There are three types of Panel Data models, namely Pooled OLS, Fixed Effect Model and Random Effect Model (Fanbasten & Escobar, 2016). Pooled OLS regression is used to estimate the relationship between one or more independent variables and a dependent variable in a pooled cross-sectional and time-series dataset. It ignores the heterogeneity that exists between entities and between time periods. To address this problem, Fixed Effect Model (FEM) and Random Effect Model (REM) are available. REM, in contrast to Pooled OLS Regression, considers potential entity heterogeneity by assuming that each entity has a unique effect that is uncorrelated with the independent variables (Gjeka, 2017). On the other hand, entity-specific fixed effects are incorporated into the regression analysis by FEMin order to account for entity-specific heterogeneity.

Selecting the appropriate model is important as the relationship between dependent and independent variables is based on it. To use Pooled OLS, the assumption of equal intercepts of all entities should be met. To choose whether Pooled OLS is appropriate for the study, the Bruesch-Pagan Test (BP test) is used. The null hypothesis of the BP test states that variances of the random effect is zero, meaning Pooled OLS is an appropriate estimator of the data. The alternate hypothesis states that the variances of the random effects is not zero, meaning Fixed Effect or Random Effect model would be more appropriate than Pooled OLS model. If the p-value of the BP test is greater than 0.05, null hypothesis could not be rejected, meaning Pooled OLS model would be more appropriate. Conversely, if p value is smaller than 0.05, null hypothesis is not accepted, then FEM/REM would be better for the study. Amongst FEM/REM, the appropriateness of the model is decided by the Hausman Test (Seenaiahet al., 2015). The next section outlines the various assumptions that need to be tested before applying Panel Data analysis and contains inferences drawn from various Panel data analyses to achieve the objectives of the study. Also, the study's primary threshold for statistical significance and for

drawing conclusion, is set at the 5% significance level. This aligns with common practices in social science studies and ensures a higher level of confidence in the observed effects.

Empirical Results and Discussion

Testing of Assumptions

The four key assumptions that are vital to Panel data analysis are no multi-collinearity, no heteroscedasticity, no unit root (stationery data) and no auto correlation (Boadi, 2015).

- Multi-collinearity means the independent variables in the study are highly correlated with each other (Boadi, 2015). To check multi-collinearity, Variance Inflation Factor (VIF) needs to be used (Gaur & Mohapatra, 2021). Data should have a VIF less than 10 to be devoid of multi-collinearity. The results of the multi-collinearity test are tabulated below:

Table 3: Multi-Collinearity Test

Variable	VIF	1/VIF
Capital Adequacy Ratio	3.94	0.25
Priority Sector Lending Ratio	2.8	0.36
NNPANA	1.72	0.58
Operating Efficiency	1.27	0.79
Ln Bank Size	1.24	0.80
Cash Deposit Ratio	1.18	0.85
Mean VIF	2.02	

Source: *Compiled by the authors*

The above table reflects that the VIF values of all the independent variables are less than 10, with a mean VIF of 2.02, which shows that the data is free from multi-collinearity and is fit for Panel Data analysis.

The next assumption is no auto-correlation. Auto-correlation means that the error terms are correlated over time (Liu, 2021). The Durbin-Watson statistic is used to detect the presence of auto-correlation in the data (Chaudhary & Kaur, 2021). A value less than 1 and greater than 3 in a Durbin Watson test is a concern for a study (Field, 2009). The value of Durbin Watson Statistics in all the models is clubbed in Table 4.

Table 4: Durbin-Watson Statistic

Models	Durbin-Watson Statistic
ROA	1.95
ROE	1.77
NIM	1.96

Source: *Compiled by the authors*

The values of the Durbin Watson statistic for all three models are all within the acceptable range of 1 to 3. Thus, auto-correlation doesn't pose a problem in this study.

The third assumption is that there should be no heteroscedasticity in the data. Heteroscedasticity is a problem when the variances of the error components or residuals differ between observations (Boadi, 2015). To detect the presence of heteroscedasticity, the Breusch–Pagan test (BP Test) is used (Gaur & Mohapatra, 2021). The null hypothesis of the BP test is that error variances are equal. Below in Table 5, the values of the BP test for the three models are displayed.

Table 5: Bruesch Pagan Test for the Models

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided			
ROA			
	Cross-section	Time	Both
Breusch-Pagan	2.686496	0.027548	2.714043
	(0.1012)	(0.8682)	(0.0995)
ROE			
	Cross-section	Time	Both
Breusch-Pagan	2.282776	0.025133	2.307909
	(0.1308)	(0.8740)	(0.1287)
NIM			
	Cross-section	Time	Both
Breusch-Pagan	0.130487	0.248978	0.379465
	(0.7179)	(0.6178)	(0.5379)

(Values in brackets signify the p-values)

Source: *Compiled by the authors*

The p value (probability value), in all the three cases are greater than 0.05, thus null hypothesis of equal variances cannot be rejected. It means that there is no heteroscedasticity in the data. The assumption is thus met.

The last assumption is testing whether data is stationery. It is tested generally to see if the mean, variance, and covariance of a time series are affected by the passage of time. However, when period of study (T) is lesser than number of entities (N), then the problem of Unit root doesn't exist (Wooldridge, 2010; Nawaz, 2018). Thus, unit root test need not be conducted in this study as T (study period) is 5 and N (number of banks) is 6. Unit root doesn't stand as a problem in this study.

Descriptive statistics

The analysis starts with discussing the descriptive statistics of the dependent and independent variables. Table 6 states the Descriptive statistics of the variables of the study.

Table 6: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
	Independent Variables				
Priority Sector Lending Ratio (PSL)	30	6.26	91.90	60.3067	24.85
Operating Efficiency	30	2.71	7.30	4.91	1.43
Cash Deposit Ratio (CDR)	30	2.12	13.82	5.71	2.89
Bank Size	30	2163.50	69077.80	16666.20	15371.46
Capital Adequacy Ratio (CAR)	30	16.40	51.47	24.82	7.77
NPA	30	.12	5.97	1.46	1.28
	Dependent Variables				
ROA	30	-2.04	3.00	.99	1.23
ROE	30	-15.30	21.98	7.96	8.82
NIM	30	3.40	11.44	7.12	2.31

Source: *Compiled by the authors*

It is evident in table VI that there is a huge gap of minimum (6.2%) and maximum (91.9) values of PSL ratio. A high standard deviation (24.8%) shows the disparity of PSL ratio among the sample banks. The difference between minimum and maximum values of operating efficiency is not as huge as the PSL ratio. The same is supported by a lower standard deviation value of 1.43%. In case of Cash Deposit Ratio there isn't a noteworthy variation as is evident by a smaller standard deviation value. However, there is a huge difference between the minimum and maximum bank size. The huge standard deviation shows the disparity amongst the sample banks in terms of their assets. The mean Capital Adequacy Ratio is 24.82 and the range (difference between minimum and maximum values) of Capital Adequacy ratio is also a significant one. The NPA values aren't that huge. The mean NPA ratio is 1.46%, which is comparatively better than the overall banking sector of India.

For the dependent variables, the mean ROA is 0.99%, but some banks have had negative ROA during the study period. Also, some banks have had high ROA, like 3%, which shows disparity in ROA amongst the SFBs. ROE shows a dynamic picture too. During the study period, amongst the sample banks, some banks have had a negative ROE to the extent of -15.30% and there are banks that have had a significantly high ROE (21.98%). The standard deviation value of ROE depicts that the highest variation exists in ROE amongst the dependent variables. The average Net Interest Margin is 7.12%.

It can thus be concluded from the above analysis that amongst dependent variables, the highest mean and highest standard deviation are observed in ROE and amongst independent variables, the highest mean and highest standard deviation are observed in bank size.

Panel Data Analysis

After evaluating the initial results, the article continues by applying panel data models to estimate the profitability determinants of ROA, ROE and NIM, showcasing the results in tables 7, 8, and 9, respectively.

Table 7: Results of Panel Data Model—ROA

Dependent Variable: ROA				
Method: Panel Least Squares				
Sample: 2018 –2022, Periods included: 5				
Cross-sections included: 6				
Total panel (balanced) observations: 30				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-3.104668	2.522780	-1.230653	0.2309
LOGBANKSIZE	0.561184	0.222625	2.520758	0.0191
CAR	0.079297	0.043713	1.814034	0.0827
NNPANA	-0.735256	0.174019	-4.225151	0.0003
CASHDEPORATIO	-0.122273	0.064249	-1.903094	0.0696
OE	-0.224129	0.133929	-1.673493	0.1078
PSL	-0.004190	0.011527	-0.363515	0.7195
R-squared	0.560116	Mean dependent var		0.993667
Adjusted R-squared	0.445364	S.D. dependent var		1.237727
S.E. of regression	0.921784	Akaike info criterion		2.875952
Sum squared resid	19.54277	Schwarz criterion		3.202898
Log likelihood	-36.13927	Hannan-Quinn criter.		2.980544
F-statistic	4.881087	Durbin-Watson stat		1.957517
Prob (F-statistic)	0.002373			

Source: *Compiled by the authors*

The initial model employs ROA for measuring bank profitability. The Pooled OLS method is used, as the BP test did not provide evidence to reject null hypothesis (table V). The empirical results reveal that the model, as a whole, is statistically significant in explaining the profitability of SFBs. The F-statistic of 4.88, with a p-value less than 0.05, indicates that the regression model's explanatory variables collectively have a significant impact on the dependent variable, Return on Assets (ROA). The overall regression model has an R-squared value of 0.5601, indicating that approximately 56% of the variation in ROA can be explained by the independent variables included.

The empirical results indicate that several factors significantly affect ROA. Firstly, bank size is found to have a positive and significant impact on ROA, suggesting that larger banks within the sample tend to be more profitable. This could be due to economies of scale and the ability of larger banks to generate higher revenues. Secondly, credit risk (NNPANA) is found to have a negative and significant impact on ROA. This implies that a higher proportion of non-performing assets relative to advances adversely affects profitability of SFBs. On the other hand, variables such as cash deposit ratio, operating efficiency, and priority sector lending ratio are found to have an insignificant negative impact on ROA. Lastly, capital adequacy ratio is determined to be insignificant, implying that it has no major impact on the ROA of SFBs. These findings highlight the significance of bank size and management of non-performing assets in influencing their financial performance.

The empirical results of the model using ROE are depicted in table 8:

Table 8: Results of Panel Data Model—ROE

Dependent Variable: ROE				
Method: Panel Least Squares				
Sample: 2018 2022, Periods included: 5				
Cross-sections included: 6				
Total panel (balanced) observations: 30				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-18.78658	18.17076	-1.033891	0.3119
LOGBANKSIZE	4.238828	1.603496	2.643491	0.0145
CAR	0.424769	0.314853	1.349102	0.1904
NNPANA	-4.160299	1.253400	-3.319210	0.0030
CASHDEPORATIO	-0.826880	0.462767	-1.786816	0.0872
OE	-2.686209	0.964646	-2.784658	0.0105
PSL	0.008364	0.083025	0.100737	0.9206
R-squared	0.550925	Mean dependent var		7.965000
Adjusted R-squared	0.433775	S.D. dependent var		8.823246
S.E. of regression	6.639307	Akaike info criterion		6.824856
Sum squared resid	1013.849	Schwarz criterion		7.151802
Log likelihood	-95.37284	Hannan-Quinn criter.		6.929449
F-statistic	4.702737	Durbin-Watson stat		1.774523
Prob (F-statistic)	0.002926			

Source: *Compiled by the authors*

The BP test suggests that Pooled POLS model is appropriate, as the null hypothesis of no heteroscedasticity cannot be rejected (table V). The overall model is statistically significant, as indicated by an F-statistic of 4.70 with a p-value below 0.05. The R-squared for the model is 0.5509, indicating that approximately 55% of the variation in ROE can be explained by the independent variables.

Regarding the specific independent variables, the results indicate that bank size, credit risk (NNPANA), and operating efficiency have a significant effect on ROE. Bank size exhibits a positive impact on ROE, suggesting that larger banks tend to achieve higher returns on equity. Conversely, NNPANA has a negative impact on ROE. A higher proportion of non-performing assets relative to advances negatively affects the profitability of SFBs, which could be a result of credit risk management challenges. Similarly, higher operating inefficiency hampers ROE, potentially due to inefficiencies in cost management and operational processes. On the other hand, the remaining independent variables, namely capital adequacy ratio, priority sector lending (PSL) ratio, and cash deposit ratio, do not have a significant impact on ROE.

Table 9 provides valuable insights into the factors influencing the NIM of SFBs.

Table 9: Results of Panel Data Model—NIM

Dependent Variable: NIM				
Method: Panel Least Squares				
Sample: 2018 2022, Periods included: 5				
Cross-sections included: 6				
Total panel (balanced) observations: 30				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-1.557095	3.310798	-0.470308	0.6426
LOGBANKSIZE	0.137438	0.292165	0.470412	0.6425
CAR	0.120595	0.057368	2.102136	0.0467
NNPANA	-0.562795	0.228375	-2.464339	0.0216
CASHDEPORATIO	-0.118586	0.084318	-1.406410	0.1730
OE	1.155104	0.175763	6.571938	0.0000
PSL	0.003741	0.015127	0.247307	0.8069
R-squared	0.783808	Mean dependent var		7.128000
Adjusted R-squared	0.727411	S.D. dependent var		2.317010
S.E. of regression	1.209713	Akaike info criterion		3.419607
Sum squared resid	33.65833	Schwarz criterion		3.746553
Log likelihood	-44.29410	Hannan-Quinn criter.		3.524200
F-statistic	13.89785	Durbin-Watson stat		1.963450
Prob(F-statistic)	0.000001			

Source: *Compiled by the authors*

The BP test indicates that Pooled OLS is appropriate for this model, as the null hypothesis of no heteroscedasticity is not rejected (table V). The overall model is statistically significant, as evidenced by the F-statistic of 13.89 and its associated p-value, which is less than 0.05. The R-squared is 0.7838, indicating that approximately 78% of the variation in NIM can be explained by the independent variables.

Examining the impact of individual independent variables, it is found that the capital adequacy, credit risk (NNPANA) and operating efficiency have a statistically significant effect on NIM. The capital adequacy ratio exhibits a positive impact on NIM, indicating that higher capital adequacy leads to a higher Net Interest Margin. This positive effect can be attributed to the increased confidence of depositors and investors, allowing the bank to attract funds at lower costs, thereby positively influencing the Net Interest Margin. Similarly, operating efficiency has a positive impact on NIM. It indicates that the increase in operating expenses leads to higher NIM. On the other hand, NNPANA has a negative impact on NIM. A higher proportion of non-performing assets relative to advances negatively affects the profitability and asset quality of SFBs, resulting in a lower NIM. This negative effect highlights the importance of effective credit risk management and the need to minimize non-performing loans to maintain a healthy and profitable interest margin. The remaining independent variables, including bank size, priority sector lending (PSL) ratio, and cash deposit ratio, were observed to have a negligible impact on the NIM.

The findings of the three models are summed up below in table 10. The '+' symbol is used to depict the positive impact of variables and '–' symbol is used to show the negative impact of the variables. The symbol '*' is used to depict those variables that have a significant impact on the profitability measures.

Table 10: Summary of the Results

Profitability Measures	Bank Size	Capital Adequacy Ratio	PSL	Operating Efficiency	Credit Risk	Cash Deposit Ratio
ROA	+ **	+ *	-	-	- ***	- *
ROE	+ **	+	+	- **	- ***	- *
NIM	+	+ **	+	+ ***	- **	-

*** p<.01, ** p<.05, * p<.1*

Source: *Compiled by the Authors*

Conclusion

This study aimed to examine the profitability dynamics of Small Finance Banks (SFBs) in the Indian financial landscape by investigating the key determinants of profitability. Through panel data regression analysis, this study obtained valuable insights into the factors influencing the profitability metrics of SFBs, including Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM). This study represents one of the initial and original studies specifically focusing on the profitability of SFBs, addressing a notable gap in the literature.

The findings revealed that bank size had a positive and significant impact on both ROA and ROE, suggesting that larger SFBs tend to be more profitable. This aligns with the concept of economies of scale, where larger banks can benefit from cost efficiencies and generate higher revenues. However, the effect of bank size on NIM was found to be insignificant, indicating that other factors play a more prominent role in determining the Net Interest Margin. Furthermore, the analysis highlighted the significant negative impact of credit risk, as represented by the Net Non-Performing Asset to Net Advances (NNPANA) ratio, on all the three dependent variables. This underscores the importance of effective credit risk management in minimizing non-performing loans and improving the overall profitability of SFBs. Regarding NIM, the results revealed that the capital adequacy ratio had a positive and significant impact. Additionally, operating inefficiency, as indicated by higher operating expenses, was found to have a positive impact on NIM. On the other hand, variables such as priority sector lending (PSL) ratio and cash deposit ratio were observed to have a negligible impact on profitability measures across different models.

Overall, the results contribute to a better understanding of the profitability dynamics of SFBs and emphasize the importance of bank size, credit risk management, capital adequacy, and operational efficiency in driving profitability. These findings can guide SFBs in formulating strategies to enhance their financial performance, such as improving credit risk assessment practices, optimizing operational efficiency, and maintaining adequate capital levels. It will provide valuable insights for policymakers, regulators, and SFBs themselves, enabling them to make informed decisions and develop strategies to enhance profitability, sustain growth, and contribute to the overall stability and development of the Indian financial system.

It is important to note that this study addresses a gap in the existing literature on the profitability of SFBs, which has been relatively limited. By providing empirical evidence on the specific determinants of profitability, this research contributes to a more comprehensive understanding of the financial dynamics within the Indian banking sector. Given the relative novelty of the study and the limited existing literature on the profitability of SFBs, further research and analysis are warranted to explore additional factors and potential interactions that may influence the profitability dynamics of SFBs in India.

One important limitation of this study is the small sample size, which consists of only six Small Finance Banks (SFBs). Although efforts were made to ensure a balanced panel, the restricted number of observations may limit the generalizability of the findings. Therefore, caution should be exercised in extrapolating the results to the entire population of SFBs in India. Future research endeavours could address this limitation by expanding the sample size to include a larger number of SFBs, encompassing the entire universe of these banks operating in India.

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PRADHAN MANTRI SURYA GHAR MUFT BIJLI YOJANA: EVALUATING INDIA'S ROOFTOP SOLAR GROWTH AND ACHIEVEMENTS

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Abstract

The Pradhan Mantri Surya Ghar Muft Bijli Yojana, launched in 2024, is a flagship initiative promoting rooftop solar adoption by providing households up to 300 units of free electricity monthly. It supports India's target of achieving 500 GW of non-fossil fuel capacity by 2030 through decentralized renewable generation. The scheme uses subsidies, concessional loans, and simplified approvals to boost participation, with DISCOMs, private partners, and government agencies playing key roles.

Despite progress, challenges remain, including high installation costs, low awareness, administrative delays, and uneven regional adoption. Early success is evident in urban and semi-urban areas, alongside job creation in solar panel production, installation, and maintenance. The program also contributes to reducing carbon emissions, enhancing energy security, and advancing India's green economy. To maximize its impact, continued policy support, awareness efforts, and capacity building are essential.

Keywords: Pradhan Mantri Surya Ghar Muft Bijli Yojana, Rooftop Solar, Renewable Energy, Sustainable Development, Energy Transition, India, Clean Energy Policy

JEL Classification: Q42, Q48, Q56, O13, O38

Introduction

The most ambitious home rooftop solar program in the world, the PM Surya Ghar Muft Bijli Yojana, was introduced by Prime Minister Narendra Modi on February 13, 2024. By March 2027, it aims to provide up to 300 units of free electricity per home every month by solar-powering one crore (10 million) dwellings. Supported by a substantial ₹75,021 crore investment, the program is essential to India's shift to renewable energy. The program easily fits in with India's larger green energy goals, which include reaching net-zero by 2070 IBEF, supplying 50% of energy from renewable sources, and generating 500 GW of renewable energy by 2030. It seeks to lower electricity costs and give homes energy independence; encourage the development of jobs in the solar manufacturing, installation, O&M, and related industries; and reduce carbon emissions and further climate objectives

The scheme follows a subsidy-based implementation strategy. It provides subsidy in the manner as namely, 1. 60% cost assistance for up to 2 kW systems, 2. 40% subsidized for capacity between 2–3 kW, 3. Equates to subsidies: ₹30,000 (1kW), ₹60,000 (2kW), ₹78,000 (3kW or above)

The Scheme has two innovative deployment models viz.

1. *RESCO Model:* Solar companies install and own systems for 5 years; households pay for generated power.

2. *Utility Led Asset (ULA):* DISCOMs own systems temporarily before transferring ownership to beneficiaries. Streamlined digital portal for easy registration, vendor choice, subsidy disbursal (ideally within 15 days).
3. *Model Solar Village initiative:* Every district pilots a solar village, promoting rural adoption and energy literacy.

Literature Review

The Literature pertaining to the study is limited in number and only those studies which totally align with the title of study has been reviewed. P.M Surya Ghar Muft Bijli Yojana is a recent development and Literature is not entirely available.

Wei S., Temitope E. (2024) in their paper "Adoption of solar grid-tied PV-system adopted in a residential building," Wei S. and Temitope E. (2024) proposed that the installation of a solar grid-tied system in a three-bedroom house in Auckland, New Zealand, would have both economic and environmental benefits. In order to reduce its need on conventional energy sources, the property installed a 4.5 kW photovoltaic panel. Energy-efficient material integration further increased cost savings, demonstrating the viability and sustainability of solar systems when combined with contemporary technologies.

Dixit S. (2018) in their study "Role of solar energy and issues in its implementation in the Indian context," evaluated how the solar industry in India faces challenges due to high costs and a lack of subsidies. Adoption rates could be increased by broadening eligibility requirements and simplifying regulations. Practical steps for stakeholders are the main emphasis of the recommendations.

Shaughnessy E. (2023) in their study "Impacts of non-residential solar on residential adoption decisions," examined how solar systems on commercial sites can promote residential adoption in the surrounding area. This strategy emphasizes the cumulative effect of non-residential solar installations and encourages community-wide adoption.

Sahu G. (2022) in their study "Determinants of residential adoption of solar energy system: A survey of rural India," looked at how government policies, awareness, and supporting infrastructure influence the adoption of solar energy systems in rural India. Perceived advantages and behavioral elements are important in determining people's intentions to use solar technology.

Dalal R. (2021) proposed that a 3-kWp solar PV system enhances energy ratings for Indian homes with a 3–7-year payback period in their paper "Bridging the energy gap of India’s residential buildings by using rooftop solar PV systems for higher energy stars." The results highlight the economic and environmental benefits, which promote the use of rooftop solar.

Kant K (2020) in their study, "Renewable energy policies and their effectiveness in promoting solar energy adoption in India" proposed that solar energy is effectively promoted by India's renewable energy laws. Although there are still implementation issues, state-level initiatives are crucial in promoting acceptance.

Gande Acosta G. (2020), in their study “Boosting Energy Efficiency and Solar Energy in the Residential, Commercial, and Public Services Sectors in Mexico,” posited that the adoption of solar energy in Mexico could substantially reduce emissions and generate cost savings, albeit

necessitating considerable investments. The report advocates for the investigation of additional efficiency measures.

Kiray V. (2019), in the paper "Feasibility Study for Utilization of Solar Energy in Arctic Areas," concluded that a photovoltaic system featuring a dual-axis tracker and gazebo design improves both aesthetics and energy efficiency. It exemplifies cost-effectiveness and attracts residential consumers.

Jain M. (2022), in their study "Solar Energy for the Commercial Buildings Sector: Recommendations for the Indian Scenario," examined the policy-related obstacles confronting off-grid solar systems in commercial buildings. Streamlined procedures and enhanced subsidy initiatives can facilitate adoption in the Indian market.

Rathod. S. and et.al. (2024) in their study presented a descriptive view and highlighted the positive outcomes and shortcomings of the scheme.

Shah. N (2024) in his study highlighted the impact of sustainable renewable energy practices which significantly lowers the electricity cost. He further highlighted that this type of efforts will increase the employment opportunities for the skilled workers. He concluded that there are few challenges such as higher upfront cost, difficulty in obtaining subsidies etc.

Amin. U (2025) highlighted the positive outcomes of adoption of Roof top solar installations such as financial savings, environmental benefits, government initiative and also pointed out few grey areas such as limited knowledge, high installation cost.

Research Gap

The studies reviewed above provide descriptive insights into the outcomes of rooftop solar adoption but lack empirical evaluations of scheme effectiveness, financial assistance distribution, and inter-state variations. Consequently, there is a distinct research deficiency in evaluating the quantitative impact, state-level advancement, correlation among registrations, installations, and benefits, as well as the overall performance assessment of the PM Surya Ghar Muft Bijli Yojana. This study seeks to fill this gap through a descriptive and analytical methodology utilizing recent government data.

Objective of the Study

The Present study aims to assess the Current Status and Progress of Pradhan Mantri Surya Ghar Muft Bijli Yojana, India's Roof Top Solar Initiative.

Rationale of the Study

The Pradhan Mantri Surya Ghar Muft Bijli Yojana is a first-of-its-kind national effort that started in 2024 to speed up the use of solar panels on roofs by providing up to 300 units of solar-generated electricity per household per month and using large-scale subsidies, low-interest loans, and easier delivery models. A systematic evaluation of the program's initial progress, regional disparities, implementation challenges, and socio-economic effects is imperative, considering its magnitude, financial commitment, and direct correlation to India's 2030 renewable energy objectives. This study addresses a significant empirical deficiency: the existing literature is predominantly descriptive or context-specific, with a scarcity of rigorous nationwide analyses concerning registration-to-installation conversion, subsidy disbursement, and the scheme's distributional

outcomes across states and urban/rural divides. This research analyzes government data (registrations, applications, installations, households benefited, and central financial assistance) for 2024–25 and examines correlations among these indicators. It offers evidence regarding the scheme's effectiveness, areas of deficiency, and the implementation factors (awareness, administrative efficiency, DISCOM participation, state policy environments) that necessitate policy intervention. The study thus provides policymakers, DISCOMs, industry partners, and researchers with actionable insights derived from early program metrics, aimed at enhancing targeting, equity, cost-effectiveness, and the scheme's role in India's energy transition.

Research Methodology

The present study is both Descriptive and Analytical. The Study tries to examine the status and Progress of Pradhan Mantri Surya Ghar Muft Bijli Yojana.

Sources of Data

Data has been mainly procured through secondary sources, such as the Reports of the government Agencies and data is extracted from the government Databases.

Tools and Techniques Used

For analysis of data, Percentage and Correlation has been used. The Dependence on M.S. Excel Office 365 and PSPP 2.0.1 is necessary for data analysis.

Period of Study

The period between 2024 to 2025 i.e. 1(One) Financial Year has been used for the present study data.

Analysis and Discussion

Table 1: Installation of Solar Roof Top in different states of India in Nos.

SL. No.	State/UT	Installation (Nos.)	Change	% Change
1	Andhra Pradesh	6725	0	0
2	Arunachal Pradesh	0	(-6725)	0
3	Assam	2858	2858	100
4	Bihar	2291	(-567)	(-25)
5	Chhattisgarh	774	(-1517)	(-196)
6	Goa	335	(-439)	(-131)
7	Gujarat	286545	286210	100
8	Haryana	14198	(-272347)	(-1918)
9	Himachal Pradesh	423	(-13775)	(-3257)
10	Jharkhand	72	(-351)	(-488)
11	Karnataka	5099	5027	99
12	Kerala	52693	47594	90
13	Madhya Pradesh	18464	(-34229)	(-185)

14	Maharashtra	126344	107880	85
15	Manipur	63	(-126281)	(-200446)
16	Meghalaya	14	(-49)	(-350)
17	Mizoram	51	37	73
18	Nagaland	6	(-45)	(-750)
19	Odisha	1039	1033	99
20	Punjab	3572	2533	71
21	Rajasthan	18697	15125	81
22	Sikkim	1	(-18696)	(-1869600)
23	Tamil Nadu	20151	20150	100
24	Telangana	7511	(-12640)	(-168)
25	Tripura	77	(-7434)	-9655
26	Uttar Pradesh	53423	53346	100
27	Uttarakhand	9500	(-43923)	(-462)
28	West Bengal	248	(-9252)	(-3731)
29	Andaman and Nicobar Islands	1	(-247)	(-24700)
30	Chandigarh	312	311	100
31	Dadra and Nagar Haveli and Daman and Diu	33	(-279)	(-845)
32	Jammu and Kashmir	327	294	90
33	Ladakh	139	(-188)	(-135)
34	Lakshadweep	85	(-54)	(-64)
35	NCT of Delhi	1931	1846	96
36	Puducherry	440	(-1491)	(-339)
Total		634442		

N.B: Figures in Bracket Indicates Negative

Source: *Self Compilation of data from GoI reports and Analysis after that*

Table 1 depicts the number of solar Roop top that has been installed nationwide we see a healthy growth in the installation in the past one year since the scheme is launched. The states like Gujrat and Maharashtra are leading in the Table in the number of installations. This may be due to dry and sunny regions where average rainfall is low and these areas could immensely harness the solar energy.

Table 2: Table Showing No. of Registration in the Portal and Applications made and Households Benefitted in Nos.

Sl. No.	State/UT	Registration (Nos.)	Application (Nos.)	Households benefitted (Nos.)
1	Andhra Pradesh	1770413	1107234	12036
2	Arunachal Pradesh	1289	91	0
3	Assam	1749651	289307	6485
4	Bihar	951809	66157	4013
5	Chhattisgarh	243071	35475	1840
6	Goa	10708	4400	544
7	Gujarat	1740135	366097	362907
8	Haryana	449153	159218	19069
9	Himachal Pradesh	154318	5217	1111
10	Jammu and Kashmir	315332	21082	1124
11	Jharkhand	252540	6667	160
12	Karnataka	610332	208545	8181
13	Kerala	271011	111065	68938
14	Madhya Pradesh	542465	55065	26233
15	Maharashtra	1661676	546307	203742
16	Manipur	2712	671	165
17	Meghalaya	8327	1819	17
18	Mizoram	3037	604	87
19	Nagaland	1204	236	7
20	Odisha	1280205	88514	2199
21	Punjab	122004	11908	4682
22	Rajasthan	522299	225993	28064
23	Sikkim	469	51	4
24	Tamil Nadu	971032	80014	26213
25	Telangana	142085	40561	10839
26	Tripura	11766	2377	121
27	Uttar Pradesh	2822194	1004105	77937
28	Uttarakhand	159281	38024	15445
29	West Bengal	359669	26245	388

30	Andaman and Nicobar Islands	1132	125	5
31	Chandigarh	5168	1293	605
32	Dadra and Nagar Haveli and Daman and Diu	5251	1025	56
33	Ladakh	3257	611	285
34	Lakshadweep	1142	596	208
35	NCT of Delhi	24613	7578	2594
36	Puducherry	19739	1226	601
Total		17190489	4515503	886905

Source: *Self Compilation of data from GoI reports and Analysis after that*

Table 2 depicts the number of Registrations and applications and number of households that are benefited from the scheme. from the table it is pertinent that Gujrat and Maharashtra are the leading states it is due to the public awareness about the scheme and the potential to harness the renewable source of energy like solar is more.

Table 3: Table Showing Correlation Between No. of Registration, Application, Installation and Household Benefitted

		Registration (Nos.)	**Application (Nos.)**	**Installation (Nos.)**	**Households benefitted (Nos.)**
Registration (Nos.)	Pearson Correlation	1	.852**	.294	.538**
	Sig. (2-tailed)		.000	.082	.001
	N	36	36	36	36
Application (Nos.)	Pearson Correlation	.852**	1	.143	.402*
	Sig. (2-tailed)	.000		.407	.015
	N	36	36	36	36
Installation (Nos.)	Pearson Correlation	.294	.143	1	.760**
	Sig. (2-tailed)	.082	.407		.000
	N	36	36	36	36
Households benefitted (Nos.)	Pearson Correlation	.538**	.402*	.760**	1
	Sig. (2-tailed)	.001	.015	.000	
	N	36	36	36	36
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

Source: *Self Compilation of data from GoI reports and Analysis after that*

Table 3 shows the Bi variate correlation between the factors like No. of registrations, Applications, Installations and households benefitted we see that there is a positive Correlation between these factors at 1% and 5% level of significance.

Table 4: Table Showing Applications made and Households Benefitted and central Financial Assistance Received

Sl. No.	State/UT-wise	Applications (In Number)	Households Benefitted (In Number)	CFA Released (In Crore)
1	Andhra Pradesh	1156693	14086	65.11
2	Arunachal Pradesh	94	NA	NA
3	Assam	298666	8748	41.76
4	Bihar	69757	4537	20.83
5	Chhattisgarh	36344	2101	6.38
6	Goa	4458	801	2.59
7	Gujarat	384013	385820	1920.3
8	Haryana	163517	20225	88.42
9	Himachal Pradesh	5949	1409	6.85
10	Jharkhand	6947	225	0.93
11	Karnataka	214640	9316	38.29
12	Kerala	119947	75371	444.11
13	Madhya Pradesh	59147	29191	169.95
14	Maharashtra	566937	226863	804.16
15	Manipur	728	189	1.1
16	Meghalaya	2003	17	0.08
17	Mizoram	620	101	0.62
18	Nagaland	243	8	0.05
19	Odisha	91689	2680	12.86
20	Punjab	13879	5015	29.58
21	Rajasthan	235924	31687	187.2
22	Sikkim	58	4	0.01
23	Tamil Nadu	82029	27660	128.33
24	Telangana	44994	12155	49.39
25	Tripura	3008	153	0.75

26	Uttar Pradesh	1034729	87208	487.47
27	Uttarakhand	43194	17702	110.69
28	West Bengal	26540	419	NA
29	Andaman and Nicobar Islands	158	15	0.01
30	Chandigarh	1342	625	1.56
31	Dadra and Nagar Haveli and Daman and Diu	1578	105	0.26
32	Jammu and Kashmir	25324	1811	6.65
33	Ladakh	655	320	2.15
34	Lakshadweep	672	229	1.56
35	NCT of Delhi	8196	3014	6.39
36	Puducherry	1351	690	3.87
Total		4706023	970500	4640.28

Source: *Self Compilation of data from GoI reports and Analysis after that*

Table 4 depicts the Central financial assistance released from the government it is evident from the table that the two states Gujrat and Maharashtra have received the maximum amount of Central Financial Assistance this is due to number of installations are more this is the reason why CFA in these two states is immense.

Table 5: Table Showing Correlation Between No. of Registration, Application, Installation and Household Benefitted

		Applications (In Number)	**Households Benefitted (In Number)**	**CFA Released (In Crore)**
Applications (In Number)	Pearson Correlation	1	.410*	.399*
	Sig. (2-tailed)		.014	.020
	N	36	35	34
Households Benefitted (In Number)	Pearson Correlation	.410*	1	.988**
	Sig. (2-tailed)	.014		.000
	N	35	35	34
CFA Released (In Crore)	Pearson Correlation	.399*	.988**	1
	Sig. (2-tailed)	.020	.000	
	N	34	34	34
*. Correlation is significant at the 0.05 level (2-tailed).				
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: *Self Compilation of data from GoI reports and Analysis after that*

Table 5 depicts the correlation between the three factors Applications (In Number) Households Benefitted (In Number) CFA Released (In Crore) the table above shows there is a positive correlation between these three factors between these factors at 1% and 5% level of significance.

Findings

The study shows that the Pradhan Mantri Surya Ghar Muft Bijli Yojana has made measurable early progress but also has clear gaps in how it is being carried out. Nationwide data for 2024–25 show strong participation (registrations >17 million) with applications in the range of ~4.5–4.7 million and roughly 0.9–1.0 million households benefitting; total rooftop installations reported are 634,442 and central financial assistance disbursed is about ₹4,640 crore. Gujarat and Maharashtra are clearly the leaders in installations and subsidy absorption. Urban and semi-urban areas have also seen faster uptake than many rural areas. Statistical analysis shows that there are strong, positive links between registrations, applications, installations, and households that benefited. This means that outreach and application conversion have a direct impact on implementation outcomes. The program has already created jobs in manufacturing, installation, and O&M. It has also helped India reach its decentralized renewable energy goals, reduced its reliance on the grid, and cut emissions. The remaining barriers are high upfront costs, uneven awareness, delays in administration, and differences between regions. The paper suggests that policy support should continue, subsidies should be given out faster, awareness campaigns should be stepped up, and capacity should be built to have a bigger impact.

Conclusion

The empirical analysis for 2024–25 shows that the PM Surya Ghar Muft Bijli Yojana has had some important early successes, but it also shows that there are clear geographic and operational imbalances. States with strong solar ecosystems, more awareness, and better administration (like Gujarat, Maharashtra, and Kerala) have a lot more registrations, installations, and households that have benefited. They have also received the most central government money. The strong and positive links between registrations, applications, installations, and households that benefited show that demand-side interest (registrations) is a good predictor of actual deployment. However, conversion rates differ widely from state to state, which suggests that implementation friction, not lack of demand, is a major problem in some areas. Central financial assistance closely follows the number of households that benefited, which shows that subsidy flows are generally in line with installations. However, some states have a lot of registrations but not many conversions or benefits, which could mean that vendors aren't available, approval times are too long, or beneficiaries aren't getting enough help. The program helps save money on energy, create jobs in the solar value chain, and lower emissions in the early stages. However, to reach its full potential toward national renewable energy goals and fair access, it needs to cut down on administrative delays, lower the costs for vulnerable households, improve monitoring, and expand targeted awareness and capacity-building efforts in areas that are falling behind.

Recommendations

To get the most out of the Pradhan Mantri Surya Ghar Muft Bijli Yojana, policymakers should streamline and speed up the processes for giving out subsidies and concessional loans (for example, by reducing approval delays and automating reimbursements). They should also focus on giving more help to low-income and rural households to fix regional imbalances. Put money into big, long-term campaigns to raise awareness and change behavior (in local languages, at gram

sabhas, and in schools). Also, expand the Solar Village pilots so that rural people learn more about energy and want more of it as it becomes available. Encourage different ways to get money, like scaling up RESCOs where the upfront cost is a problem and expanding DISCOM-led ULA rollouts with clear deadlines for when the money will be transferred. At the same time, make private investment less risky by offering guarantees or payments based on results. To keep beneficiaries safe and make sure systems last, set standard technical and quality standards, require accredited vendors, and enforce warranties and O&M plans after installation. Use targeted training programs and incentives to build local manufacturing and installation capacity. This will create long-term jobs and lower the cost of equipment. Require open, timely monitoring and public dashboards (registrations → installations → CFA released → households benefitted) to find problems and distribute resources based on performance. Finally, encourage learning forums between states so that high-performing states like Gujarat and Maharashtra can share best practices. Also, give states with low uptake incentives to make process and outreach improvements that are specific to their needs.

Limitations of the Study

The study has a number of important flaws. It depends completely on secondary data from the government and portal records, which may have reporting lags, missing information, or inconsistencies. This means that the data may not be accurate at the household level. The analysis is limited to a single financial year (2024–2025), which means that it is not possible to see longer-term trends, seasonal changes, or the scheme's lasting effects. The study employs descriptive statistics, percentages, and bivariate correlations—methods that discern associations without determining causality or addressing confounding variables. The literature review is constrained due to the scheme's recency, which diminishes theoretical depth and comparative context. Significant aspects, including actual energy generation (kWh), system performance, household-level socioeconomic factors, user satisfaction, and qualitative implementation challenges, were not analyzed. State-level aggregation obscures intra-state and urban-rural heterogeneity, constraining the generalizability of the findings. Lastly, if policies, markets, or technologies change quickly after the study period, some conclusions may only be true for that time and not for future phases of the program.

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GREEN FINANCE FOR RENEWABLE ENERGY IN INDIA: ASSESSING THE ROLE OF IREDA IN SOLAR CAPACITY EXPANSION

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Abstract

Meeting India's climate commitments and securing long-term resilience towards a low–carbon economy demand a decisive transition to renewable energy. The country's thrust towards renewable energy is spearheaded by institutional machineries such as the Indian Renewable Energy Development Agency Limited (IREDA), policy frameworks like the National Solar Mission and initiatives such as the PM-KUSUM Scheme and several significant state level programs. This study investigates the contribution of IREDA through mobilization of green capital towards the development of renewable energy capacity, with particular emphasis on the solar energy sector. The study adopts a quantitative research approach that integrates descriptive and inferential methods, drawing on secondary data, to explore the relationship between solar financing initiatives of IREDA and the development of installed solar energy capacity of the country over the past decade. The analysis is structured in the context of India's global commitments on environmental sustainability, while also assessing whether the growth of the solar sector has significantly influenced the nation's overall renewable energy capacity. The findings underscore the pivotal role of IREDA in driving renewable energy development through green financing, highlighting its consistent prioritization of solar energy within its sectoral loan portfolio, thereby reflecting its strategic importance in India's clean energy transition.

Keywords*:* Renewable Energy, Green Finance, IREDA, Solar Energy, India

JEL Classification: Q42, G21, G28, O13, Q48

Introduction

Green finance is a strategy to incorporate financial activities and investments that supports sustainable development by promoting various environment friendly projects for a smooth transition to a low carbon economy (Fu et al., 2023). For the adaptation of climate change, green finance is a core part of low carbon green growth and it comprises of investment in renewable energy resources, pollution control mechanisms, green infrastructure, promote biodiversity etc.

Several international agreements and initiatives like, The United Nations Framework Convention on Climate Change (UNFCCC, 1992), The Kyoto Protocol (1997), The Paris Agreement (2015), The UN 2030 Agenda for Sustainable Development Goals (SDGs) (2015), Addis Abada Action Agenda (2015), G20 Green Finance Study Group (2016), EU Sustainable Finance Action Plan (2018), Glasgow Financial Alliance for Net Zero (GFANZ) (2021) etc. are collectively promoting green finance for sustainable development. These agreements provide frameworks, rules, guidelines and commitments for all the countries and financial institutions to mobilize resources for climate action, biodiversity conservation and low – carbon growth. The global energy transition is increasingly dependent on emerging economies, with India at the forefront. Despite remarkable progress, fossil fuels still dominate India's primary energy consumption (Denya, 2025). This paradox underscores the critical need for scalable green

financing mechanisms to align with India's *Panchamrit*[1] climate targets, including 500 GW of non-fossil energy capacity by 2030 (Perwez et al., 2024).

In India, various government institutions and agencies like, Reserve Bank of India (RBI), Securities Exchange Board of India (SEBI), Indian Renewable Energy Development Agency Limited (IREDA), Small Industries Development Bank of India (SIDBI), Rural Electrification Corporation Limited, Power Finance Corporation Limited (PFC), National Bank for Agriculture and Rural Development (NABARD), Multilateral & Development banks, Private ESG funds coupled with a host of government policies such as FAME, PM-E-drive , National Solar Mission, PM-KUSUM, Sovereign Green Bonds and green deposits frameworks for banks and financial institutions, sustainability reporting guidelines and frameworks to name a few- are all working synchronously towards sustainable environment goals. The Indian Renewable Energy Development Agency Limited (IREDA) is a Public Sector Financial Institution under the Ministry of New and Renewable Energy (MNRE), Government of India, which is playing a crucial role in promoting sustainable development through green finance. The *Navaratna* company is playing a vital role in promotion, development and commercialization of new and renewable resources of energy and it provides financial assistance, risk-mitigation and other services to energy efficiency and conservation projects with the motto "Energy for Ever" (Indian Renewable Energy Development Agency Limited, 2025). Since its inception, IREDA has made a major contribution in financing various projects with a record Rs. 1.63 Lakh Crore loan disbursements towards various clean energy sectors such as solar, wind, hydro, biomass, e-mobility and green hydrogen (ETEnergy World, 2024). With its robust loan book, a 27 per cent compound annual growth rate over the last five years and a proactive leadership duly acknowledged during the MNRE Secretary's performance review, IREDA is playing a pivotal role in propelling India towards achieving its ambitious environmental targets (Shetty, 2025). In line with the Paris Agreement commitments towards achieving a Net Zero carbon emissions target by 2070, India has amplified its installed Renewable Energy (RE) capacity by over 500 per cent from about 36 thousand MW to 1.87 lakh MW over the past decade with solar energy accounting for over 63 per cent of its total RE capacity as on July, 2025 (Ministry of New and Renewable Energy, 2025). In light of the above, this study aims to carry out an in-depth analysis of the contribution of IREDA in powering India's solar revolution- advancing the nation closer to its aspiration of becoming a global leader in clean energy.

Review of Literature

Berensmann et al. (2017) suggested that to adopt climate change and foster sustainable global growth, the G20 need to implement a sustainability agenda both at the national and international level. The author confronted that G20 countries facing a worldwide investment shortfall of US$ 80-90 trillion over 15 years across sectors such as energy, water, transport, telecommunications, cannot depend solely on public funds for transforming into green finance. To bridge this gap, they must coordinate with banking, capital markets and insurance sectors with sustainability goals to have the benefit of large-scale private capital.

According to International Renewable Energy Agency (IRENA, 2023), IREDA has facilitated approximately 20 GW of renewable capacity via its financing especially in solar sector. The author also suggested promote funding in emerging technologies like battery storage, green hydrogen, e-mobility, waste-to-energy by deploying novel financing tools. The study featured

[1] The term 'Panchamrit' refers to the significant climate commitments made by India at the United Nations Climate Change Conference (COP26) in Glasgow in November 2021.

IREDA's substantial contribution as a long standing and consistent financer in India's clean energy sector.

Ravichandran and Roy (2022) in their study provide a comprehensive overview of the growing need of climate finance and its vital role in sustainable economic development. This study emphasized how considerably green funding will help in reduction in greenhouse gas emissions. The study stated that India has a huge potential to build a green infrastructure if given more importance in removing obstacles and raising corporate citizen's knowledge relating to the need of sustainable growth.

Sahoo and Nayak (2007) in their study highlighted that green finance has become a vital enabler for India's energy transition specially in wind and solar sector. The paper highlighted the crucial role of IREDA in supporting green finance initiatives in India. The authors recommend the need for policy coherence, credit enhancements and standardized green taxonomies to boost investor confidence and reduce capital costs. The analysis of the paper also provides a framework for strengthening India's green finance architecture, positioning institutions like IREDA as key players in the transition.

Sunmista and Sathana (2014) in a study found that commercial banks are taking new initiatives and promoting different types of green banking products and adopting different types of environment friendly policies. The authors stressed that bank employees should consider green finance as a necessity rather than desirability, they should change their routine operation by adopting paperless banking, mobile banking, online banking etc.

In course of review of existing literature, several reports and publications have been found to have acknowledged the significant contribution of IREDA in promoting clean energy in the country. However, few studies have been found to have adopted an empirical approach to establish the significance of IREDA financing towards the country's functional renewable energy capacity expansion. The present study adds to the existing stock of knowledge in this regard.

Research Problem

The clean energy transition targets of India critically depend on consistent financing and goal-oriented uniform government policy. IREDA has been serving as the principal arm under MNRE to channelize funds for a wide variety of RE projects; across multiple sectors. While the solar sector constitutes the largest share of IREDA's cumulative loan portfolio, limited empirical evidence exists on how IREDA's financing has augmented the country's overall RE capacity, in general, and solar energy capacity, in particular. This study addresses this gap through an empirical approach towards explaining the relationship between the IREDA's solar finance and the RE growth of the country over the past decade.

Objectives of the study

The objectives of the study are:

1. To outline IREDA's financing contribution across different renewable energy (RE) sectors;
2. To analyze the association between IREDA's solar loans and growth of installed solar energy capacity in India; and
3. To assess the impact of IREDA's solar financing on the proliferation of India's total RE capacity.

Rationale of the study

India has set several ambitious environmental targets which can be broadly summarized into achieving the Net Zero Carbon Emissions Target by 2070- the long-term goal- preceded by specific medium-term essential prerequisites, such as, achieving 500-GW of non-fossil fuel energy by 2030. In meeting these targets, along with strong policy initiatives, robust financial mechanisms to ensure sustainability of the clean energy projects, are a critical requirement. In this regard, IREDA under MNRE, Govt. of India plays a pivotal role as the financial backbone of the country's RE projects. While IREDA's contributions are frequently acknowledged in related policy reports and research papers including presentation of facts and data, there remains a lack of empirical research that carves out its role in augmenting RE growth. This study attempts to address this void through providing insights into the impact of IREDA's financial interventions- backed by evidence and highlighting IREDA's solar financing as a key determinant of the nation's overall RE capacity expansion. The study is expected to offer significant inputs for policy-makers, financial institutions, investors and other stakeholders in developing sustainable strategies for clean energy; as well as, strengthening the academic discourse on the finance- energy nexus.

Methodology of the study

Research Design:

The study adopts a quantitative research approach combining descriptive and inferential methods to assess the role of the IREDA in solar capacity expansion in India. The design accommodates an empirical analysis of IREDA's loan portfolio, sectoral emphasis, and establishing the significance of their impact on RE growth.

Data Sources:

The study is based on secondary data obtained from authentic and reliable sources such Annual Reports of IREDA, reports and statistics published by the MNRE, facts and findings of reputed publications of individual authors and organizations and other reputed and reliable internet sources.

The data period covers the decade from 2015-present in line with the accelerated RE expansion in India owing to the increased recognition and expression of the national environmental targets at various global stages during the period.

Data Analysis:

The study resorts to both descriptive tools - for mapping IREDA's financing contributions across different RE sectors, as well as, inferential tools- correlation analysis and regression analysis to assess the impact of IREDA finance on the growth of the country's solar as well as overall RE capacities. Pearson's correlation co-efficient has been used to assess the strength of the association between IREDA loan disbursement to solar power sector and total installed solar capacity of the country over the past decade. Further, in order to study the role of IREDA loans towards India's RE capacity growth the following multiple linear regression model has been employed:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where, the dependent variable Y denotes the Total installed RE Capacity of India, while the independent variables X_1 and X_2 represent IREDA loans disbursed to Solar Energy Sector and Wind Energy Sector respectively. The marginal effect of the IREDA loans to the respective RE sectors on total installed RE capacity are estimated by the coefficients β_1 and β_2 respectively.

The random error term capturing unobserved influences is denoted by ε. The model parameters have been estimated using the Ordinary Least Squares (OLS) method based on secondary data obtained from IREDA Annual Reports and data sources of Ministry of New and Renewable Energy (MNRE), Government of India.

Scope and Limitations of the study

While other factors such as government policy, private investments, international collaborations and global economic events also influence the India's green energy transition, the thrust of this study is on analyzing exclusively the role of IREDA financing on India's RE growth in order to highlight its strategic importance. The study is based on secondary data and hence the findings are limited by the availability and accuracy of published reports and sources referred.

Analysis and Discussion

Profile of the Indian Renewable Energy (RE) Sector:

As of July, 2025, India has achieved the 50 per cent milestone of its RE target of 500 GW by 2030 (Ministry of New and Renewable Energy, 2025). The rapid growth of the RE capacity of the country is marked by a 500 per cent increase in the cumulative RE capacity between 2014 and 2025 (Ministry of New and Renewable Energy, 2025). Table 1 below shows the rapid growth in cumulative of RE capacity across different RE Sectors in India.

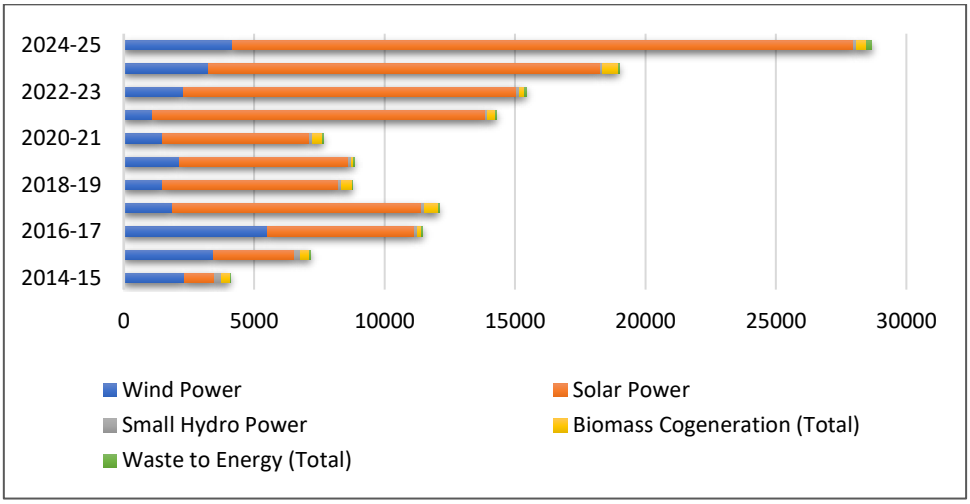
Table 1: Sector wise Installed Renewable Energy (RE) Capacity (in MWs)

Sector	Cumulative Achievements (till-31.03.14)	Cumulative Achievements (till-31.07.25)
Wind Power	21042.58	52140.10
Solar Power	2821.91	119016.54
Small Hydro Power	3803.68	5108.71
Biomass (Bagasse) Cogeneration	7419.23	9821.32
Biomass (Non-bagasse) Cogeneration	531.82	921.79
Waste to Energy	90.58	309.34
Waste to Energy (Off-grid)	139.79	545.11
Total	35849.59	187862.91

Source: *Ministry of New and Renewable Energy, Govt. of India (2025)*

The analysis of the sectoral contribution to RE Capacity reveals that more than 63 per cent of the Cumulative RE capacity as on July, 2025 comes from Solar Power, making it the largest contributor to the overall RE Capacity of the country. Table 1 above also reveals that the solar capacity has grown most rapidly and there is a shift is the sectoral contribution to overall RE capacity from Wind Energy to Solar Power over the last decade; which is further described by Figure 1 below:

Figure 1: Sectoral Contribution to RE Capacity (in MWs)



Source: *Compiled from Year- wise Achievements published in the Official Website of Ministry of New and Renewable Energy, Govt. of India (2025)*

In the context of power generation, RE contributed to 124.9 BUs (billion units) accounting for 24.4 per cent of total power generation with solar power leading at 33.2 Bus, followed by wind power at 23.2 Bus and biomass at 11.2 BUs (Anand, 2025).

Several national and international agencies such as credit rating institutions and independent think tanks project a prolific growth of the Indian RE Sector. The projections of different entities uniformly agree on a robust acceleration in India's RE Capacity by 2030, particularly solar. However, no projection has predicted the attainment of *Panchamrit* goal of 500 GW by 2030; which certainly highlights the vital role of consistent policy support, financing and infrastructure investments mobilized through generators like IREDA. The growth projections made by different agencies and institutions have been summarized in Table 2 below:

Table 2: Summary of Indian RE Capacity Projections

Forecasting Agency	Target Year	Projected RE Capacity (GW)	Key Highlights
Institute for Energy Economics and Financial Analysis (IEEFA)	FY 2029–30	~405 GW	35–40 GW annual additions anticipated
CRISIL Limited	FY 2030	360–370 GW (excluding large hydro)	175–180 GW solar additions expected
S&P Global Ratings	2025–2030	Needs ~50 GW/year additions	214 GW as of Mar 2025; acceleration essential
ICRA Limited	Mar-26	~250 GW	Driven by strong project pipeline and tenders

Source: *Compiled from ETEnergyworld.com (From the Economic Times)*

Financing contributions of IREDA

As highlighted in the previous sections of the paper, IREDA serves as the primary instrument for government policy intervention spearheading India's transition towards a clean and green energy ecosystem. It serves as a financing engine for India's renewable energy push with a focused approach towards the following:

i. *Strategic Funding for RE Projects:*

With over INR 1.63 lakh crore loans disbursed the agency has contributed up to 15 per cent of the country's total renewable energy debt making it the principal financier in the sector (ETEnergy World, 2024). To meet the varied needs of the RE developers and suppliers IREDA offers a wide range of tailored financing schemes spanning long term and short-term loans, bridge financing, subsidy-linked financing, bond guarantee schemes, securitized loans, factoring of receivables and more (Indian Renewable Energy Development Agency Limited, 2025).

ii. *Mobilizing investments targeting the national vision:*

With India reaching the 50 per cent milestone of total renewable energy target of 500 GW by 2030, the CMD of IREDA Mr. Pradip Kr. Das estimates that the annual installed RE capacity must be ramped up to 50-60 GW from 20-30 GW at present for which the sector requires an investment of around INR 30 Lakh Crore (Indian Mastermind, 2025).

iii. *Driving emerging technologies:*

Emerging clean technologies like ethanol, electric vehicle (EV) fleets, pumped storage hydropower, green ammonia, battery storage systems, and green hydrogen electrolysers are promoted by IREDA through tailored funding instruments directed towards reducing the cost of capital and fostering an innovative clean energy ecosystem (International Renewable Energy Agency, 2023).

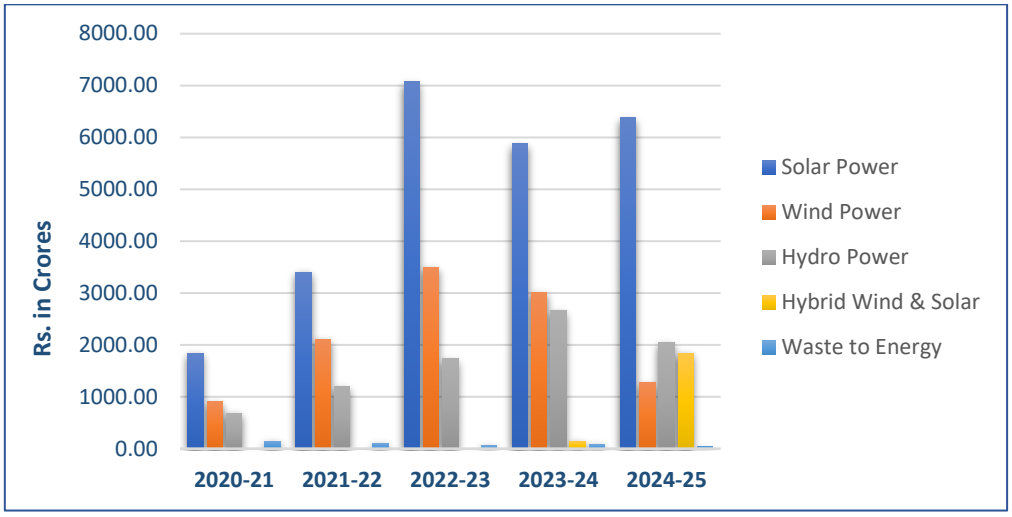
iv. *Providing reliance to stakeholders through institutional strength and structure*:

With a "*Navaratna*" status operating under the Ministry of New and Renewable Energy of the government, IREDA delivers paperless, streamlined and borrower centric services, securing stakeholder confidence and trust with regard to new and high-value projects (ETGovernment Online Bureau, 2024).

Assessment of data disseminated through Annual Reports of IREDA spanning over the past decade reveals that the finance to different RE sectors constitute a major share of the total loan disbursal portfolio on a year-to-year basis. Among the different RE sectors, solar energy has been the prime focus of IREDA financing with an average of 24 per cent[2] of total loan disbursements during the last five-year period. Figure 2 below portrays the loan disbursements to different RE sectors over the last five-year period:

[2] Compiled from loan disbursement data from IREDA Annual Reports for the period 2020-21 to 2024-25.

Figure 2: IREDA Loan Disbursements to RE Sectors



Source: *Compiled from IREDA Annual Reports (2020-21 to 2024-25)*

IREDA finance and Solar Capacity expansion

The data presented in Figure 2 above clearly show that the solar power sector has received a significantly larger share of the total loan basket of IREDA relative to the other RE sectors, towards augmenting the RE capacity of the country. The impact of the thrust towards the solar sector is explained by Table 3 below which presents a correlation analysis (Pearson's correlation coefficient) between IREDA loan disbursement to solar sector and solar capacity development. The results indicate a very high positive correlation between the IREDA loans disbursed to solar sector and solar capacity growth of the country over the period from 2015-16 to 2024-25.

Table 3: Correlation Matrix of IREDA Solar Finance[3] and Installed Solar Energy Capacity[4]

	Loans Disbursed to Solar Power Sector (₹ in Crores)	**Installed Solar Energy Capacity (MW)**
Loans Disbursed to Solar Power Sector (₹ in Crores)	1	
Installed Solar Energy Capacity (MW)	0.812859721	1

Source: *Authors' Self-construct*

Impact of IREDA Solar finance on India's 2030 RE Targets:

As of July, 2025, India has reached the 50 per cent landmark of its targeted non-fossil fuel energy capacity of 500 GW by 2030. Data presented in Table 1 above indicates that among the different RE sectors, the solar energy and wind energy sectors combined contribute more than 91 per cent towards the cumulative total installed RE capacity as on 31st July, 2025[5], augmenting the total installed renewable energy capacity of the country by more than 500 per

[3] Data compiled from IREDA Annual Reports.
[4] Data obtained from Official Website of MNRE, Govt. of India
[5] Compiled from data on Installed RE Capacity published in the Official Website of MNRE, Govt. of India.

cent over the past decade. Constituting 15 per cent of the country's total renewable energy sector debt, IREDA is a vital source of fueling the remarkable clean energy achievements of the country. In order to explain the statistical significance of IREDA loans towards the country's RE capacity growth the multiple linear regression model elaborated in the methodology of the study above has been used. The model has been estimated using ten years of data (2015-16 to 2024-25) on IREDA's sector-specific loan disbursements alongside the corresponding figures for total installed RE capacity. The results are summarized in Table 4 below:

Table 4: Impact of IREDA's Sectoral RE finance on Installed RE Capacity

	Coefficients	**Standard Error**	**t Stat**	**P-value**
Intercept	5519.971464	3820.087189	1.444985727	0.191695
Solar Power (X_1)	2.643160936	0.876143356	3.016813307	0.019474
Wind Power (X_2)	-1.028066653	1.877206036	-0.547657867	0.600945

Source: *Authors' Self- construct*

With a *p-value* of less than 0.05, IREDA loans towards the Solar Power Sector show a statistically significant impact on the development of overall RE capacity of the country. The sectoral loan disbursal towards Wind Power, however, fails to display a substantial impact.

Conclusion

The study highlights the critical role of IREDA in propelling renewable energy development through its green financing initiatives, in alignment with India's environmental commitments outlined by ambitious declarations made through global platforms such as Paris Agreement in 2015 and *Panchamrit* Action Plan in Conference of the Parties (COP 26) to the UNFCCC[6] held in Glasgow in 2021. Over the last decade, IREDA has consistently directed a significant share of its sectoral loan portfolio towards solar energy, reflecting its strategic importance in India's clean energy transition. The analysis demonstrates that IREDA's financing has been instrumental in driving the impressive growth of installed solar capacity, which now constitutes a significant portion of the country's renewable energy mix. Correlation analysis confirms a very high positive relationship between IREDA's solar loan disbursements and solar capacity growth, while the regression results further validate the significant contribution of solar finance to the growth of overall renewable energy capacity. These findings highlight that IREDA's financial interventions have not only supported India's achievements in clean energy but have also laid a foundation towards fulfilling the prerequisites for meeting the vision of Net Zero carbon emissions by 2070. Nonetheless, the way forward remains challenging, requiring rigorous policy initiatives, substantial additional investments and innovative financing models as India's environmental commitments demand sustained financial flows and strengthened institutional support for a consistent renewable energy growth.

[6] United Nations Framework Convention on Climate Change.

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EVALUATING THE IMPACT OF PUBLIC SECTOR BANKS ON FINANCIAL INCLUSION: A JOURNEY TOWARDS VIKSIT BHARAT

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Abstract:

In the quest for a developed India, or Viksit Bharat, financial inclusion is essential to social justice, long-term economic prosperity, and national advancement. Public Sector Banks (PSBs) extends beyond traditional banking functions thereby ensuring & conforming access / ingress to the financial services pertaining to underserved and marginalized populations i.e. ensuring that everyone, especially the underprivileged and marginalized segments of society, has access to reasonably priced and efficient financial services, such as deposit accounts, insurance, credit. The objectives of this study are to analysis the role pertaining to PSBs in financial inclusion (FI), identify areas for improvement, and offer suggestions for strengthening their impact on inclusive growth. The present study is based on the role of public sector banks on financial inclusion. Therefore, various parameters of public sector banks in Uttarakhand have been taken from 2017 to 2024 for this empirical analysis to measure the impact. To shed light on the relationships between the variables, the study use regression. The findings of this paper demonstrate that PSB's have been playing the pioneer role & responsibility in driving FI concept in India, particularly in reaching underserved, rural, and marginalized communities. Ultimately, financial inclusion is a fundamental tool in India's pursuit of a Viksit Bharat, where economic opportunities are equitable, and growth is shared across all sectors of society.

Key Words: Banks, Financial Inclusion, Viksit Bharat, FI Index, GSDP.

JEL Classification: G21, Q56, O5

Introduction

Addressing the economic gaps between various societal segments, financial inclusion is essential to inclusive growth. It guarantees that the public as a whole receives economic advantages rather than just the wealthy, which helps to lessen social discontent, poverty, and inequality. Economic advancement is further accelerated by greater financial literacy and access to formal financial institutions, which also increase tax collections, foster openness, and improve the efficacy of governmental initiatives. Long-term economic stability, socioeconomic fairness, and national success are made possible by financial inclusion, which closes the economic gap and creates a workforce that is more resilient, empowered, and productive. In the end, financial inclusion is the catalyst that propels India closer to its objective of being a fully developed country, not only a tool for policy.

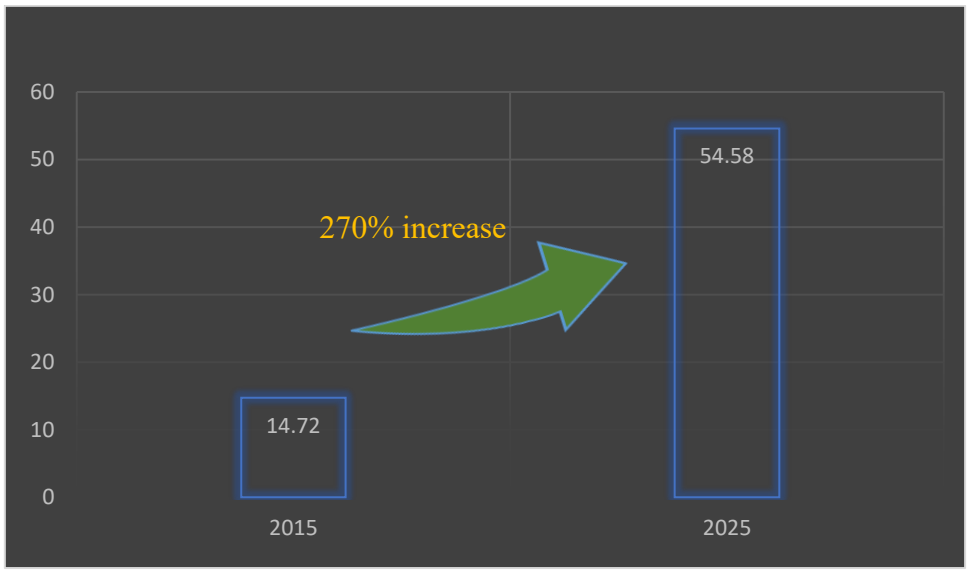
Financial inclusion is built on three essential pillars: deposit, insurance and credit. By offering security, access to capital, and growth prospects, they collectively establish a holistic financial ecosystem that empowers people and enterprises, particularly those in marginalised communities. By promoting saving, deposits assist people in establishing a stable financial situation and a transaction history that facilitates loan availability. By facilitating investments, entrepreneurship, and revenue generation, credit empowers both people and companies.

Insurance, on the other hand, lowers financial risks by guarding against unanticipated circumstances and making sure that financial failures do not force people into poverty. When combined, these three financial services produce a cycle of resilience, growth, and stability that enables marginalised populations to enhance their financial well-being and fully engage in the economy.

To sum up, financial inclusion is a key factor in social justice, economic empowerment, and inclusive growth rather than merely a way to give people access to banking services. India can build a more resilient, self-sustaining economy by guaranteeing that all societal sectors, especially the underprivileged and marginalised, have access to necessary financial tools. For better and good growth in economy, a substantial percentage of the participation of common people & involvement in the formal system of FI & method is definitely required & mandatory (Maity & Sahu, 2017). A Viksit Bharat, where affluence is evenly distributed, opportunities are available to everyone, and the advantages of progress go beyond the elite, is being sparked by the ongoing growth of programs like PMJDY, PMSBY, PMJJBY, and APY. The objectives behind these initiatives is to transform the lives of vulnerable people, mainly weeks, by providing access to banking finance and enabling them to generate stable income (Reddy, 2017). (DOEA, 2024) demonstrates the advancements made in financial inclusion and its aim to further expand digital financial inclusion as the next objective, with 77% of people already owning a bank account. Important steps towards a more financial environment include the drastic change and alteration from a household (Group) to an individual focus or thrust, digital innovations like UPI Pay and UPI Lite, and foreign partnerships.

In fiscal year 2024, Nations FI's index stood at 64.2. According to the RBI, it grew from 43.4 in 2017 to its present level, indicating improved & enhanced inclusion financially i.e FI. The Country's FI index gauges the overuse and consumption of formal & simple financial services, including as banking & finance, insurance (Bancassurance), investing, pension & services related to Post Office. FI is a road to a more equitable, prosperous society, as it helps individuals and businesses to access the fundamental financial assistance, they need (Pratik, 2024).

Chart 1: PMJDY Account (in crore)

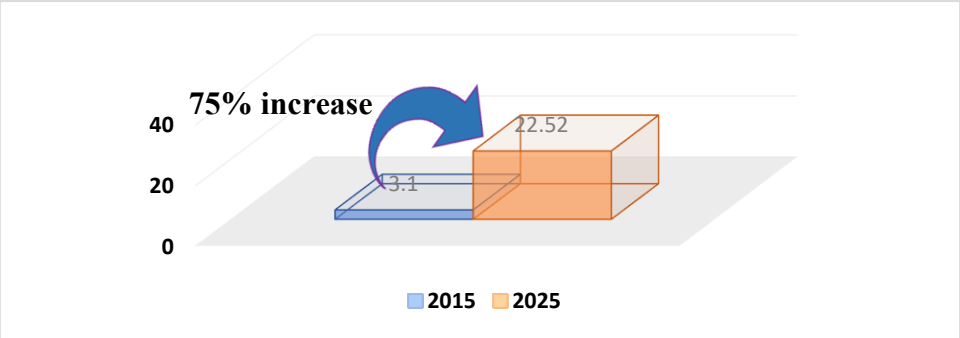


Source: *Ministry of Finance, GOI*

As on Jan'25 over 54.58 crore accounts have been opened under the scheme of PMJDY, with ₹2.46 lakh crore in total deposits. Over the past ten years, the integration of the informal

economy with the formal banking system has been greatly aided by this flagship financial inclusion initiative. By giving them ingress to fundamental financial access & services like savings, credit, insurance, and pensions, it has empowered underprivileged and marginalised groups in society. Through Direct Benefit Transfers (DBT), the program has made it possible for government subsidies and welfare payments to be delivered effectively while maintaining transparency and minimising leaks. Additionally, PMJDY has helped to improve financial awareness and saving practices, particularly in rural regions. Beneficiaries, especially women, now enjoy greater financial security and independence (PIB., 2025).

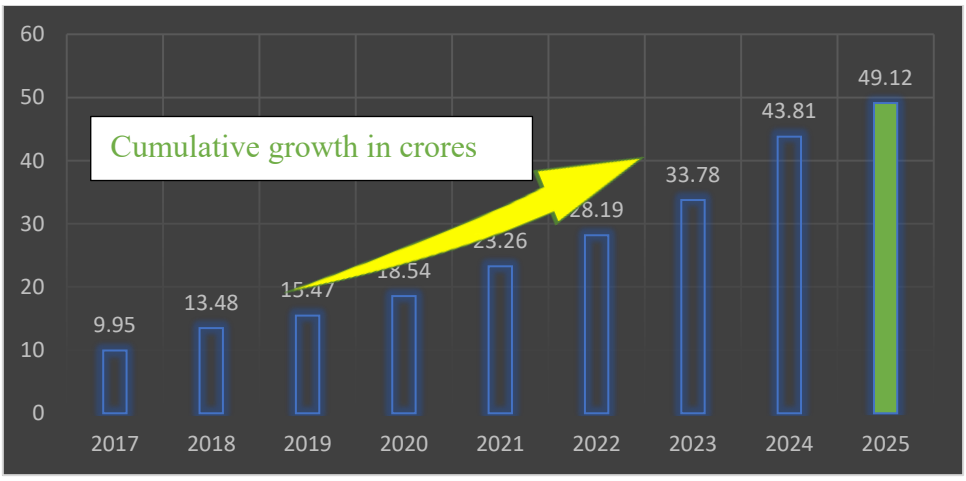
Chart 2: PMJJBY Enrolment



Source: *Ministry of Finance, GOI*

The scheme of PMJJBY, which was launched in the parliamentary budget of 2015 with the goal of increasing insurance coverage to more than 20% of the population, has achieved notable progress in increasing access to life insurance. 22.52 million people had been successfully registered in the program as of January 2025, offering low-income and vulnerable groups access to reasonably priced life insurance. It provides ₹2 lakh in life insurance at a small yearly price, giving families financial stability during difficult times. By paying out ₹17,600 crore in benefits and resolving 8.8 lakh claims, the initiative has proven its effectiveness. This illustrates both the efficacy of the program and the growing confidence of the insured population. In order to advance social security and financial safety nationwide, PMJJBY is still essential (PIB., 2025).

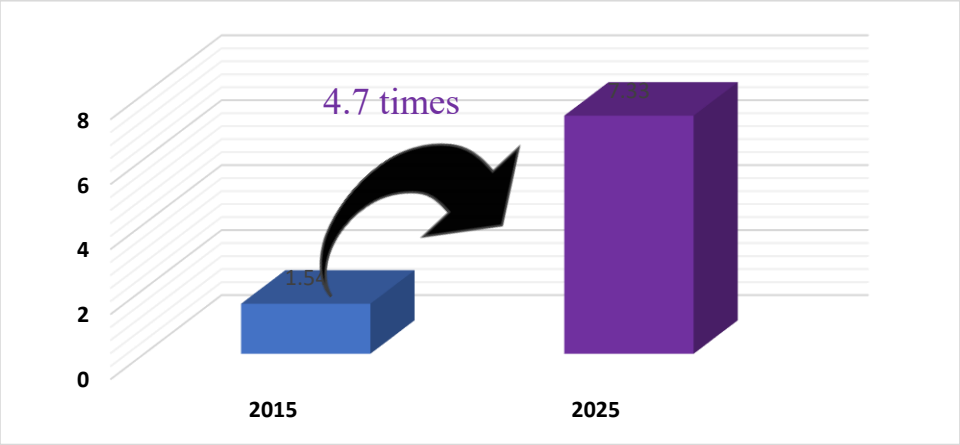
Chart 3: PMSBY Enrolment (in crore)



Source: *Ministry of Finance, GOI*

With 49.12 crore participants as of 2025, the scheme of PMSBY has greatly increased accidental insurance coverage in India. The program, which was created to offer reasonably priced personal accident insurance, guarantees families financial support in the event of an unintentional death or disability. With an annual fee of only ₹12, it is now very affordable for underprivileged and impoverished people. PMSBY has successfully processed claims of ₹2,994.75 crore in 2025 alone, providing afflicted families with vital support. The broad scope of the program reflects rising public awareness of and confidence in government-sponsored social security programs. The safety net for millions of people across is still being strengthened by PMSBY. (PIB., 2025).

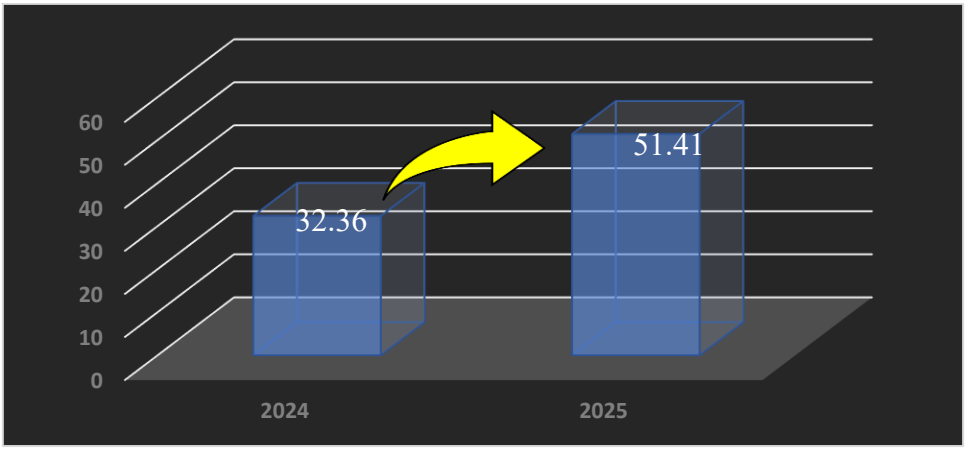
Chart 4: APY Enrolment (in crore)



Source: *Ministry of Finance, GOI*

Under the auspices of the NPS, the APY is governed by the PFRDA. Through a guaranteed pension, it seeks to give workers in the unorganised sector certainty for their old age income. Over 89.95 lakh new members joined the scheme in the fiscal year 2024–2025, marking a notable increase in enrolment. Total enrolments reached 7.33 crore by January 2025, indicating that more people were becoming aware of and accepting of pension benefits. The program's popularity has increased due to its affordability and government co-contribution characteristics. In India, APY keeps fortifying the framework of financial inclusion and social security (PIB., 2025).

Chart 5: PMMY (in crore)



Source: *Ministry of Finance, GOI*

The Pradhan Mantri Mudra Yojana (PMMY) has emerged as a powerful tool for financial empowerment, having sanctioned 51.41 crore loans amounting to ₹32.36 lakh crore. A significant aspect of the scheme is its inclusive outreach, out of the total loan 68% is for the welfare of the women and 50% is directed towards the communities of SC, ST & OBC's. By providing collateral-free micro-credit, PMMY has enabled millions to start or expand small businesses, fostering entrepreneurship at the grassroots level. This access to finance has not only enhanced livelihoods but also reduced economic disparities across regions. The scheme plays a pivotal role in advancing inclusive growth and social equity. Ultimately, such initiatives are vital for achieving the vision of Viksit Bharat by 2047 (PIB., 2025).

Another important factor in socioeconomic growth is digital financial inclusion, which has the potential to fulfil our shared aspirations of "Atmanirbhar" and "Viksit Bharat" when it is supported by technological innovation and cooperation. Incorporating financial inclusion into national policy promotes social peace, economic stability, and poverty reduction in addition to a dynamic and productive workforce. Sustained policy efforts, innovation, and inclusive growth is a way to achieve a "Viksit Bharat" – India's goal to become a developed economy by 2047.

The extent to which financial inclusion programs like PMMY, PMJDY, PMSBY, PMJJBY, and APY actually contribute to economic growth and inclusive development in states like Uttarakhand is still not well understood, despite tremendous efforts to promote financial inclusion through these programs. Although outreach and enrolment have increased, there is no empirical data on how these programs affect macroeconomic metrics like the Financial Inclusion Index and GSDP. Furthermore, more research is needed to fully understand the connection amongst financial inclusion & important developmental outcomes like entrepreneurship and job creation. Developing successful policy interventions requires an understanding of the statistical significance and strength of these relationships. Therefore, this specific study tries to critically analyze the economic jolt of FI programs on Uttarakhand's growth trajectory.

Literature Review

Numerous research on the topic of banking the unbanked population have been carried out in the Indian setting. The following analysis provides a quick overview of the literature on a few chosen studies.

Economic expansion is fueled by financial development, which is a by-product of growing economies. Financial inclusion (FI) is the result of increasing the quantity, calibre, and effectiveness of services provided by financial intermediaries. It helps people save money in the community, which means more money to invest in local companies. Different people all across the world have different ideas when it comes to financial inclusion. The demand for financial products varies among nations and individuals (Elaine Kempson, 2004). One of the best steps adopted to eliminate poverty is by financial inclusion (FI) through PMDJY, any scheme's effectiveness depends heavily on ongoing evaluation and frequent checks, and its effective execution would not only lessen poverty but also curb corruption. (Kumar, 2014). With varying & different set of variables, encompassing the bank accounts per capita, the different branches of bank, ATM's, Credit & Debit Cards, and the huge & substantial numbers of household depositors & borrowers, the majority & substantial portion of the research has used and followed a multifaceted approach. (Sarma, 2012). It is very important to assess the Enduring relationship between FI's and economic broadening by using & adopting a multi-dimensional FI index. (Seethi & Acharya, 2018). It is anticipated that the Reserve Bank's annual July publication of the financial inclusion index will serve as a roadmap for future

actions that must be taken in addition to reflecting the effectiveness of the actions currently taken and ongoing by different stakeholders. The government and RBI have been working to promote financial inclusion across the nation in a number of ways (Ghosh & Dutta, 2019). The RBI also took a wide approach to financial inclusion thereby aiming to connect people with the system of banking and not only providing them credit, but also giving them access to payment system and promote financial inclusion as a viable & feasible business model and opportunity (Pandey & Gupta, 2022). In the study of (Maity.. & Sahu, 2020) found that overall average efficiency towards financial inclusion increases significantly during post-phase introduction of PMJDY, through all Public Sector Banks are actually not performing similarly & parallels. (Qazi, 2020) concluded and assessed in the role & responsibility of the FI's in the implementation & promotion of the PMDJY scheme and the FI's are promoting PMJDY. The State Bank of India was ranked best in terms of PMDJY program execution, according to a study by (Singh & Deep, 2024) , who found that PSB's outperformed Pvt. Banks in the term of increasing FI under the plan of Pradhan Mantri Jan Dhan Yojana (PMJDY). (Maity.. & Sahu, 2020) looked into how well & judiciously PSB's helped & assisted in spreading the FI concept before and during the PMDJY programme. The effectiveness & importance of FI's in fostering & promoting FI is being assessed using the method of Data Envelopment Analysis (DEA) methodology. Studies. Financial inclusion in India had positively contributed in the success of the Atmanirbhar Bharat Abhiyan. With policy changes and with more inclusiveness, it can certainly make India a self-reliant economy in the long run (Kutty, Jauhari, & Indapurkar, 2024).

Objectives of the study

The primary and core objective apropos of the study is there to examine & analyse the impact of financial inclusion (FI) through PSBs on the Uttarakhand's economy by encouraging entrepreneurship, reducing inequality, helping to generate employment and enabling people to participate and engage fully in the global economy.

1. To assess the impact of PMMY on Uttarakhand's GSDP.
2. To evaluate the role of PMJDY, PMSBY, PMJJBY, and APY in economic growth.
3. To analyze how FI initiatives affect the Financial Inclusion Index.
4. To examine the statistical significance of FI schemes on GSDP and FI Index.
5. To study the link between FI initiatives and entrepreneurship & employment.

Significance of the study

The study is significant as it assesses empirically how Public Sector Banks promote financial inclusion and support India's Viksit Bharat agenda. In Uttarakhand, it emphasises the vital role that programs like PMJDY, PMJJBY, PMSBY, APY, and PMMY play in fostering equitable growth. The results give policymakers important information to increase banking outreach and boost economic engagement. By relating financial inclusion to the FI Index and GSDP, it enhances scholarly knowledge. Furthermore, it illustrates how important financial inclusion is to India's sustainable development, equitable growth, and poverty alleviation.

Research Hypothesis

The study attempts to establish the objectives framed on this research paper, and therefore following are the research questions/hypothesis has been proposed for this paper:

$H_0$1: There are no significant roles of Public sector banks (PSBs) in the growth of Uttarakhand's economy through deposit, insurance and credit initiatives.

H_A1: There are significant roles of Public sector banks (PSBs) in the growth of Uttarakhand's economy through deposit, insurance and credit initiatives.

$H_0$2: There is no consequential impact of financial inclusion initiatives on FI Index.

H_A2: There is consequential impact of financial inclusion initiatives on FI Index.

Data and Methodology

This essay is based on empirical research. The study evaluated the effectiveness of the PSBs in Uttarakhand over a period of eight years, from 2017–18 to 2023–2024, based on data from the State Level Bankers Committee (SLBC). Using quantitative metrics, the study investigates how financial inclusion affects Uttarakhand state's economy. Mean difference approach (Kothari & Garg, 2019) is being used for justifying the result and impact of financial inclusion (FI) initiatives. The effect of initiatives on the state of Uttarakhand's GDP has been investigated using regression analysis. Cronbach's alpha and other statistical tools have also been used to assess the data's trustworthiness.

Finding relationships, forecasting, and guiding decision-making across disciplines are all made easier by regression analysis. Dependent and independent variables relationship is being expressed by a method know as regression equation. The general form of a basic linear regression equation is as follows:

$$Z = a + bY + \epsilon$$

where the dependent variables are denoted by Z.
The value of Z, when Y = 0 is called the z-intercept, or a.
The line's slope, or the change in Z for every unit change in Y, is denoted by b.
The independent variable is denoted by Y.
The variance in Z that cannot be explained by Y is represented by the error term, ϵ.

Both unstandardized and standardized coefficients are used in regression analysis to ascertain how independent and dependent variables relate to one another. They differ and are expressed as follows:

When measured in their original units, unstandardized coefficients (b) show the tendency of change of dependent variables in tandem with independent variables change by one unit. It is denoted as:

$z=c_0 + c_1b_1 + c_2b_2 +\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + c_nb_n$

Where:

- z is the dependent variable.
- c_0 is the intercept.
- c_1, c_2, $\ldots\ldots\ldots\ldots\ldots\ldots\ldots c_n$ are the unstandardized coefficients for the independent variables b_1, b_2, $\ldots\ldots\ldots\ldots\ldots b_n$.

Standardized coefficients (β) quantify to which extent a dependent variable changes (in standard deviations - SDs) when there is a change in the independent variable by a mere one standard deviation (SD). They enable for a comparison of predictors' relative relevance across multiple scales. It is denoted as:

$C_y = £_0 + £_1Cx_1 + £_2Cx_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots + £_nCx_n$

Where:

- C_y is the standardized dependent variable.
- Cx_1 are the standardized independent variables.
- £$_0$ is the standardized intercept.
- £$_1$, £$_2$…… £$_n$ are the standardized coefficients.

Data Analysis and Interpretation

Several stakeholders' insights help drive policy, investment, and innovation in financial services to promote sustainable economic growth. Government bodies, international organizations, financial institutions, and investors all benefit from analysing the Uttarakhand's GDP impact of FI's. Below is the regression analysis of FI initiatives as independent variable and Uttarakhand's GDP as dependent variable.

Table 1: R Square Analysis (PMMY)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Dimension	0.862	0.743	0.701	29094.661
a. Predictors: (Constant), PMMY (Amt. in crore)				

Source: *Author's self-construct*

Table 2: Regression Analysis

	Dependent variable: GSDP Rs in Crores Independent variable: PMMY Amt in Crores				
Model	**Sum of the Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	1.471	1	1.471	17.378	0.006
Residual	5.079	6	8.465		
Total	1.979	7			

Source*: Author's self-construct*

(Ozili, 2023) in his study has clearly stated that the value of R-square should fall in between 0.50 and 0.99 in the study of social science, principally & significantly when most of the explanatory factors are so statistically significant & acceptable. The dependent variable is strongly and significantly impacted, according to the previously indicated analysis of R2 values (0.743). The regression analysis makes it clear that the predictors significantly affect the GDP of Uttarakhand. The same was proven with significance at the 0.01 level since F calculated > F tabulated. Thus, it can be said that PMMY and the expansion of the Uttarakhand economy are significantly correlated (HA1).

Table 3: Coefficient Analysis

	Dependent variable: GSDP Rs in Crores				
Model	**Unstandardized Coefficient(s)**		**Standardized Coefficient(s)**	**T**	**Sig.**
	B	**Std. Error**	**Beta**		
(Const.)	128970.549	22055.234		5.848	0.001
PMMY (Amt in Crore)	37.033	8.884	0.862	4.169	0.006

Source: *Author's self-construct*

Regression coefficient analysis is an excellent approach for extracting relevant insights from data, making informed decisions, and promoting evidence-based practices. Beta (0.862) shows a strong impact of credit through PMMY on GSDP and economic growth of the state. F calculated > F tabulated, with significant & accurate at the level of 0.01 is being established, makes it clear from the coefficient analysis that the result (p=0.006) is significant. Consequently, it may be said that PMMY and GSDP are significantly correlated.

Table 4: R Square Analysis (APY, PMJJBY, PMJDY, PMSBY)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Dimension	0.990	0.980	0.953	11497.339
a. Predictors: (Constant), APY, PMJJBY, PMJDY, PMSBY				

Source: *Author's self-construct*

Table 5: Regression Analysis

Dependent variables: GSDP Rs in Crores Independent variables: PMJDY, PMSBY, PMJJBY, APY					
Model	**Sum of the Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	1.939	4	4.848	36.677	0.007
Residual	3.966	3	1.322		
Total	1.979	7			

Source: *Author's self-construct*

Once more, the dependent variable is strongly and significantly impacted, according to the examination of R2 values (0.980). The regression analysis makes it clear that Uttarakhand's economic development is significantly impacted by financial inclusion programs, such as insurance and deposits. The same was proven with significance at the 0.01 level since F calculated > F tabulated. Thus, it simply can be stated that financial inclusion programs unquestionably have a major influence on entrepreneurship and job creation (HA1).

Table 6: Regression Analysis

Dependent variables: FI Index Independent variables: PMJDY, PMSBY, PMJJBY, APY					
Model	**Sum of the Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	350.632	4	87.658	195.848	0.001
Residual	1.343	3	0.448		
Total	351.975	7			
a. Predictors: (Constant), PMMY, PMJJBY, PMJDY, PMSBY, APY					
b. Dependent Variable: FI Index					

Source: *Author's self-construct*

Initiatives for financial inclusion, such as credit, deposits, and insurance, are analysed in detail using these factors as independent variables. The dependent variable is significantly impacted, as indicated by the R2 value of 0.980. Regression analysis makes it clear that the financial inclusion index (FI Index), which measures the availability, use, and calibre of financial services, significantly influences independent variables. The outcome shows how particular the regression model is all total. An increased F-value indicates that the model can account for a significant portion of the variance in the dependent variable. Since the value of p is less than 0.05, the model can be considered as statistically significant & accurate, suggesting that the independent factors significantly influence how the dependent variable is explained. Initiatives for financial inclusion have a major effect on the FI Index (HA2).

Findings

1. *Strong & firm Positive correlation Between PMMY and GSDP*

   The R Square value of 0.743 and Beta coefficient of 0.862 indicate a strong and statistically significant impact of PMMY credit disbursement on Uttarakhand's GSDP.

2. *Significance of PMMY in Economic Growth*

   The p-value (0.006) and F-statistic (17.378) confirm that the PMMY has a meaningful and statistically significant impact on the state's economic output at the 1% significance level.

3. *Comprehensive Impact of Deposit and Insurance Schemes on GSDP*

   A higher R Square value of 0.980 and significant F-statistic (36.677, p = 0.007) indicate that schemes like PMJDY, PMSBY, PMJJBY, and APY collectively exert a substantial influence on GSDP.

4. *FI Initiatives and the Financial Inclusion Index (FI Index)*

   Regression analysis shows an R Square of 0.980 for FI schemes influencing the FI Index, and an F-statistic of 195.848 (p = 0.001), confirming a strong relationship between the availability of FI schemes and the inclusiveness of the financial system.

5. *Statistical Significance of All Models*

   In all models analyzed, F calculated > F tabulated, and p-values are less than 0.01 or 0.05, indicating strong model significance and high explanatory power of the independent variables.

Conclusion

The study comes to the conclusion that efforts to promote financial inclusion significantly and favourably affect Uttarakhand's economic development. Regression study shows that credit-based programs, such as the Pradhan Mantri Mudra Yojana (PMMY), have a good correlation with the Gross State Domestic Product (GSDP) of the state, suggesting that they help to boost revenue generation and encourage entrepreneurship. Similar to this, schemes based on deposits and insurance, such PMJDY, PMJJBY, PMSBY, and APY, also have a significant impact on GSDP, indicating that savings and financial stability support overall economic growth.

Additionally, it is discovered that the combined use of these programs greatly influences the Financial Inclusion Index (FI Index), which reflects advancements in the availability, use, and calibre of financial services. Overall, the findings & results demonstrate that FI is a strategic economic driver that significantly supports employment, entrepreneurship, and sustained

growth rather than just being a social project. These findings underline how crucial inclusive financing is to realising Viksit Bharat, the country's overarching ambition.

Issues persisting in Financial Inclusive Initiatives

There are still significant gaps in financial services utilization that need to be addressed by policymakers through appropriate coordination and efficient oversight. This is true even though a number of parties have worked to improve financial inclusion in the nation by implementing a range of strategies. Inadequate infrastructure, inadequate connectivity, lack of convenience and relevance, socio-cultural hurdles, product consumption, and payment infrastructure are all factors under consideration.

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A STUDY ON THE PERCEPTION AND USAGE OF FINTECH SERVICES AMONG URBAN WOMEN: A STUDY IN THE STATE OF ASSAM, INDIA

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Abstract

This study explores the perception and usage of FinTech services among urban working women in Assam, a northeastern state of India, through an exploratory and descriptive research design. Data were collected using a convenience sampling method from a diverse cross-section of respondents across various employment sectors, ensuring representation in terms of age, education, and professional background. The study is based on primary data from 400 urban working women across twelve urbanised districts of Assam, supplemented by 30 qualitative interviews. The study covers a broad spectrum of FinTech services, including digital payments, neo-banking, lending platforms, investment tools, insurance technology, personal finance applications, remittance systems, and crowdfunding models.

Findings reveal a pronounced gap between awareness and actual adoption of FinTech services, primarily due to concerns related to digital security, fear of fraud, and limited digital confidence. Trust in digital systems emerges as a major sociological barrier, reflecting broader anxieties about technological change and institutional reliability. Although many women recognize the potential benefits of FinTech in improving financial management, persistent concerns limit their full engagement. The study also highlights a substantial digital financial literacy gap, emphasizing the urgent need for accessible education and trust-building initiatives.

From a sociological perspective, the research demonstrates how intersecting factors such as gender, professional background, education level, and age significantly influence digital inclusion patterns. It also underscores the localized cultural and infrastructural realities of Assam, where traditional financial practices coexist alongside emerging digital systems. The study concludes that increasing FinTech adoption among working women in transitional economies like Assam requires addressing structural trust deficits, improving digital and financial literacy, and developing culturally sensitive, user-friendly financial technologies. These insights provide valuable guidance for policymakers, educators, and FinTech developers aiming to foster inclusive digital financial ecosystems in similar socio-cultural contexts.

Keywords: FinTech, Digital Inclusion, Gender and Technology, Financial Literacy, Urban Sociology

JEL Classification: G20, G21, D14, O33, J16, R23

Introduction

The rapid growth of Financial Technology (FinTech) has transformed the global financial landscape, reshaping the way individuals and institutions manage, invest, and transfer money (Gomber et al., 2018). FinTech now covers a wide range of services, from mobile payments and peer-to-peer lending to digital banking and blockchain solutions (Arner et al., 2016). While these innovations promise greater financial inclusion, efficiency, and convenience, their adoption remains uneven, especially among women in developing economies (Demirgüç-Kunt et al., 2018). In India, despite impressive strides in building digital infrastructure and launching

initiatives like Jan Dhan Yojana, Aadhaar, and the Unified Payments Interface (UPI), a gender gap in FinTech adoption persists (Sarma & Pais, 2011; Mehrotra & Verma, 2021).

This study focuses on understanding how urban working women in Assam, a northeastern state of India, perceive and use FinTech services. Urban working women, in this context, are those residing in urban or semi-urban areas and engaged in paid employment across both formal sectors such as corporate jobs, government services, education, and healthcare and informal sectors like small businesses, self-employment, and gig economy roles (United Nations [UN], 2018). This group is marked by its growing financial independence and access to urban infrastructure, including digital and financial services (World Bank, 2020), although challenges like wage gaps, workplace discrimination, and limited advancement opportunities persist (International Labour Organization [ILO], 2022). Given their greater likelihood of accessing digital financial tools compared to rural or non-working women (Demirgüç-Kunt et al., 2018), urban working women represent a critical demographic for studying FinTech adoption.

Assam's financial ecosystem offers a particularly interesting case. The state is undergoing a period of transition where traditional cash-based systems and banking practices coexist with emerging digital financial solutions (Bhattacharjee & Das, 2020). Urban centers like Guwahati are experiencing rapid digitization, but many rural and semi-urban areas remain dependent on informal financial systems (Das & Dutta, 2022). This uneven shift has created a dual financial environment, where opportunities for FinTech growth exist but are still hindered by infrastructural gaps, digital illiteracy, and strong socio-cultural norms.

Despite these hurdles, the participation of women in Assam's workforce is steadily increasing across sectors like education, healthcare, small businesses, and the gig economy (Saikia & Bora, 2022). Their expanding economic role makes them crucial stakeholders in Assam's FinTech story. Digital financial services have the potential to give women greater control over their finances, empowering them to save, invest, and build secure financial futures. However, significant barriers remain. Issues like limited access to smartphones, lower digital literacy, societal restrictions on independent financial decision-making (Bora & Saikia, 2021), and widespread fears over cybersecurity and fraud (Reserve Bank of India [RBI], 2023) continue to restrict women's ability to fully engage with digital finance.

Addressing these barriers is essential for achieving meaningful financial inclusion. Women's access to FinTech tools does not just enhance individual autonomy it also strengthens household resilience and contributes to broader economic growth (Demirguç-Kunt et al., 2018). FinTech holds particular promise in bridging gaps left by traditional banking systems, offering women microloans, insurance, and investment opportunities that were historically difficult to access (GSMA, 2021).

However, without deliberate and inclusive strategies, there is a risk that new technologies could deepen existing gender inequalities. Policymakers, financial institutions, and FinTech developers must proactively design solutions that meet the specific needs of Assamese women through user-friendly, vernacular-based platforms, digital literacy initiatives, and strong security assurances (Mehrotra & Verma, 2022). Only then can Assam realize the full transformative potential of FinTech and create a more inclusive financial ecosystem where women are not just passive users but active drivers of digital change.

The Rise of FinTech and Its Sociological Implications

FinTech has emerged as a disruptive force in global finance, reshaping traditional banking models and democratizing access to financial services (Schueffel, 2016). The integration of digital payment systems, blockchain technology, and artificial intelligence has facilitated faster,

cheaper, and more transparent financial transactions (Philippon, 2016). In developing economies, FinTech holds particular promise for enhancing financial inclusion by reaching unbanked and underbanked populations (GSMA, 2020). However, the adoption of these technologies is not uniform; it is influenced by factors such as digital literacy, trust in technology, and socio-cultural norms (Ozili, 2018).

From a sociological perspective, FinTech adoption is not merely a technological shift but a socio-cultural transition that interacts with existing power structures, gender roles, and institutional trust (Mader, 2018). Feminist scholars argue that financial technologies, while potentially empowering, often replicate patriarchal biases embedded in traditional financial systems (Rankin, 2013). For instance, women may face restricted access to digital financial services due to lower smartphone ownership, limited financial autonomy, or societal norms discouraging independent financial decision-making (Gammage et al., 2017). In India, where gendered financial exclusion remains a persistent issue, understanding how women perceive and engage with FinTech is essential for designing inclusive policies (Khera, 2016).

FinTech Adoption Among Women in India: Existing Research and Gaps

The literature reveals persistent gendered barriers in FinTech adoption across India, with urban working women demonstrating markedly lower engagement with digital financial services compared to men (Demirguç-Kunt et al., 2021). This disparity becomes particularly pronounced in transitional economies like Assam, where high mobile penetration coexists with surprisingly low digital financial engagement (Bhattacharjee & Das, 2023). Cultural norms emerge as a dominant theme, with studies indicating many women require male approval for financial transactions, creating invisible barriers to digital inclusion (Saikia & Bora, 2022). The hybrid nature of Assam's financial ecosystem presents unique challenges, as traditional microfinance systems continue to dominate even as modern FinTech solutions become available (Das & Dutta, 2023).

Research highlights how linguistic and cultural specificity shapes financial behaviours, with strong preferences for vernacular interfaces and localized financial products (Bora, 2023). The professional context appears significant, with women in formal employment showing greater FinTech adoption than those in traditional sectors like tea cultivation (Assam Economic Survey, 2023). Patriarchal structures surface repeatedly in studies, not just as social norms but as institutionalized barriers embedded in financial systems (Reserve Bank of India [RBI], 2023). Infrastructure limitations compound these challenges, particularly in semi-urban and rural areas where connectivity issues persist (GSMA, 2023).

Emerging scholarship emphasizes the potential of leveraging Assam's existing microfinance networks and unique cultural assets, such as matrilineal traditions in certain communities, to design more inclusive financial technologies (World Bank, 2023). Comparative studies with neighbouring regions suggest that agent banking models and female-centric product design could significantly improve adoption rates (KPMG, 2022). The literature consistently identifies three key intervention areas: digital literacy programs tailored to women's needs, development of culturally-sensitive FinTech solutions, and infrastructure improvements in underserved areas (Global Findex, 2021). These findings underscore the need for context-specific approaches to bridge the digital gender divide in Assam's evolving financial landscape.

Despite growing research on FinTech adoption in India, significant gaps remain regarding women's digital financial inclusion in Assam. Current studies largely overlook the intersectional dynamics of how caste, ethnicity, and occupational sectors differentially impact FinTech usage among Assamese women (Bhattacharjee & Das, 2023). While patriarchal barriers are well-documented (Bora & Saikia, 2021), there is insufficient examination of how

Assam's unique cultural contexts - including matrilineal traditions in some communities - might enable alternative pathways to financial inclusion. The literature also lacks rigorous evaluations of localized policy interventions like Assam's Digital Mission or vernacular FinTech solutions, despite evidence that language remains a critical barrier (Das & Dutta, 2023). Furthermore, most studies employ cross-sectional designs that cannot capture how adoption evolves across generations or life stages, particularly for women transitioning from informal to formal work sectors. These gaps highlight the need for mixed-methods research that combines quantitative surveys with ethnographic approaches to better understand the socio-cultural dimensions of FinTech adoption in Assam's rapidly urbanizing context.

Research Objectives

1. To examine the socio-cultural and structural factors influencing the disparity between awareness and actual usage of FinTech services among urban working women in Assam, with particular focus on (a) digital security concerns, (b) gendered financial decision-making norms, and (c) institutional trust barriers.
2. To assess how intersecting identity markers (professional sector, education level, age, and ethnicity) shape digital financial inclusion patterns among Assam's urban working women.

Significance of the Study

This research carries substantial scholarly and pragmatic implications for advancing financial inclusion in emerging economies. By systematically investigating the sociocultural and structural determinants inhibiting FinTech adoption among urban professional women in Assam, the study offers three critical contributions: First, it provides policymakers with empirically grounded evidence to formulate gender-responsive digital finance policies and targeted financial literacy initiatives. Second, it equips FinTech innovators with actionable insights to develop culturally-adapted, vernacular-based platforms that address gender-specific usability concerns and security apprehensions.

From a theoretical perspective, the study advances knowledge in feminist political economy by elucidating how technological adoption patterns are mediated through intersecting axes of gender, class, and regional identity in transitional economies. Furthermore, it enriches urban sociology discourse by examining the dialectic between digital financial systems and traditional economic practices in semi-peripheral regions undergoing rapid urbanization.

At the grassroots level, enhancing women's FinTech engagement promises multiplier effects: strengthening individual financial agency, improving household economic resilience, and contributing to Sustainable Development Goals (SDGs) related to gender equality (SDG 5) and reduced inequalities (SDG 10). The study's context-specific findings hold particular relevance for developing inclusive digital finance frameworks across India's northeastern states and similar Global South contexts where traditional and modern financial ecosystems coexist.

Theoretical Framework and Methodology

This study adopts an exploratory and descriptive research design, integrating quantitative surveys with qualitative interviews to understand FinTech adoption among urban working women in Assam. It is anchored in the Technology Acceptance Model (TAM) (Davis, 1989) and Feminist Political Economy theory (Elson, 1999), examining both technological and socio-cultural dimensions of digital financial inclusion.

Primary data were collected using a structured questionnaire through convenience sampling across twelve urbanized districts of Assam, namely Kamrup Metropolitan, Jorhat, Tinsukia, Nalbari, Cachar, Dibrugarh, Sonitpur, Nagaon, Golaghat, Barpeta, Sivasagar, and Morigaon. Respondents were working women across government, private, and entrepreneurial sectors.

These districts were selected because they represent Assam's most commercially active and urban or peri-urban centres, with higher concentrations of salaried women, digital banking touchpoints, UPI-enabled merchants, and smartphone penetration (Bhattacharjee & Das, 2020; Das & Dutta, 2022; GSMA, 2023; Government of Assam, 2023). This selection aligns with prior studies that emphasise focusing on urbanised financial ecosystems when analysing gendered FinTech adoption (Bhattacharjee & Das, 2020; Das & Dutta, 2022; GSMA, 2023)

Although Assam has 35 districts, the study is limited to these twelve with demonstrable urban economic bases. The research objective is to analyse FinTech perception and usage among *urban working women* who participate in formal and semi-formal financial systems, not the rural female population. Similar methodological delimitations are found in financial-inclusion studies focusing on specific socio-economic clusters (Demirgüç-Kunt et al., 2021; World Bank, 2023)

A total of 400 usable responses were collected from working women across the twelve districts. A non-probability convenience sampling approach was adopted because (a) no centralised frame exists for "urban working women" in Assam, and (b) access to working women varies across employment settings. This approach is consistent with exploratory FinTech studies in emerging economies (Mehrotra & Verma, 2021; Roy, 2021)

Respondents were approached at workplaces, commercial areas, and service centres (banks, telecom outlets, payment kiosks) during working hours. Participation was voluntary, and only women who self-identified as "working for income" were included to match the target group of urban working women.

Quantitative data were analysed using descriptive statistics, cross-tabulations, Chi-square tests, and multiple logistic regression. Additionally, qualitative insights were gathered through semi-structured interviews, analysed using thematic coding with NVivo software. Secondary data from academic and government sources supplemented the research.

Given the non-probability sampling and the localized urban focus, the findings offer important exploratory insights but may not be fully generalizable to the broader Indian context.

Measurement of Key Variables

FinTech Awareness Score

Respondents were asked to rate their awareness of eight categories of FinTech services (for example UPI / mobile wallets, neo-banking, digital lending apps, online investment platforms, insurance / Insurtech, personal finance / budgeting apps, domestic digital remittance tools, and crowdfunding platforms) on a 5-point Likert scale where 1 meant "I have never heard of this" and 5 meant "I understand this service well and could explain it to someone else." The FinTech Awareness Score for each respondent was computed as the arithmetic mean of these eight item scores. This produced a continuous indicator ranging from 1 to 5.

Security Concern Score

Respondents rated their level of concern about digital fraud, data theft, and unauthorised transactions on a 5-point Likert scale (1 = "Not concerned at all," 5 = "Extremely concerned").

Trust in Institutions Score

Respondents rated their trust in banks, payment apps, and other digital financial service providers on a 5-point Likert scale (1 = "No trust," 5 = "Complete trust").

Gendered Norms Influence Score

Respondents indicated the extent to which financial decisions in their household are influenced or controlled by male family members, again on a 5-point Likert scale (1 = "Not at all," 5 = "Almost always decided by them").

Composite Likert-style perception indices of this kind are standard in financial inclusion and technology adoption studies, including those that apply constructs from the Technology Acceptance Model and gendered financial autonomy literature (Davis, 1989; Elson, 1999; Venkatesh, Thong, & Xu, 2012; Sinha, Sharma, & Verma, 2020).

Analysis of Objective No 1:

Descriptive Statistics

The survey was conducted with a sample of 400 urban working women across Select cities in Assam. Key demographic and survey-related statistics are summarized below:

The survey results revealed that the respondents' ages ranged from 22 to 50 years, with a mean age of approximately 36 years. In terms of employment, 37.5% were engaged in government services, another 37.5% worked in the private sector, and 25% were entrepreneurs or self-employed. The mean FinTech Awareness Score, calculated as the mean self-rated awareness (1 = never heard, 5 = can explain confidently) across eight FinTech service types, was 2.99 out of 5, indicating a moderate level of awareness. Regarding usage, around 59% of the women reported actively using FinTech services such as UPI applications, mobile wallets, and digital investment platforms, while 41% did not engage with these technologies. Concerning digital security, half of the respondents (50%) expressed high levels of concern, 30% indicated medium concern, and 20% reported low concern. The average level of trust in financial institutions was relatively moderate, with a mean trust score of 3.12 out of 5.

Cross-tabulation: Security Concerns and FinTech Usage

A cross-tabulation between digital security concerns and FinTech usage revealed that 57.7% of respondents who expressed high security concerns still used FinTech services. Similarly, among those with medium or low levels of concern, 60% reported using FinTech platforms. These findings suggest that although digital security concerns are prevalent among urban working women, they do not act as an absolute deterrent to the adoption and usage of FinTech services.

Regression Analysis

An Ordinary Least Squares (OLS) regression analysis was conducted to examine the extent to which security concerns, trust in institutions, and the influence of gendered financial decision-making norms predict FinTech awareness scores.

To examine predictors of FinTech awareness, an Ordinary Least Squares (OLS) regression model was estimated. The dependent variable in this model is the FinTech Awareness Score, which reflects each respondent's self-reported level of awareness of different FinTech services. The independent variables are Security Concerns, Trust in Institutions, and Gendered Norms Influence.

Table 1: Regression Analysis

Predictor Variable	Coefficient (B)	Standard Error	t-Statistic	p-Value	Confidence Interval (2.5%)	Confidence Interval (97.5%)
Security Concerns (Score)	-0.02475	0.09387	-0.26363	0.792203	-0.20929	0.159799
Trust in Institutions (Score)	0.033541	0.051156	0.655659	0.512424	-0.06703	0.134111
Gendered Norms Influence (Score)	0.048962	0.097183	0.503811	0.614675	-0.1421	0.24002

Source: *Primary survey data collected by the researcher (2025)*

Interpretation

The multiple regression analysis sought to determine whether security concerns, trust in institutions, and the influence of gendered financial decision-making norms significantly predicted FinTech awareness among urban working women. The results indicated that none of the independent variables were statistically significant predictors, with p-values for all variables exceeding the conventional threshold of 0.05. The model's R-squared value was extremely low at 0.0018, suggesting that the three predictors collectively explained less than 0.2% of the variance in FinTech awareness scores. Additionally, the F-statistic was 0.237 with a p-value of 0.871, further confirming that the overall model lacked statistical significance. These findings imply that while security concerns, trust in institutions, and gendered norms are important factors contextually, they do not independently predict FinTech awareness in this cohort. It is likely that other latent variables such as digital literacy, peer influence, past experience with technology, or socio-economic status may exert a stronger influence on FinTech awareness and adoption patterns.

Qualitative Data Analysis

Semi-structured interviews were conducted with 30 respondents to gain a deeper and more nuanced understanding of the socio-cultural and structural factors influencing FinTech engagement among urban working women in Assam. The interview guide included open-ended questions that explored participants' experiences with FinTech platforms, their perceptions of digital security, family dynamics in financial decision-making, and levels of trust in financial institutions. Interviews were transcribed verbatim, and thematic analysis was carried out using NVivo software to systematically organize and interpret the qualitative data. Through iterative coding and categorization, three prominent themes were identified: fear of digital fraud, husband/father approval and influence, and institutional betrayal and lack of redress.

The first theme, fear of digital fraud, emerged as a major emotional barrier. Many participants expressed anxiety over the possibility of losing their money due to hacking, phishing, or unauthorized transactions, indicating that despite using FinTech services, their engagement was often accompanied by fear and scepticism. Statements like "I am scared of someone hacking my bank account if I use online apps" and "I trust cash more because it feels real" illustrate how security apprehensions persist even among users.

The second theme, husband/father approval and influence, reflected the persistence of gendered financial norms. Several women revealed that their financial behavior, especially in adopting

new technologies like FinTech, was heavily influenced or even controlled by male family members. Common responses included sentiments such as "My husband handles all our online payments" and "My father said it's risky to put card details online," suggesting that financial autonomy remains constrained by patriarchal family structures.

The third theme, institutional betrayal and lack of redress, highlighted widespread mistrust toward financial institutions and digital platforms. Many women cited negative experiences or perceived lack of transparency from banks and FinTech companies, fuelling a sense of vulnerability. Remarks such as "Banks hide charges in fine print; who knows what these apps do?" and "If something goes wrong, nobody helps; we have to run around" captured the underlying frustrations related to inadequate consumer protection and grievance redressal mechanisms.

Together, these themes reveal that emotional, relational, and structural barriers not merely technological factors play critical roles in shaping women's engagement with FinTech services. Building trust, enhancing consumer protection, and promoting financial autonomy must therefore be central to any strategy aimed at improving FinTech adoption among this demographic.

Summary of Findings

The quantitative findings suggest that although a significant number of women express concerns about digital security, these apprehensions do not entirely prevent them from engaging with FinTech services. The results of the regression analysis further demonstrate that, when examined individually, factors such as security concerns, institutional trust, and gendered financial norms have limited influence on shaping FinTech awareness levels. In contrast, the qualitative insights unveil a more intricate landscape of emotional and socio-cultural barriers. Themes such as fear of digital fraud, reliance on male family members for financial decision-making, and deep-seated mistrust toward financial institutions emerged as critical obstacles that inhibit women's full and confident participation in FinTech ecosystems. These findings highlight the need for interventions that go beyond promoting technical literacy alone. Efforts to expand FinTech adoption among urban working women must also focus on building emotional trust, enhancing feelings of digital security, and fostering greater financial autonomy, both at the individual and institutional levels.

Analysis for Objective 2

Analytical metrics

The quantitative analysis for the second objective was carefully designed to assess how intersecting identity markers namely professional sector, education level, age, and ethnicity shape the patterns of digital financial inclusion among urban working women in Assam. Structured survey data facilitated a comprehensive evaluation of FinTech usage trends and digital financial literacy levels across diverse demographic categories.

The survey instrument collected data on a range of variables essential for the analysis. Respondents were categorized by their professional sector (Government, Private Sector, Entrepreneur, NGO), education level (High School, Bachelor's Degree, Master's Degree, Professional Degree), and age group (22–30 years, 31–40 years, 41–50 years). Ethnicity was recorded with classification into major groups such as Assamese, Bengali, Bodo, Karbi, Mishing, and Others. In addition to demographic information, participants reported their FinTech usage status, coded both as a binary variable (User/Non-user) and in terms of the frequency and range of digital services used. A Digital Financial Literacy Score was computed

for each respondent, based on objective measures of their knowledge regarding secure digital practices, transaction mechanisms, and fraud prevention strategies.

To process the collected data, several statistical techniques were employed. Descriptive statistics were first utilized to present the overall FinTech usage rates and to summarize the mean digital financial literacy scores within each demographic group. Following this, cross-tabulations were conducted to explore the bivariate relationships between FinTech usage and individual identity markers such as professional sector, education, age, and ethnicity. Chi-square tests of independence were applied to assess whether the observed differences between groups were statistically significant, providing initial insights into how identity influences FinTech engagement.

Further, a binary logistic regression model was developed to deepen the analysis. In this model, the dependent variable was FinTech usage (coded as 1 for users and 0 for non-users), while the independent variables included professional sector, education level, age group, and ethnicity. Logistic regression enabled the estimation of the likelihood that a respondent would adopt FinTech services based on her identity attributes, controlling for the simultaneous influence of multiple factors. This approach helped move beyond simple associations to understanding predictive relationships between identity and digital financial inclusion.

An intersectionality framework guided the interpretation of the results. Rather than examining identity categories such as age, education, or ethnicity in isolation, the analysis considered how overlapping and interconnected social identities collectively influenced FinTech usage patterns. For example, cross-tabulated data allowed the exploration of whether younger women employed in the private sector with higher education levels demonstrated higher FinTech adoption rates compared to older women entrepreneurs with lower levels of education. This analytical perspective acknowledges that financial inclusion experiences are shaped by the interplay of multiple socio-cultural factors rather than single determinants.

The interpretation of the quantitative findings will be centered on identifying significant associations between identity markers and FinTech adoption patterns. Chi-square test results will be analyzed to determine which demographic factors such as professional sector, education level, age group, or ethnicity are significantly associated with higher or lower rates of FinTech usage. Simultaneously, the strength and direction of predictors from the logistic regression model will be examined to understand which factors most strongly influence the likelihood of adopting FinTech services. Special attention will be given to exploring how education, professional exposure, and cultural identity interact to either facilitate or hinder digital financial inclusion among urban working women. This intersectional approach aims to uncover the nuanced ways in which overlapping identities compound advantages or disadvantages in digital access. Based on these insights, the study will identify specific identity groups, such as lower-educated entrepreneurs or older ethnic minority women, who may require targeted interventions to bridge gaps in FinTech literacy and access. The ultimate goal of this interpretation is to translate statistical findings into practical recommendations for inclusive digital financial strategies tailored to the socio-cultural realities of Assam.

Through this rigorous application of descriptive, inferential, and multivariate statistical techniques, the study systematically analysed the complex ways in which identity markers influence digital financial behaviours among urban working women in Assam.

Table 2: Descriptive Statistics and FinTech Usage Across Demographic Categories

Variable	Category	Frequency (n)	Percentage of Total (%)	FinTech Users (%)
Professional Sector	Government	150	37.5%	55.3%
	Private Sector	150	37.5%	62.7%
	Entrepreneur/NGO	100	25.0%	58.0%
Education Level	High School	80	20.0%	40.0%
	Bachelor's Degree	180	45.0%	61.1%
	Master's Degree	100	25.0%	68.0%
	Professional Degree	40	10.0%	70.0%
Age Group	22–30 years	130	32.5%	65.4%
	31–40 years	160	40.0%	58.1%
	41–50 years	110	27.5%	51.8%
Ethnicity	Assamese	180	45.0%	61.2%
	Bengali	80	20.0%	57.5%
	Bodo	50	12.5%	48.0%
	Karbi	40	10.0%	50.0%
	Mishing	30	7.5%	46.7%
	Others	20	5.0%	55.0%

Source: *Primary survey data collected by the researcher (2025)*

Table 3: Logistic Regression Results Predicting FinTech Usage

Predictor	B Coefficient	Standard Error	Wald Chi-Square	p-value	Odds Ratio (Exp(B))
Professional Sector (Private)	0.420	0.210	4.00	0.045	1.52
Professional Sector (Entrepreneur/NGO)	0.270	0.230	1.38	0.240	1.31
Education Level (Bachelor's)	0.580	0.260	4.98	0.026	1.79
Education Level (Master's/Professional)	0.740	0.280	6.98	0.008	2.10
Age Group (31–40)	-0.300	0.220	1.86	0.172	0.74
Age Group (41–50)	-0.540	0.250	4.66	0.031	0.58
Ethnicity (Minority Groups)	-0.430	0.240	3.21	0.073	0.65

Source: *Primary survey data collected by the researcher (2025)*

Interpretation

The descriptive analysis revealed important patterns regarding FinTech adoption across different identity groups among urban working women in Assam. In terms of professional sector, women employed in the private sector exhibited the highest FinTech usage rate (62.7%), followed by entrepreneurs and NGO workers (58.0%), while government employees showed comparatively lower usage (55.3%). Education level showed a strong positive association with FinTech adoption; usage rates progressively increased from 40.0% among high school graduates to 70.0% among those holding professional degrees. Age also played a notable role, with younger respondents (22–30 years) showing the highest adoption rate at 65.4%, compared to 58.1% for those aged 31–40 years and 51.8% for those aged 41–50 years. Ethnic background influenced usage patterns as well; Assamese women exhibited the highest adoption rate (61.2%), whereas women from Bodo and Mishing communities showed lower engagement, at 48.0% and 46.7% respectively.

The logistic regression analysis further confirmed these trends by identifying education level and professional sector as significant predictors of FinTech adoption. Women holding a bachelor's degree were 1.79 times more likely to use FinTech services compared to those with a high school education, while those with a master's or professional degree were over twice as likely (Odds Ratio = 2.10). Employment in the private sector also significantly increased the likelihood of FinTech usage (Odds Ratio = 1.52) compared to government employment. Age and ethnicity, while influencing usage rates descriptively, were not statistically significant predictors in the regression model at the 5% confidence level, although minority ethnic group status approached marginal significance. The model's Nagelkerke R^2 value of 0.184 indicates that approximately 18.4% of the variance in FinTech usage could be explained by the identity variables included.

Overall, the findings suggest that higher education and private sector employment play key roles in facilitating digital financial inclusion among urban women, while older age groups and minority ethnic backgrounds may still face barriers to adoption. These insights highlight the need for targeted digital literacy interventions that account for educational, occupational, and cultural differences within the urban female population of Assam.

Summary of the findings

This study set out to examine the influence of intersecting identity markers namely professional sector, education level, age, and ethnicity on patterns of digital financial inclusion among urban working women in Assam. Using a mixed-methods approach with an emphasis on quantitative analysis, the research revealed important disparities in FinTech usage across different demographic segments.

Descriptive statistics indicated that women employed in the private sector, those holding higher educational qualifications, and younger age groups exhibited higher rates of FinTech adoption. Assamese women demonstrated comparatively greater digital financial inclusion, whereas women from ethnic backgrounds such as the Bodo and Mishing communities showed lower engagement levels.

The logistic regression analysis confirmed that higher education levels and private sector employment were significant predictors of FinTech usage, while age and ethnicity, though influential descriptively, were not statistically significant predictors when controlling for other factors. The model explained approximately 18.4% of the variance in FinTech usage behavior.

Overall, the findings highlight that while educational attainment and occupational exposure enhance women's digital financial participation, persistent barriers remain for older women and those from marginalized ethnic groups. These results underscore the need for culturally and educationally sensitive interventions aimed at promoting equitable digital financial access for all sections of urban working women in Assam.

Discussion and Conclusion

This study examined the perception, usage, and barriers surrounding FinTech services among urban working women in Assam. The findings revealed a complex and layered reality of digital financial inclusion shaped by both individual-level factors and broader socio-cultural structures.

Quantitative results showed that although concerns around digital security, fraud, and institutional trust were common, these factors alone did not significantly predict FinTech awareness or usage when examined individually through regression analysis. Instead, educational attainment and professional exposure emerged as strong predictors of FinTech adoption. Women with higher education levels and those employed in the private sector were significantly more likely to use FinTech services compared to their counterparts in government employment or with lower educational backgrounds. Although descriptive data indicated that younger women and Assamese women had higher FinTech adoption rates, age and ethnicity were not statistically significant predictors when controlling for other factors. This highlights that while demographic variables such as age and ethnicity influence patterns of usage, their impact is intertwined with education and professional environment.

The qualitative findings enriched this understanding by revealing emotional and relational barriers that quantitative models alone could not capture. Fear of digital fraud, reliance on male family members for financial decision-making, and deep-rooted mistrust towards financial institutions emerged as critical obstacles inhibiting full and confident FinTech engagement. These insights emphasize that technological access and awareness must be accompanied by emotional trust-building and cultural sensitivity if digital financial inclusion goals are to be achieved.

Together, the quantitative and qualitative analyses highlight that FinTech adoption among urban working women is not merely a function of access to technology or technical literacy. It is deeply influenced by educational background, employment sector, socio-cultural expectations, emotional security, and the perceived reliability of financial institutions.

In conclusion, promoting FinTech usage among urban women in transitional economies like Assam requires an integrated and multifaceted approach. Improving digital financial literacy, fostering emotional resilience towards digital platforms, building institutional trust, and designing culturally sensitive financial technologies are all critical components. Beyond expanding access, stakeholders must address the hidden emotional and relational barriers that continue to limit women's full participation in the digital financial ecosystem. By doing so, Assam and similar regions can move towards a more inclusive, equitable, and sustainable model of digital financial empowerment for women.

Practical Implications

The findings of this study offer several actionable insights for policymakers, educators, FinTech developers, and financial institutions seeking to enhance digital financial inclusion among urban working women. First, there is a pressing need to design and implement targeted digital financial literacy programs specifically tailored for women, focusing not only on

technical competencies but also on building confidence in navigating digital financial systems. Second, the development of culturally adapted FinTech solutions, including interfaces in local languages and culturally familiar formats, is critical to accommodate the linguistic and cultural diversity of users, particularly among minority ethnic groups. Third, trust-building initiatives must be prioritized, involving the strengthening of consumer protection mechanisms, simplification of grievance redressal systems, and transparent communication regarding digital security measures to foster greater confidence in FinTech platforms. Moreover, special interventions should focus on women with lower educational backgrounds and those employed in government or informal sectors, where FinTech adoption remains comparatively low. Community-based outreach efforts, leveraging the influence of local NGOs, women's groups, and trusted community leaders, can also play a pivotal role in promoting FinTech literacy and bridging trust gaps. Finally, policymakers must formulate inclusive, gender-sensitive digital financial inclusion strategies that explicitly address the socio-cultural and emotional barriers inhibiting women's full participation, moving beyond a purely infrastructural focus. By implementing these multifaceted interventions, stakeholders can contribute significantly to building a more inclusive and empowering digital financial ecosystem.

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NEUROMARKETING: THE IMPACT ON CUSTOMER ENGAGEMENT AND PURCHASE DECISION

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Abstract

Neuromarketing, a developing discipline combining neuroscience and marketing, provides valuable insights into how unconscious consumer reactions impact engagement and buying decisions. This study investigates the impact of neuromarketing techniques on two key variables - customer engagement and purchase decisions—examining how neurobiological data can refine marketing strategies for greater effectiveness. Using a descriptive research design with convenience sampling, the study focuses on consumers in Kerala, India, analysing data through proportionate percentage analysis, chi-square tests, one-way ANOVA and multivariate techniques like exploratory factor analysis. Findings reveal how neuromarketing-driven stimuli enhance emotional engagement and shape buying choices compared to traditional marketing approaches. The research also discusses ethical considerations and strategic implications for businesses seeking to leverage cognitive science for competitive advantage. This study provides actionable recommendations for optimizing customer engagement and driving informed purchase decisions through neuromarketing.

Keywords: Neuromarketing, ANOVA, Exploratory Factor Analysis, Consumer Behaviour, Marketing

JEL classification: M31

Introduction

In the digital age, where consumer behaviour is rapidly shifting and competition is at an all-time high, businesses are constantly searching for innovative ways to understand and influence consumer decisions. Conventional marketing techniques, such as surveys, focus groups, and sales data analysis, often fail to identify the subconscious influences that shape consumer decisions. This limitation has paved the way for neuromarketing, a field that combines neuroscience, psychology, and marketing to understand how consumers' brains react to different marketing stimuli. According to some studies, this approach has been regarded as a revolutionary shift in the marketing landscape (Misra, 2023).

Neuromarketing is an interdisciplinary field that investigates the neural, emotional, and cognitive processes driving consumer behaviour. Utilizing advanced technologies such as "functional Magnetic Resonance Imaging (fMRI), Electroencephalography (EEG), eye-tracking devices, and facial expression analysis," it enables researchers and marketers to gain deeper insights beyond self-reported data. It uncovers unconscious reactions to advertisements, brands, packaging, pricing, and product design, which are often more influential than conscious decisions. It employs various techniques to understand subconscious factors influencing purchasing decisions (Singh, 2020; Berson, 2025). Certain fMRI studies also shown that both age and divided attention have minimal impact on neural and behavioural measures of familiarity in memory tasks, suggesting that familiarity-based memory processes are largely preserved across the adult lifespan (de Chastelaine et al., 2023).

The core idea behind neuromarketing is that consumers are not always aware of the full range of factors influencing their purchasing decisions. In fact, research suggests that much of what drives our decisions occurs on a subconscious level. Emotional responses, often triggered by visual stimuli, sounds, and other sensory inputs, play a significant role in how we form attitudes toward brands and products. Neuromarketing seeks to harness this understanding to create more effective and personalized marketing strategies.

One of the fundamental goals of neuromarketing is to measure how consumers emotionally engage with brands or advertisements. Emotional engagement is crucial because emotional responses tend to drive stronger purchasing behaviours compared to rational decision-making. By measuring brain activity, marketers can pinpoint what resonates with consumers emotionally and uses these insights to tailor their marketing efforts, leading to enhanced customer engagement.

As neuromarketing techniques evolve, companies can fine-tune their marketing strategies to address the subconscious needs and desires of their target audiences. This approach moves beyond broad demographic targeting and focuses on creating deeply personalized experiences that can foster stronger brand loyalty, increase customer retention, and ultimately, drive purchasing decisions.

Neuromarketing has gained substantial attention from industries such as retail, entertainment, automotive, and technology, with companies leveraging brain science to improve product design, optimize advertising campaigns, and enhance customer experience. The findings from neuromarketing research assist organizations in identifying which aspects of their marketing materials capture attention, trigger emotional reactions, and drive purchasing decisions. Consequently, neuromarketing provides businesses with a strategic advantage, allowing them to create campaigns that are both captivating and psychologically compelling.

This study explores the practical applications of neuromarketing, focusing on its impact on customer engagement and purchasing decisions. It seeks to connect neuroscience with marketing, providing valuable insights on how businesses can leverage this innovative field to effectively influence consumer behaviour.

Review of Literature

Stefko et al. (2021) investigated gender-based differences in consumer behaviour and found statistically significant variations, suggesting that men and women may neurologically respond differently to marketing messages. This aligns with the idea that marketing strategies should consider these gender differences to enhance their effectiveness. In a similar vein, Alsharif et al. (2021) reviewed the development of neuromarketing techniques, such as fMRI and EEG. They highlighted both the growing applications of these tools and the ethical dilemmas surrounding privacy and consumer autonomy, raising concerns that need to be addressed as the field continues to expand.

Looking to the future of neuromarketing, Glova and Mudryk (2020) argued that advances in neuro-technology could make neuromarketing more accessible and valuable for predicting consumer behaviour. These developments could offer deeper insights into how consumers think and make decisions. In a study using EEG, Golnar-Nik et al. (2019) monitored brain activity during consumer choices and found that increased alpha wave power correlated with positive preferences. However, they noted the limitations of their study due to a small sample size, which may affect the generalizability of their findings.

Harrell (2019) defined neuromarketing as the measurement of brain and physiological responses to marketing, highlighting its use in areas like product design, pricing, and advertising. By aligning strategies with consumer reactions, neuromarketing can help brands optimize their marketing efforts. Devaru (2018) emphasized that neuromarketing bridges the gap between neuroscience and marketing. However, he cautioned that the field faces challenges such as ethical issues, methodological inconsistencies, and the lack of standardized frameworks, which hinder its full potential. Previous literature has cited that integrating neuroscience with consumer psychology offers promising insights into branding, but future research must address methodological standards and ethical concerns to fully realize its potential (Plassmann et al., 2012).

Jordão et al. (2017) conducted an integrated literature review and found that neuromarketing significantly contributes to understanding consumer behaviour by revealing how the brain processes marketing stimuli, influencing buying decisions. In their systematic review, Cruz et al. (2016) categorized neuromarketing literature into three main themes: conceptual background, brain mapping, and information processing. They also called for more ethical considerations in neuromarketing research, recognizing the importance of consumer protection.

Fortunato, Giraldi, and De Oliveira (2014) demonstrated that using attractive figures or celebrities in advertisements activates trust-related areas in the brain, providing a neurological explanation for the effectiveness of such marketing tactics. Similarly, Morin (2011) emphasized the emotional power of advertising, noting that neuromarketing tools can measure subconscious reactions, allowing marketers to create more emotionally resonant and persuasive campaigns. Renvoise and Morin (2007) introduced a brain-based marketing model that categorizes the brain into the old brain, middle brain, and new brain. They argued that the old brain plays a dominant role in consumer decision-making, which has important implications for marketers aiming to target the most instinctive aspects of consumer behaviour.

Finally, Kumar and Tyagi (2004) explored the complexity of consumer decisions, suggesting that purchasing behaviour is often a structured process involving sub-goals, motivations, and varying levels of cognitive involvement. This emphasizes the importance for marketers to grasp the complex nature of consumer decision-making in order to develop more effective strategies.

Objectives of the Study

1. To study demographics of the population and survey on the general awareness on Neuromarketing among the target population.
2. To assess the impact of gender on impulse purchasing behaviour influenced by product marketing.
3. To evaluate the influence of age on consumer familiarity with neuromarketing techniques.
4. To access the factors that influence purchase decision among the target group.

Hypothesis

H_1: "There is a significant association between gender and making an impulse purchase due to product marketing."

H_2: "There is a significant difference in the mean familiarity with neuromarketing techniques between at least two age groups."

Limitations

The study was limited to the geographic region of Kerala which will not give an overall picture of impact of Neuromarketing on the entire population of India.

The time limitation on the data collection restricted the accumulation of more from the target population through the survey.

Scope of the Study

This study aims to explore the impact of neuromarketing on two critical aspects of consumer behaviour: customer engagement and purchase decisions. It aims to offer a thorough understanding of how neuromarketing techniques, including brain imaging, eye tracking, and facial coding, impact consumers' emotional and cognitive reactions to marketing stimuli. By investigating these factors, the research will highlight how businesses can leverage neuromarketing to create more engaging and persuasive marketing strategies that drive consumer behaviour. The results will offer valuable insights for marketers, advertisers, and brand strategists interested in incorporating neuromarketing techniques to improve consumer engagement and optimize purchasing decisions.

Methodology

The study employed a descriptive research design using a structured survey to investigate the awareness of neuromarketing and its impact on purchase decision mong the target group. Convenience sampling was employed, with primary data obtained through an online survey and secondary data sourced from journals and reports. The sample size included 120 respondents from Kerala, India, from students across the region. Kerala is one of consumer markets in the country where the population is exposed to influence of different national and international brands. Data was collected via Google Forms, with sections focused on demographics and related questions neuromarketing awareness. The second part focused on the factors influencing purchase decision and also the relation between age as well as gender on neuromarketing techniques. Descriptive statistics, inferential statistics like Chi-square tests and multivariate analysis including exploratory factor analysis using IBM SPSS.

Findings and Discussion

"Demographics and general survey questions related to Neuromarketing"

Table 1: Demographic characteristics

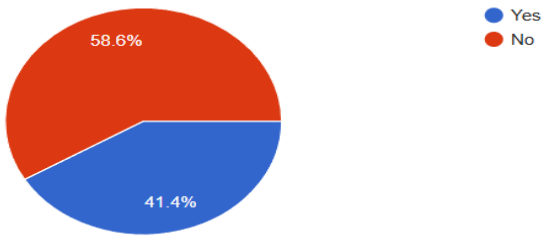
Demographic Characteristics	Number	Percentage
Age:		
18 - 24	79	65.8
25 – 34	21	17.5
35 - 44	8	6
45 - 54	8	6
55 +	4	3
Gender:		
Male	62	51.6
Female	58	48.8

Qualification:		
High school	7	5.8
Bachelor's degree	68	56.6
Master's degree	49	40.8
Ph.D.	2	1.6
Other	4	3.3
Employment status:		
Student	73	60.8
Employed	29	24.1
Self-employed	9	7.5
Unemployed	9	7.5

Source: *Author's field survey (2025). Sample Size = 120.*

The demographic data show that the majority of respondents (65.8%) are between the ages of 18 - 24, with a lower proportion from older age groups. (51.6 %) of respondents belong to Male category and remaining (48.8 %) of respondents are female category. (56.6%) have a Bachelor's degree, 40.8% of respondents have a Master's degree, (5.5%) possess a High school, (1.6%) of respondents hold a Ph.D. and remaining (3.3%) have another qualification.

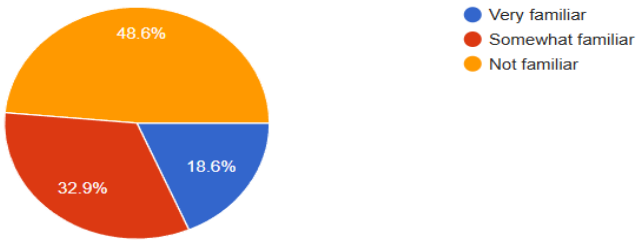
Figure 1: Awareness of the term "Neuromarketing"



Source: *Author's field survey (2025)*

A considerable majority (58.6 %) of respondents said they heard of the term neuromarketing before. Remaining (41.1%) of respondents have not heard the term neuromarketing.

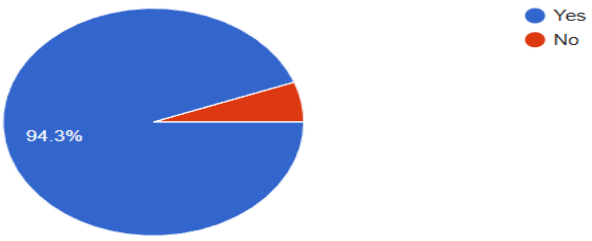
Figure 2: Familiarity with Neuromarketing Techniques



Source: *Author's field survey (2025)*

The familiarity with neuromarketing techniques, (48.6%) of respondents are not familiar with neuromarketing techniques, (32.9%) of respondents are somewhat familiar and remaining (18.6%) of respondents are not familiar with neuromarketing techniques.

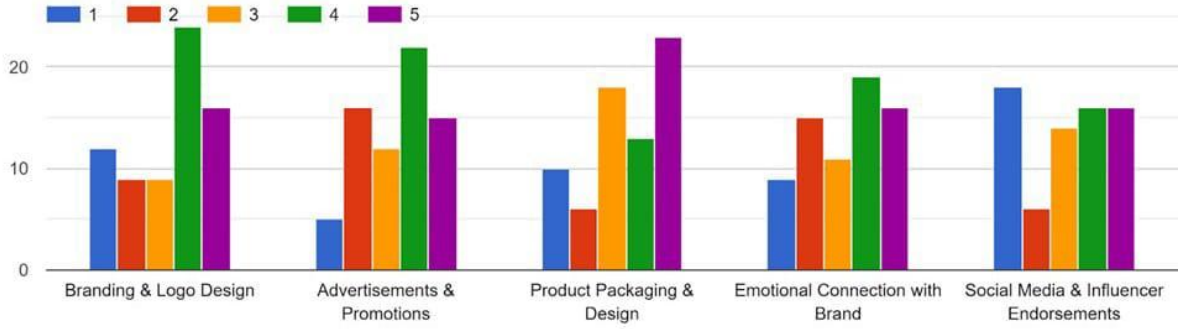
Figure 3: Customer Belief on the Use of Psychological Techniques in Marketing



Source: *Author's field survey (2025)*

A majority of respondents (94.3%) believe that brands use psychological techniques - such as (colours, sounds, scents, and emotions) to influence buying decisions. Only a small portion (6.7%) do not share this belief. Previous studies have hinted that distinct neural circuits play predictive roles in consumer purchasing decisions, suggesting that brain activity linked to anticipated gain and loss can forecast buying behaviour (Knutson et al., 2007).

Figure 4: Influence of branding and advertising on purchase decisions



Source: *Author's field survey (2025)*

Branding and logo design emerged as a significant factor in influencing purchase decisions. A majority of respondents rated this aspect as highly important, particularly choosing the top two points on the scale. This suggests that Branding & Logo Design greatly affects consumer perception and can be a decisive factor during purchasing.

Advertisements and Promotions, this factor was also rated favourably by most participants. The most of respondents are selected high importance ratings, while some indicated moderate importance. Very few respondents viewed advertisements and promotions as unimportant. These findings suggest that marketing campaigns, Advertisements & promotions are vital role in attracting and persuading consumers.

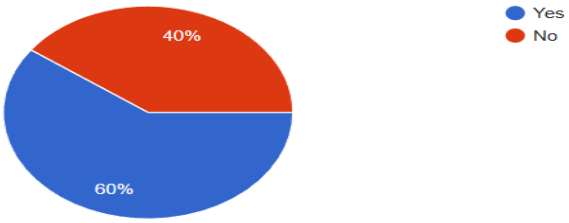
Product packaging and design stood out as one of the most influential factors. The highest number of participants rated it at the top level of importance. This reflects the strong impact

that product appearance, packaging quality, and design aesthetics have on consumers. Not only does packaging influence first impressions, but it also contributes to perceptions of product quality, trust, and brand identity.

Emotional connection with Brand, A substantial portion of respondents rated this factor as important, though slightly lower than branding or packaging. This suggests that emotional resonance - such as shared values, storytelling, and personal & social relevance can influence purchasing decisions. It highlights the role of brand loyalty and consumer-brand relationships in the decision-making process.

Social media and Influencer Endorsements, this factor received the most mixed responses. While a portion of the participants rated it as highly important, a significant number also rated it as the least important. This variation suggests that the effectiveness of social media and influencer marketing is audience-dependent such as demographics.

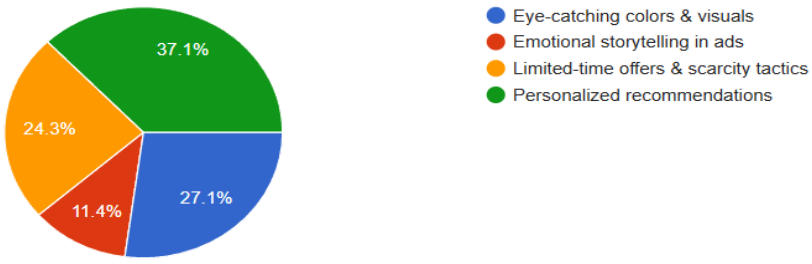
Figure 5: Impact of marketing on impulse purchase



Source: *Author's field survey (2025)*

A considerable majority (60%) of respondents reported that they have made an impulse purchase due to how a product was marketed. The remaining (40%) indicated that they have not made such a purchase. Interestingly, some research suggests that female consumers are more influenced by perceived hedonic value during livestream e-commerce, leading to greater impulsive buying behaviour compared to males (Huang et al., 2024).

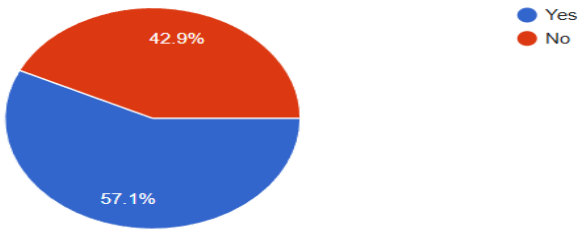
Figure 6: Most influential marketing technique



Source: *Author's field survey (2025)*

Analysing most influential marketing technique on purchase decision f a customer. A majority of respondents (37.1%) says that personalized recommendations are most influencing factor. (27.1%) of respondents said that eye – catching colours & visuals. (24.3%) have to limited time offers & security tactics and remaining (11.4%) of respondents agreed that emotional story telling ads are least influencing factor.

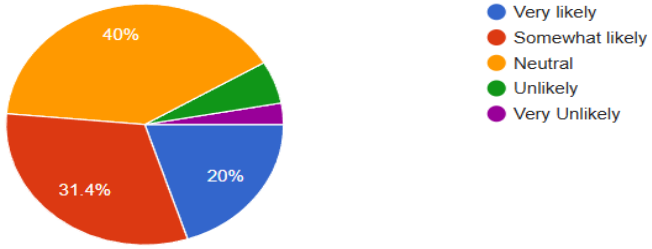
Figure 7: Trust in emotional or psychological advertising



Source: *Author's field survey (2025)*

An analysis of consumer trust in brands that use emotional or psychological triggers in advertising, the majority of respondents (57.1%) expressed trust, while the remaining 42.9% expressed a lack of trust.

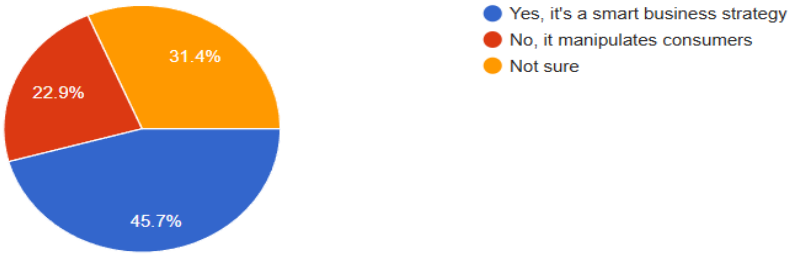
Figure 8: Willingness to recommend brands using neuromarketing



Source: *Author's field survey (2025)*

While analysing how likely respondents are to recommend a brand that employs engaging neuromarketing strategies, responses varied significantly. Almost half portion of respondents (40%) maintained a neutral stance, indicating neither a strong inclination nor resistance toward recommending such brands. Meanwhile, (31.4%) of respondents reported being somewhat likely to recommend them, reflecting a moderate level of influence. Additionally, (20%) expressed a strong positive response, stating they are very likely to recommend brands using these strategies and remaining (9.6%) indicated they are very unlikely to recommend such brands that means, indicating discomfort with the psychological nature of these strategies.

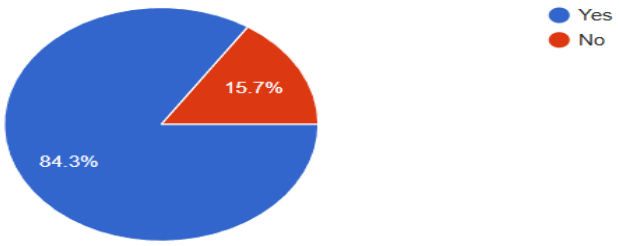
Figure 9: Perceptions of the ethics in neuromarketing



Source: *Author's field survey (2025)*

In analysing customer perceptions regarding the ethicality of neuromarketing, the majority of respondents (45.7%) viewed it as a smart business strategy - implying that they consider neuromarketing and its techniques to be ethical. Additionally, (31.4%) of respondents were unsure, a smaller group (22.9%) expressed a neutral opinion, with some believing that neuromarketing could be manipulative and potentially influence consumers in ways that raise ethical concerns.

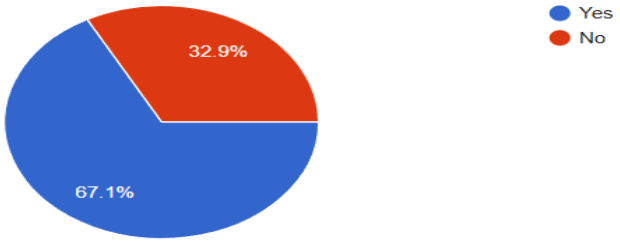
Figure 10: Preference for transparency in psychological marketing



Source: *Author's field survey (2025)*

A strong majority of respondents (84.3%) indicated a clear preference for brands to be transparent about their use of psychological marketing techniques, reflecting a growing consumer expectation for honesty and ethical communication. In contrast, only 15.7% did not share this preference, suggesting a minority remains indifferent or less concerned about such disclosure.

Figure 11: Impact on neuromarketing on shopping experiences



Source: *Author's field survey (2025)*

The analysis of customer perspectives on neuromarketing revealed that a majority (67.1%) believe it enhances the overall shopping experience by making interactions more personalized and engaging. However, 32.9% of respondents did not believe that neuromarketing contributes positively to their shopping journey.

Chi-Square Test: ***Gender *Have you ever made an impulse purchase because of how a product was marketed?***

Hypotheses

- Null Hypothesis (H_0): "There is no significant association between gender and making an impulse purchase due to product marketing."

- Alternative Hypothesis (H_1): "There is a significant association between gender and making an impulse purchase due to product marketing."

Table 2: Gender Vs Have you ever made an impulse purchase because of how a product was marketed?

		Have you ever made an impulse purchase because of how a product was marketed?		**Total**
		No	**Yes**	
Gender	**Female**	30	21	51
	Male	11	58	69
Total		46	74	120

Source: *Author's field survey (2025)*

Table 3: Chi-Square Test Summary

Test	**p**	**df**	**Significance (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	0.08	1	0.777		
Continuity Correction	0.001	1	0.972		
Likelihood Ratio	0.081	1	0.777		
Fisher's Exact Test				0.809	0.487
Linear-by-Linear Association	0.079	1	0.778		

Source: *Author's field survey (2025)*

A chi-square test of independence was conducted to examine the relationship between gender and impulse purchasing behaviour in response to product marketing. The sample consisted of 70 participants, of whom 30 were female and 40 were male. Among females, 63.3% (n = 19) reported having made an impulse purchase due to marketing, while 47.5% (n = 19) of males reported the same. Conversely, 36.7% of females and 52.5% of males indicated they had not made such a purchase.

The results of the chi-square test revealed no statistically significant association between gender and impulse purchasing behaviour, χ^2 (1, N = 120) = 0.08, p = .777. This finding was consistent with the continuity correction, χ^2 (1, N = 120) = 0.001, p = .972, and the likelihood ratio test, χ^2 (1, N = 120) = 0.081, p = .777. Additionally, Fisher's Exact Test did not indicate significance (2-sided p = .809).

The results indicate that there is no substantial difference in impulse purchasing behavior between genders in this sample. Previous research indicates that women are generally more susceptible to impulse buying due to perceived hedonic value, especially in contexts like livestream e-commerce and Instagram marketing (Huang et al., 2024). Men, on the other hand, are less influenced by emotional marketing stimuli and tend to prefer products that project independence and activity (Kovacheva et al., 2022).

Onaway-ANOVA Test: ***Assessing the Impact of Age on Consumer Familiarity with Neuromarketing Techniques***

Hypotheses

- Null Hypothesis (H_0): "There is no significant difference in the mean familiarity with neuromarketing techniques across different age groups."
- Alternative Hypothesis (H_2): "There is a significant difference in the mean familiarity with neuromarketing techniques between at least two age groups."

Table 4: Descriptives - How familiar are you with Neuromarketing techniques?

Age	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
18 - 24	79	1.5	0.629	0.095	1.31	1.69	1	3
25 - 34	21	2.3	0.823	0.26	1.71	2.89	1	3
35 - 44	8	2	0.894	0.365	1.06	2.94	1	3
45 - 55	8	2.29	0.756	0.286	1.59	2.98	1	3
55 +	4	2.33	1.155	0.667	-0.54	5.2	1	3
Total	120	1.77	0.783	0.094	1.58	1.96	1	3

Source: *Author's field survey (2025)*

Table 5: ANOVA Summary

How familiar are you with Neuromarketing techniques?					
	Sum of Squares	**df**	**Mean Square**	**F**	**p**
Between Groups	9.148	4	2.287	4.478	0.003
Within Groups	33.195	65	0.511		
Total	42.343	69			

Source: *Author's field survey (2025). $p<.05$*

A one-way analysis of variance (ANOVA) was performed to assess whether age group affects self-reported familiarity with neuromarketing techniques. Participants were categorized into five age groups: 18–24, 25–34, 35–44, 45–54, and 55+.

Descriptive statistics showed that participants aged 18–24 reported the lowest familiarity (M = 1.50, SD = 0.63), while those in the 25–34 age group had the highest mean familiarity (M = 2.30, SD = 0.82). The overall mean familiarity across all age groups was M = 1.77 (SD = 0.78).

The ANOVA revealed a statistically significant difference in familiarity with neuromarketing techniques across age groups, $F(4, 65) = 4.48$, $p = .003$. This indicates that age has a significant effect on how familiar individuals are with neuromarketing strategies. Interestingly, some

studies have mentioned no significant difference among age groups related to neuromarketing techniques (de Chastelaine et al., 2023).

Exploratory Factor Analysis (EFA): ***Factors influencing your purchase decisions***

Table 6: KMO and Bartlett's Test Summary

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.855
Bartlett's Test of Sphericity	**Approx. Chi-Square**	286.944
	df	10
	Sig	<.05

Source: *Author's field survey (2025)*

Table 7: Pattern Component Matrix, Eigen Values and Total Variance Percentage for Components obtained by Principal Component Analysis with Varimax Rotation Method

Variables	**Component**	
	1	**2**
Branding & amp; Logo Design	0.903	
Advertisements & amp; Promotions	0.806	
Product Packaging & amp; Design	0.784	
Social media & amp; Influencer Endorsements		0.875
Emotional Connection with Brand		0.86
Eigen values	3.2	1.02
Percentage of total variance	68.47	20.09
Note: Factor loadings <.035 have been omitted from the table		

Source: *Author's field survey (2025)*

A Principal Component Analysis (PCA) with Varimax rotation was conducted to identify underlying components influencing consumer purchase decisions based on five sensory marketing-related factors. The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, with a value of .855, which is considered "meritorious" (Kaiser, 1974). "Bartlett's Test of Sphericity was statistically significant, $\chi^2(10) = 286.94$, $p < .001$, indicating that the correlation matrix was not an identity matrix and thus suitable for factor analysis."

The analysis identified two components with eigenvalues greater than 1, which together accounted for a cumulative variance of 88.56%. The first component explained 47.63% of the variance, while the second accounted for 40.92%, based on the rotated sums of squared loadings. Communality values for all items were above .85, suggesting that a significant portion of the variance for each item was captured by the extracted components. From the rotated component matrix, the first factor (Component 1) was heavily loaded by Branding & Logo Design (.903), Advertisements & Promotions (.806), and Product Packaging & Design (.784). This factor appears to reflect "Visual and Promotional Appeal". The second factor

(Component 2) was strongly associated with social media & Influencer Endorsements (.875) and Emotional Connection with Brand (.860), suggesting a theme of "Emotional and Social Engagement." These results indicate that consumer purchase decisions in this context are influenced by two distinct dimensions: one based on visual and promotional elements, and the other on emotional and social connections. The high communalities and strong factor loadings support the reliability and clarity of the factor structure. Previous Literature has sighted similar results that these factors affecting purchase decision (Dejene & Kant,2023). Also, Neuromarketing has found hint the companies regarding consumer behaviour according to previous research which justifies the findings of this paper (Ismajli et al., 2022).

Conclusion

Neuromarketing holds transformative potential in decoding consumer behaviour by bridging neuroscience and marketing. However, to harness its full value, the field must overcome ethical, methodological, and transparency challenges. The path forward lies in establishing standardized practices, encouraging cross-disciplinary collaboration, and prioritizing consumer welfare. Only then can neuromarketing evolve into a responsible and impactful force in the future of marketing.

Recommendations

Neuromarketing should progress through the development of strict ethical frameworks to safeguard consumer privacy and ensure transparent data practices. Establishing standardized research methods and analytical protocols will enhance reliability and comparability of findings across studies. Cross-disciplinary collaboration among neuroscientists, psychologists, and marketers is vital to deepen understanding and innovation in the field. Above all, neuromarketing must prioritize consumer welfare and transparency to build trust and ensure its responsible integration into modern marketing practices.

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A STUDY ON THE PERCEPTION OF MSMEs TOWARDS THE VARIOUS SCHEMES PROVIDED BY DI&CC IN NAGAON DISTRICT

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Abstract

Micro, Small, and Medium Enterprises (MSMEs) are the driving force behind India's economic growth, especially in employment generation, industrial production, and entrepreneurship development. In light of their significance, the Government of India, in partnership with state-level organizations such as the District Industries and Commerce Centre (DI&CC), has introduced various schemes to promote the growth and viability of MSMEs. Owing to these schemes, a discernable gap is observed in awareness, accessibility, and actual utilization—particularly in rural and semi-urban areas, like the Nagaon district of Assam.

This research identifies the understanding of MSME owners of Nagaon about different government schemes provided by the DI&CC. The key aims were to review perceived advantages of such schemes in business development and explore the issues entrepreneurs are facing in availing the facilities of these programs. With a mixed-method research design, 20 MSME respondents were gathered using structured questionnaires (through Google Forms and field visits) and interview with DI&CC officer. Based on the analysis, although many MSMEs are aware of the potential advantages of government assistance especially financial stability and business growth multiple impediments such as unawareness, cumbersome documentation, and delayed disbursement of funds remain for many of them. Substantively, more than one-third of the respondents had never been reached by DI&CC schemes because they lacked information or had their outreach constrained.

The conclusions of the study rest on suggestions like stepped-up awareness drives, reduced application complexity, and faster responsiveness of DI&CC services. This study provides important findings for policymakers, DI&CC officials, and development agencies to enhance MSME support systems and facilitate inclusive industrial development at the district level.

Keywords: Micro, Small, and Medium Enterprises (MSMEs), District Industries and Commerce Centre (DI&CC), Awareness, Accessibility, Scheme Utilization

JEL Classification: E2, H5, H76, M13, M38, O1

Introduction

The Micro, Small, and Medium Enterprises (MSME) sector occupies a crucial position in India's industrial and economic landscape. It not only generates large-scale employment but also fosters entrepreneurship, innovation, and equitable regional development. Accounting for over 30% of India's GDP and nearly half of its exports, MSMEs serve as engines of inclusive growth. Recognizing their transformative potential, the Government of India and various state governments have introduced multiple policy frameworks, incentives, and institutional mechanisms to strengthen and sustain this sector.

At the district level, the District Industries and Commerce Centres (DI&CCs) play a vital role in implementing these initiatives. Established with the objective of promoting industrialization and entrepreneurship, DI&CCs act as the single-window agencies for supporting MSMEs through project guidance, registration, financial linkages, and marketing assistance. In Assam,

DI&CCs administer a variety of central and state schemes such as the Prime Minister's Employment Generation Programme (PMEGP), Micro Units Development and Refinance Agency (MUDRA) Yojana, North East Industrial Development Scheme (NEIDS), and the Uttar Poorva Transformative Industrialization Scheme (UNNATI). Each of these programs aims to enhance the competitiveness and resilience of local enterprises by facilitating credit access, skill development, and infrastructure support.

Despite the government's continued efforts, many MSMEs in districts like Nagaon struggle to fully benefit from these schemes. Several challenges such as limited awareness, procedural delays, lack of technical knowledge, and inadequate communication between institutions and entrepreneurs restrict the effective realization of policy benefits. The divergence between policy formulation and its practical implementation has created an urgent need to understand how MSME owners perceive these initiatives, the extent of their awareness, and the factors influencing their participation.

The Nagaon district represents a unique case within Assam's MSME ecosystem. It is home to a large number of micro and small enterprises, particularly in traditional, agro-based, and service sectors. However, empirical observations suggest that the uptake of government schemes through DI&CC remains relatively low compared to other districts. Understanding the perception, level of awareness, and challenges faced by MSMEs in accessing these schemes is essential to bridging this gap. Such an analysis not only highlights the ground realities of policy implementation but also provides constructive insights for improving institutional outreach and responsiveness.

This project is therefore grounded on a comprehensive review of the historical evolution of MSMEs in India, the establishment and functioning of DI&CCs, the various central and state-level schemes designed for enterprise development, and the socio-economic conditions influencing MSME operations in Nagaon. By examining these dimensions, the study seeks to evaluate the effectiveness of DI&CC initiatives and their impact on the local entrepreneurial ecosystem. Through field-based evidence and policy analysis, it aims to contribute to the formulation of more inclusive, accessible, and efficient MSME development frameworks—forming the foundation upon which this project has been prepared.

Key schemes include:

- *North East Industrial Development Scheme (NEIDS), 2017:* A central initiative that provides fiscal incentives such as capital investment subsidy, transport and employment subsidies, and GST reimbursement to industries established in the North Eastern region. It aims to attract investment and generate employment.

- *North East Industrial Investment Promotion Policy (NEIIPP), 2007 (now replaced by NEIDS):* Previously offered similar financial incentives and played a foundational role in boosting industrial activity in the region.

- *The Uttar Poorva Transformative Industrialization Scheme (UNNATI 2024):* A central government initiative introduced by the Department for Promotion of Industry & Internal Trade (DPIIT) with the objective of fostering industrial growth and investment across the North-Eastern Region of India. The scheme took effect on 2024, and remains valid until 2034, with an additional eight-year period allocated for meeting committed liabilities.

- *Prime Minister's Employment Generation Programme (PMEGP):* A centrally sponsored credit-linked subsidy scheme that assists individuals in setting up new

micro-enterprises in manufacturing or service sectors. DI&CC acts as the district-level nodal agency for implementation.

- *Micro Units Development and Refinance Agency (MUDRA) Yojana:* Launched in 2015, MUDRA aims to provide institutional credit up to Rs.10 lakhs to non-corporate, non-farm small/micro enterprises. It is categorized under three products—Shishu (up to Rs.50,000), Kishore (Rs.50,000 to Rs.5 lakh), and Tarun (Rs.5 lakh to Rs.10 lakh). DI&CC helps facilitate awareness and coordination with lending institutions for eligible applicants.

These schemes collectively aim to address the financial, infrastructural, and knowledge-based needs of MSMEs, enabling inclusive and sustainable industrial growth.

The Khadi and Village Industries Commission (KVIC) is a statutory body established under the Khadi and Village Industries Commission Act of 1956, functioning under the Ministry of Micro, Small and Medium Enterprises (MSME), Government of India. Its primary objective is to promote and develop khadi and village industries across rural India, thereby generating employment and supporting self-reliance.

KVIC implements several flagship programs like the Prime Minister's Employment Generation Programme (PMEGP), SFURTI, and Gramodyog Vikas Yojana, which focus on rural entrepreneurship, skill development, and financial support to small-scale industries.

KVIC operates at the national level, but it relies on DICC at the district level to implement its schemes on the ground. DICC acts as a facilitator and verification agency for schemes like PMEGP. Entrepreneurs apply through DICC, which assists in documentation, project report preparation, and forwards proposals to banks and KVIC for subsidy and financial assistance.

Thus, KVIC and DICC are interlinked in the scheme implementation framework — KVIC provides the policy and funding, while DICC ensures local outreach, support, and monitoring.

In Nagaon district, where different types of traditional, agro-based, service, and small-scale industrial units are set up, the awareness and perception towards these schemes vary which is often under the influence of numerous socio-economic factors. The present study explores the actual experiences, perceptions, and challenges faced by MSMEs in dealing with DI&CC schemes and services.

Table 1: MSME Classification Chart (Based on April 1, 2025)

Enterprise Category	Investment in Plant & Machinery / Equipment	Annual Turnover
Micro	Up to Rs.2.5 crore	Up to Rs.10 crore
Small	Above Rs.2.5 crore and up to Rs.25 crore	Above Rs.10 crore and up to Rs.100 crore
Medium	Above Rs.25 crore and up to Rs.125 crore	Above Rs.100 crore and up to Rs.500 crore

Source: *Ministry of MSME, Government of India (2025). MSME classification based on investment and turnover. Notification-S.O-no-1364-E-dated-21.03.2025-Revised-Definition.pdf*

This classification allows the government to design specific schemes—like subsidies, tax benefits, or credit assistance—tailored to the scale of the business (Micro, Small, or Medium).

Background of the Study

The Indian government has launched a lot of flagship schemes for MSME empowerment. In Assam, DI&CCs decentralize schemes so that they can be accessed easily at the grassroots level. Around 61% of Northeast MSMEs (mostly in Assam) cited difficulty accessing credit as their primary hurdle, despite Assam being the region's largest MSME base (The Hindu, 2022). Districts like Nagaon, despite having a high density of MSMEs, show low utilization of government schemes, while Dibrugarh and Tinsukia in Upper Assam exhibit significantly better uptake (Das & Goswami, 2022).

Some of the factors that have been identified are insufficient information sharing, absence of digital literacy, language barriers, and bureaucratic hurdles. This disconnects between policy formulation and its impact at the ground level constitutes the major thrust of this study.

Review of Literature

The literature review forms the foundation of this study by exploring previous scholarly work on MSMEs, government intervention through schemes, and the role of institutions like DI&CC in facilitating development. It integrates conceptual ideas, empirical findings, and theoretical bases relevant to understanding how MSMEs perceive and engage with governmental support systems.

Balasubramanian (1992) in his dissertation titled "A Study of Industrial Development in the Composite Ramanadu District", suggested that DIC should make arrangements for adequate supply of raw materials and take more efforts to help the entrepreneurs to their finished products, instead of simply directing them to approach SIDCO. He was also suggested that at least 40 percent of the project cost should be granted as margin money assistance, instead of the present 25 per cent.

Umesh C. Patnaik (1990) has made an analysis of Contribution of DIC Programme to SSI in India and found that after launching DIC programme, the growth rate of SSI sector was less, particularly in the case of export and employment generation.

Baldwin et al (1994) found that small and medium-sized firms have experienced that skilled labor was one of the most important factors contributing to their growth. To be successful in a global market, a small firm needs a highly motivated, skilled and satisfied workforce that can produce at low costs.

Safizadeh et al. (1996) reveals the key factor to survival and prosperity of small businesses in this decade and beyond will likely rest on their ability to successfully exploit and benefit from the rapidly developing field of information processing in manufacturing.

Chandrika (1990) in her dissertation "A Study of DIC in Madurai District During 1980-90" has analysed the various schemes of DIC. In her conclusion, she suggested that there should be a branch office of DIC at each and every taluk head –quarters to promote the small-scale units. Further, it was suggested that various schemes of DIC should be given wide publicity

Srivasatava and Rajput (1995) in their article titled "Sick SSI units in India: Role of Commercial Banks", mentioned that though a number of steps were being taken by commercial banks in nourishing SSI units, it was difficult to bring the sick SSI units on to the right track. For example, the industry's exposure to SSI as a percentage of total advances has ranged between 15 and 18 per cent. But the recovery percentage had lowered to about 35 percent, much below the minimum of 60 per cent for a viable recycling of funds.

Statement of the Problem

Though more MSMEs are emerging and schemes meant for their growth are proffered, the gap between what is intended and actual uptake persists. Reports from the field in Nagaon indicate that what primarily affects the uptake of the schemes is lack of awareness, low-level engagement from DI&CC officials, and limited digital accessibility.

There is little scholarly information specifically targeting Nagaon district, and no in-depth study yet challenges that looks into the perception and experiential feedback from MSMEs.

Objectives of the Study

The study is conducted with the following objectives:

1. To assess the awareness level of MSME owners regarding DI&CC schemes in Nagaon.
2. To examine the perceived benefits of these schemes for business growth of the MSMEs.
3. To identify the key challenges faced by MSMEs in accessing these schemes.

Significance of the Study

This study holds multifaceted significance for various stakeholders including policymakers, government agencies, and entrepreneurs within the MSME sector. By focusing on the District Industries and Commerce Centre (DI\&CC) in Nagaon, it offers critical insights into the implementation and reception of government MSME schemes at the grassroots level. For policy implementers, the findings provide valuable feedback on areas where schemes are effectively reaching the intended beneficiaries and highlight gaps where there is a disconnect between policy formulation and ground-level execution. For DI\&CC, the research informs strategies to improve outreach and communication, especially among semi-urban and remote entrepreneurs who often remain unaware of available schemes due to barriers such as lack of information, procedural complexity, or digital illiteracy. The study promotes the empowerment of local entrepreneurs by documenting successful case studies, thereby encouraging greater participation and trust in government programs. It also emphasizes the need for inclusive and accessible frameworks, particularly for unregistered, micro, and women-led enterprises, drawing attention to equity in policy reach. Academically, this research contributes to the limited body of literature on district-level MSME ecosystems in Northeast India, filling a crucial gap in regional development studies. Furthermore, it establishes a foundation for future comparative and longitudinal research by providing a benchmark to assess trends, policy impact, and sectoral progress over time. Ultimately, the study strengthens the link between policy intent and entrepreneurial development by offering empirical evidence that supports more responsive and data-driven governance.

Research Methodology

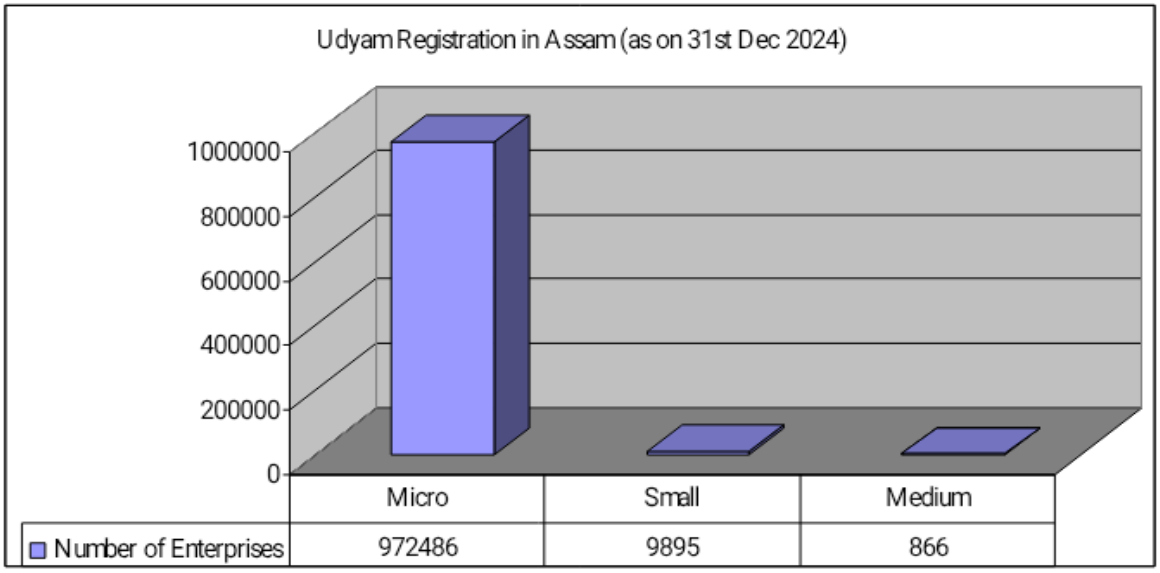
This study employed a descriptive and exploratory research design to investigate the awareness, usage, and perception of Micro, Small, and Medium Enterprises (MSMEs) in Nagaon district, Assam, regarding government schemes facilitated by the District Industries and Commerce Centre (DI&CC). A mixed-method approach was adopted, combining quantitative data from structured Google Form questionnaires and qualitative insights from a key informant interview with a DI&CC Extension Officer. The study population consisted of approximately 40 MSMEs across trading, manufacturing, service, and informal sectors, out of which a purposively and conveniently selected sample of 20 MSMEs (11 beneficiaries and 9 non-beneficiaries) participated, along with one DI&CC official. Data collection involved online and in-person distribution of questionnaires covering enterprise demographics, scheme

awareness, experiences, and suggestions, while the key informant interview explored administrative processes and institutional challenges. Primary data was supplemented with secondary sources such as government reports, academic literature, and policy documents related to schemes like PMEGP, MUDRA etc. Data analysis was conducted using MS Excel for quantitative responses, with frequency tables, percentages, and charts used to identify trends and conduct cross-sectional comparisons between beneficiaries and non-beneficiaries. Qualitative responses were reviewed to extract key themes such as challenges, information dissemination, and beneficiary experiences. This integrated methodology ensured a rich, holistic, and reliable understanding of how MSMEs in Nagaon interact with DI&CC schemes

Findings and Discussion

To contextualize the primary data collected from MSMEs in Nagaon, it is essential to consider broader patterns in the state of Assam. As shown in Figure 1, according to official data from the Ministry of MSME, Assam recorded a total of 9,83,247 Udyam-registered enterprises as of December 31, 2024. Out of these, 9,72,486 were Micro Enterprises, followed by 9,895 Small and 866 Medium Enterprises, reaffirming that the MSME landscape in Assam is overwhelmingly micro-dominated. This aligns with the sample in this study, where the majority of enterprises surveyed also operated on a small or micro scale, indicating that the local findings mirror the wider structural characteristics of the state's enterprise distribution.

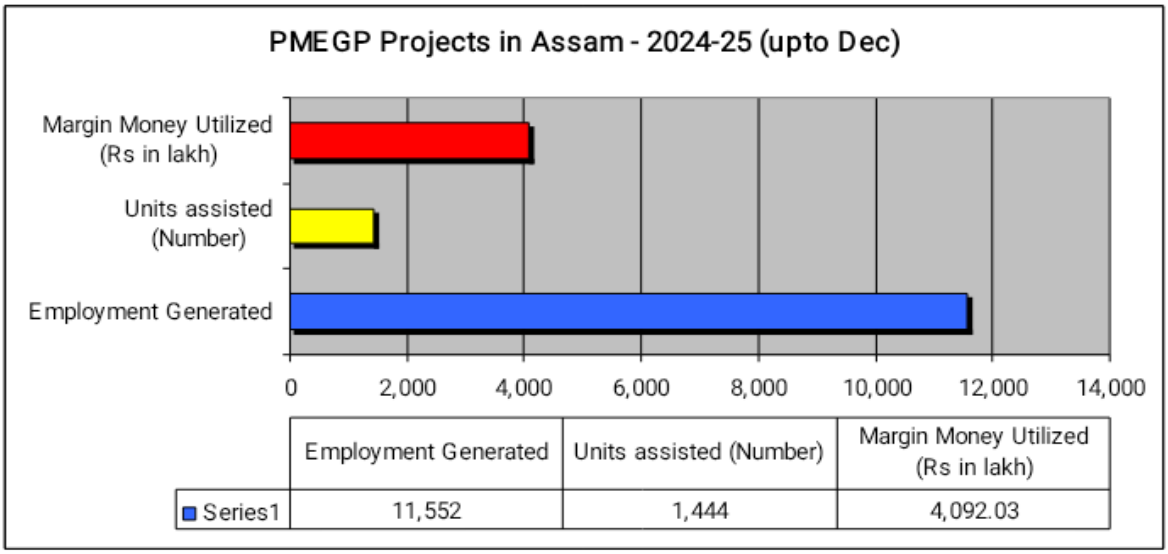
Figure 1: Udyam Registration in Assam as of 31st December 2024



Source: *Ministry of MSME, Government of India (Annual Report 2024–25)*

Complementing this, the performance of the Prime Minister's Employment Generation Programme (PMEGP) in Assam further validates the relevance of government-backed schemes. As shown in Figure 2, as per the annual report, 1,444 PMEGP projects were assisted in Assam during the 2024–25 financial year (up to December), with over 40.92 crore in margin money disbursed. Notably, these projects are estimated to have generated employment for 11,552 individuals, emphasizing the significant role of schemes in fostering enterprise-led job creation. The data supports field observations that government schemes have the potential to yield measurable economic impact when effectively accessed and implemented. Among the 11 scheme beneficiaries in the present study, similar themes emerged—ranging from improved capital access to infrastructure expansion.

Figure 2: PMEGP Projects Assisted in Assam – 2024–25 (up to December)



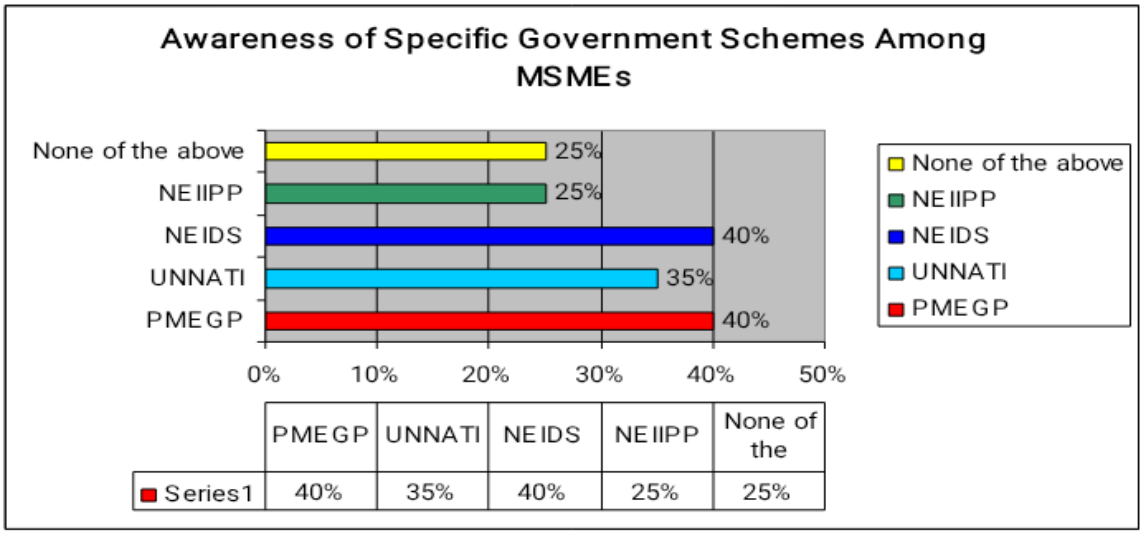
Source: *Ministry of MSME, Government of India (Annual Report 2024–25)*

These secondary data points not only strengthen the validity of the field sample from Nagaon but also reinforce the broader significance of effective scheme delivery. Despite visible institutional support, the survey found that many micro-enterprises in Nagaon still face procedural and informational barriers in accessing schemes—underscoring the gap between policy potential and on-ground reality. Based on these observations the following discussion aims to explore the perceptions, challenges, and recommendations gathered through primary field data.

The findings from the survey conducted among 20 Micro, Small, and Medium Enterprises (MSMEs) in the Nagaon district provide meaningful insights into how these businesses perceive and engage with government schemes facilitated by the District Industries and Commerce Centre (DI&CC). The data portrays a nuanced picture, indicating a moderate level of awareness among MSMEs regarding DI&CC schemes. Although all respondents addressed the awareness question, only 11 had actually applied for a scheme, revealing that while knowledge of the schemes exists, it may be insufficient or incomplete for many businesses. This suggests a gap between awareness and action, potentially due to ineffective communication, low trust in government initiatives, or limited understanding of the schemes' benefits and processes. These issues resonate with broader findings in the Indian MSME sector, where outreach efforts often fall short, particularly among micro and rural enterprises that operate with minimal exposure to formal institutional support.

To gain deeper insights into the respondents' familiarity with specific government schemes, participants were asked to select all the schemes they had heard about from a given list. As illustrated in Figure 3, 40% of the respondents were aware of both the Prime Minister's Employment Generation Programme (PMEGP) and the North East Industrial Development Scheme (NEIDS). The Uttar Poorva Transformative Industrialization Scheme (UNNATI) was known to 35%, while 25% had heard of the North East Industrial Investment Promotion Policy (NEIIPP). Notably, 25% of respondents indicated that they had not heard of any of the listed schemes. It is important to note that this was a multiple-response question, and respondents could choose more than one scheme. This data highlights a mixed level of scheme-specific awareness among MSMEs in Nagaon.

Figure 3: Awareness of Specific Government Schemes Among MSMEs

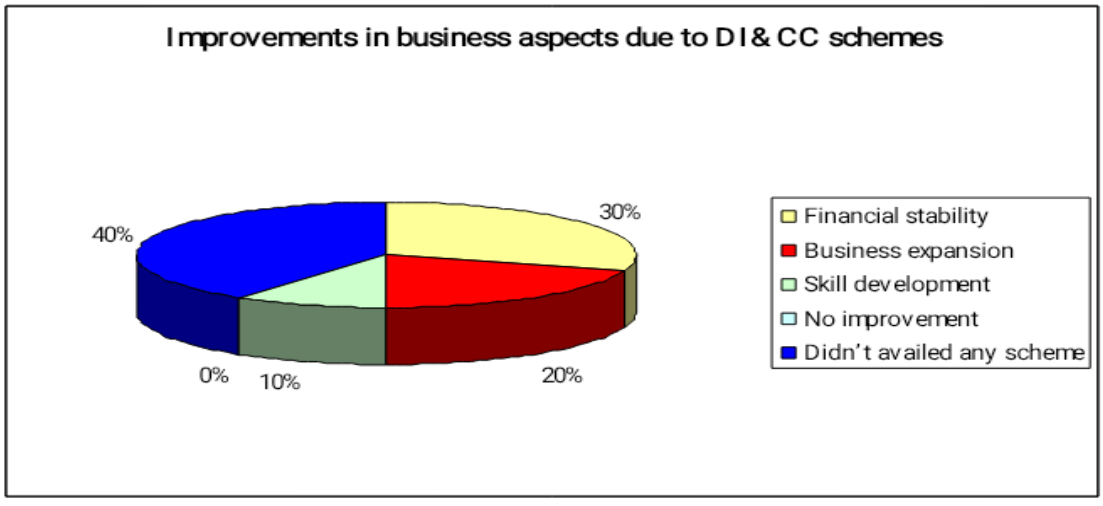


Source: *Primary Survey, Nagaon District, 2025*

The study observed a 55% application rate among respondents, which indicates a reasonable engagement level but also highlights significant underutilization. Those who had not applied were equally divided between planning to apply in the future and expressing no interest. This division points toward two prevalent challenges: procedural complexity and a perceived lack of relevance or suitability of the schemes. This aligns with existing literature on MSME policy in India, which frequently notes that bureaucratic hurdles, documentation requirements, and delayed responses deter many enterprises from participating in government programs.

To better understand the specific areas of impact, respondents were asked to indicate which aspect of their business had improved the most due to the schemes. As shown in Figure 4, 30% of respondents cited financial stability as the most significant improvement, followed by 20% reporting business expansion and 10% mentioning skill development. Notably, 40% of respondents indicated they did not avail of any scheme, which reinforces the earlier observation of moderate engagement levels. These findings highlight the schemes' potential to address core entrepreneurial needs when utilized effectively.

Figure 4: Improvements in Business Aspects Due to DI&CC Schemes



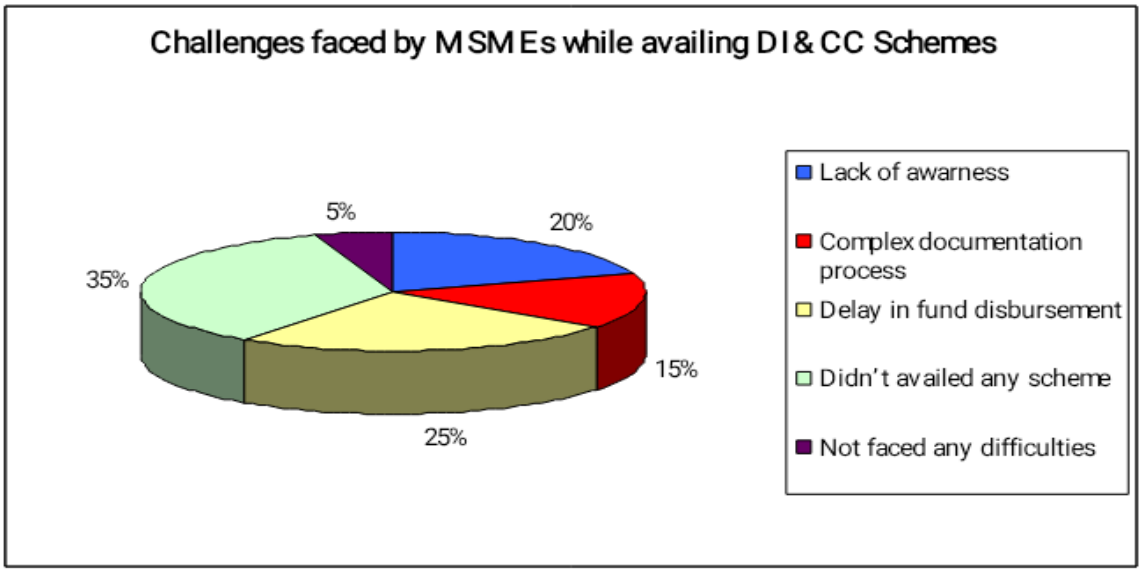
Source: *Primary Survey, Nagaon District, 2025*

Among those who availed DI&CC schemes (11 entrepreneurs), the majority expressed a positive perception of the support received. Nearly half of the beneficiaries found the schemes to be highly beneficial, while a similar proportion responded with neutral views, and a small minority found them not beneficial. This suggests that, when accessible and applicable, DI&CC schemes—particularly those related to credit guarantees and subsidies—can effectively address core needs such as access to finance, infrastructure enhancement, and business expansion. The nature of perceived benefits appeared to vary by enterprise type. For instance, healthcare enterprises reportedly invested in infrastructural improvements, while manufacturing units utilized support to enhance technology and inventory management. However, the presence of neutral or negative responses points to inconsistencies in implementation and scheme effectiveness, possibly arising from mismatches between scheme provisions and enterprise scale or sector, or from delays in fund disbursement and inadequate follow-up mechanisms.

The challenges cited by MSMEs during the study reveal systemic issues in policy execution. Respondents highlighted documentation burdens, lack of timely and clear guidance, and slow processing timelines as major impediments. These issues disproportionately impact micro-enterprises, which often lack the administrative capacity to navigate complex procedures. For such enterprises, even minor bureaucratic inefficiencies can become significant obstacles. The findings also revealed divergent views on the adequacy of DI&CC support. While some respondents reported meaningful assistance, others viewed the institutional support as insufficient, indicating gaps in both the coverage and quality of service delivery.

The study further explored the specific obstacles MSMEs face while engaging with DI&CC schemes. As shown in Figure 5, 25% of respondents reported delays in fund disbursement, 20% pointed to a lack of awareness, and 15% cited complex documentation as a major challenge. Importantly, 35% had not availed of any schemes at all, while 5% reported no difficulties. These results suggest that procedural and informational bottlenecks remain prominent barriers and disproportionately affect smaller enterprises with limited administrative capacity.

Figure 5: Major Challenges Faced by MSMEs While Availing DI&CC Schemes



Source: *Primary Survey, Nagaon District, 2025*

Overall, the results reflect both the potential and limitations of DI&CC schemes in driving inclusive economic development in Nagaon. While the schemes are clearly appreciated by beneficiaries and have contributed to tangible improvements in business performance, several

structural issues continue to hinder their broader impact. The diversity of Nagaon's MSME landscape—ranging from hospitals to pottery units—underscores the inadequacy of one-size-fits-all approaches. This diversity necessitates customized interventions that are sensitive to enterprise size, sectoral requirements, and geographic context. The findings call for greater investment in awareness campaigns, simplification of administrative procedures, and targeted policy design to bridge the current implementation gaps. Strengthening institutional responsiveness and ensuring equitable access to all types of MSMEs are essential steps toward realizing the full potential of government schemes in fostering entrepreneurship and regional economic development.

Conclusion

The findings of this study reveal that while the District Industries and Commerce Centre (DI&CC) in Nagaon has made some progress in engaging with MSMEs, substantial gaps remain in outreach, accessibility, and service delivery. Only 45% of respondents were fully aware of existing schemes, and approximately 35% had never interacted with the DI&CC, indicating a significant communication shortfall. Among those who did benefit from the schemes, the outcomes were largely positive—such as improved cash flow and business expansion—highlighting the potential effectiveness of these initiatives when successfully accessed. However, the application process remains a major obstacle, with challenges including complex documentation, lack of support, and delays in disbursement often pushing entrepreneurs toward informal credit alternatives.

Moreover, structural barriers such as the digital divide, limited regional language resources, and lack of digital literacy hinder many rural and smaller enterprises from accessing support. The absence of female participants in the sample also points to a deeper gender disparity in both entrepreneurship and access to institutional resources. These issues highlight the need for inclusive, localized strategies and improved administrative responsiveness. In conclusion, while DI&CC schemes have a positive theoretical framework and demonstrated benefits, their practical impact can only be realized through more targeted outreach, simplified procedures, and ongoing engagement with entrepreneurs to address implementation challenges.

Limitations of the Study

Although the study provides insightful results, it is not without limitations. Firstly, the sample size was limited to 20 respondents, which restricts the generalizability of the findings across all MSMEs in Nagaon. Secondly, the sample was entirely male, which leaves a significant gap in understanding the experiences and challenges faced by women entrepreneurs. Thirdly, due to time constraints, the study did not include a comparative analysis between different regions within the district, which could have offered more nuanced insights into rural-urban disparities. Lastly, because the data was primarily self-reported, there may be a bias in how respondents perceived and shared their experiences.

Recommendations

Based on the insights and challenges observed, the following recommendations are made to improve the accessibility, efficiency, and impact of DI&CC schemes in Nagaon:

1} *Enhanced Awareness Campaigns:*

DI&CC should organize regular awareness drives, particularly in rural and semi-urban areas. These campaigns must be conducted in local languages and target both male and female entrepreneurs. Use of community radio, WhatsApp groups, and local trade associations can improve reach.

2} *Simplification of Application Procedures:*

Simplifying forms, offering sample templates, and providing a checklist in vernacular languages can ease the application burden. Introducing a step-by-step helpline or chatbot could assist first-time applicants.

3} *Faster Fund Disbursement:*

Establishing time-bound deadlines for approvals and disbursals, along with real-time status tracking systems, can build trust and encourage participation.

4} *Rural Outreach Units:*

Creating mobile DI&CC units or satellite offices in remote areas can ensure wider coverage and better interaction with rural entrepreneurs who may otherwise be excluded.

5} *Digital and Physical Support Desks:*

A hybrid helpdesk—offering online support and in-person assistance—should be established to assist those lacking digital literacy or infrastructure.

6} *Encouraging Women and Marginalized Groups:*

A special outreach wing must be developed for women-led and unregistered enterprises. Incentivized schemes or exclusive capacity-building programs can help overcome historical barriers.

7} *Capacity Building:*

More focus must be placed on entrepreneurship development programs, soft skill training, and market awareness sessions. These can improve confidence among first-time entrepreneurs.

8} *Regular Feedback and Monitoring:*

Implementing a transparent grievance redressal mechanism and periodic surveys will enable DI&CC to receive real-time feedback and make continuous improvements.

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CAPITAL STRUCTURE AND PROFITABILITY OF SMALL AND MEDIUM ENTERPRISES- AN EMPIRICAL STUDY

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Abstract

In India, MSMEs' contribution to total exports is very significant—it contributed 45.03% in 2021–22. Moreover, MSMEs accounted for more than 29% of the national GDP in 2021–22, reflecting their vital role in economic development. The progress of MSMEs has a positive impact on the advancement of the nation's economy. This study examines the relationship between capital structure and profitability and the impact of capital structure on the profitability of Small and Medium enterprises (SMEs). Financing decisions, being a crucial aspect of firm management, require an appropriate mix of debt and equity to efficiently finance the firm's assets. A number of factors influence the capital composition of these enterprises, particularly the availability and accessibility of funds. Financial data were collected from the financial statements of 10 small and medium enterprises for the period 2021–22 to 2022–23. Using multiple correlation and regression analysis, the study found that capital structure variables have a measurable influence on profitability. Specifically, while the debt-equity ratio shows a weak positive relationship with profitability, the debt-total capitalization ratio exhibits a stronger and statistically significant positive association. However, the findings are based on a limited sample size and a narrow geographic scope (Kamrup district, Assam), which may restrict the generalizability of results. Wider inference therefore requires more representative and longitudinal data across different regions and enterprises.

Keywords: Capital structure, Profitability, MSME, Debt-equity ratio, Return on Equity

JEL Classification: G32, L25, L26, M13, O16

Introduction

Capital structure refers to the association of various long-term forms of financing, such as debentures, preference share capital and equity share capital. There should be a proper mix of owned and borrowed capital in financing the firm's assets. A financing decision is a crucial one for a firm. Every firm should aim to achieve the optimum capital structure. An optimum capital structure is the combination of owned and borrowed capital that leads to the maximum worth of the enterprise. A firm may raise its fund requirements from different owned and borrowed sources. The capital composition decision is significant since it has an effect on the profit-making capability of the enterprises.

The Micro, Small and Medium enterprise sector (MSMEs) has a substantial role in the economy all over the world. In India, MSMEs contribute a large proportion to total exports (i.e., 45.03% in 2021-22) and 29.9 % contributed to the GDP in 2021-22. The progress of MSMEs has a positive impact on the advancement of the nation's economy. However, financial resources are a critical hindrance to the progression of this sector. A number of factors have an influence on the capital composition of these enterprises. One of them is the availability and accessibility of those sources of capital to these enterprises. Hence, it is very essential to know whether the firm's performance is influenced by its capital structure or not.

Review of literature

Sultan and Adam (2015) conducted a study titled "The effect of capital structure on profitability: an empirical analysis of listed firms in Iraq" to test the impact of capital structure on profitability among listed Iraqi firms by using a multiple regression analysis model. According to the researchers, capital structure has a significant positive effect on profitability.

Taqi et al. (2016) surveyed the effect of the capital structure of selected trading companies on the profitability of the companies in India and their study found that the capital structure of a company's influence on its performance. The researchers concluded that equity and long-term debt enhance the performance of a company.

Singh and Bagga (2019) did a study among 50 listed in the National Stock of India and measured the influence of capital structure on profitability by using correlation, regression analysis, etc. by selecting some profitability indicators (dependent variables) and capital structure indicators (independent variables). The researcher found that higher the total debt in the capital structure results lower the return on assets, while a decrease in equity results in a decrease in return on assets and vice-versa.

Chang et al. (2019) revealed that a substantial negative connection between leverage and profitability and a positive relationship between growth and financial leverage, which indicates that profitability is associated with leverage and the lower the leverage the higher the profitability of the firm.

Thanh et al. (2021) studied the effect of capital structure on the profitability of companies in emerging markets by using capital structure variables (long-term debt to assets ratio, short-term debt to assets ratio, debts to assets ratio, etc.) and profitability variables, i.e., return on equity. The study revealed that profitability has a positive association with debt-to assets ratio and has a impact of firm size and revenue growth on profitability. Moreover, the researcher found that the long-term debt-to-assets ratio has a negative effect on the profit-making capability of the firm.

Kokeyeva et al. (2022) conducted a study among 230 SMEs in Kazakhstan during 2015–2019. The study revealed that has a substantial effect on the capital structure decision of industry nature and a negative impact of debts on the return of enterprises.

Objective of the study

- To study the effect of capital structure on profitability of small and medium enterprises.

Research Questions

(1) Does the debt-to-equity ratio and the enterprise's return on equity have a significant relationship?

(2) Does the debt-to-equity ratio and the enterprise's return on capital employed have a significant relationship?

(3) Does the debt-total capitalisation ratio and the enterprise's return on equity have a significant relationship?

(4) Does the debt-total capitalisation ratio and the enterprise's return on capital employed have a significant relationship?

Significance of the Study

The rationale behind this study arises from the pivotal role that capital structure decisions play in determining the financial health and profitability of enterprises, particularly in the Micro, Small and Medium Enterprises (MSME) sector. MSMEs constitute the backbone of the Indian economy, contributing significantly to employment generation, exports and GDP. However, despite their importance, MSMEs often face persistent challenges in accessing adequate and affordable finance.

Understanding the relationship between capital structure and profitability is essential for these enterprises, as an inappropriate mix of debt and equity can adversely affect their cost of capital, liquidity position and overall sustainability. This study therefore seeks to empirically examine how different financing patterns especially debt-equity and debt-total capitalisation ratios affect profitability indicators such as Return on Equity (ROE) and Return on Capital Employed (ROCE) among SMEs.

The significance of this study lies in the following aspects:

1. Practical Insight for SME Managers: It provides empirical evidence that can help SME owners and managers make informed financing decisions to achieve an optimal capital structure that enhances profitability and firm value.
2. Guidance for Financial Institutions: The findings can assist banks and other lending institutions in understanding how leverage levels influence SME performance, helping them design more suitable and flexible credit products for this sector.
3. Policy Implications: Policymakers can use the insights to formulate financing and support schemes that improve MSMEs' access to capital while maintaining their financial stability.
4. Academic Contribution: The study adds to the growing body of literature on capital structure and firm performance, particularly within the Indian MSME context, where empirical research remains relatively limited.
5. Regional Relevance: By focusing on enterprises registered under the DICC, Kamrup (Assam), the study sheds light on financing challenges and patterns in a regional setting, offering a base for comparative studies across other states and regions.

In essence, this research bridges the gap between theoretical finance models and practical decision-making in SMEs, providing valuable insights that can enhance both business performance and economic development.

Research methodology

Data have been gathered from the annual report of 10 private limited companies for a period of 2 years (2021-22 and 2022-23) that are registered in DICC of Kamrup (Assam) as small and medium enterprises. Out of 10 companies, 5 are small and 5 are medium enterprises. After collecting data, statistical tools such as correlation and regression have been applied to analyse the data.

To test the effect of capital structure on profitability, the following profitability and capital structure indicators are selected:

Table 1: Selected variables for the study

Capital structure ratio (Independent variables)
(1) Debt-Equity ratio
(2) Debt-assets ratio
Profitability ratio (Dependent variables)
(1) Return on Equity
(2) Return on capital employed

Source: *Author's self-construct*

Capital structure variables (Independent variables)

(1) Debt-to-equity ratio: The debt-to-equity ratio is a useful tool for assessing how much debt financing an entity has employed. This shows the appropriate claims made by outsiders and owners against the enterprise's assets. Higher debt-to-equity ratios signify a higher use of debt financing. Conversely, a lower debt-to-equity ratio indicates that the enterprise's capital structure contains a smaller proportion of loan funds. It is calculated as follows:

$$\text{Debt} - \text{equity ratio} = \frac{\text{Total debt}}{\text{Total shareholders' equity}}$$

(2) Debt-Total Capitalisation ratio: The debt-total capitalisation ratio establishes a relationship between debt and the total capitalisation of the firm. It measures the firm's financial leverage. It is calculated as follows:

$$\text{Debt} - \text{Total Capitalisation ratio} = \frac{\text{Long-term Debt}}{\text{Total Capitalisation}} \times 100$$

Profitability variables (Dependent variables)

(1) Return on equity: The net income returned, expressed as a proportion of shareholders' equity, is called the return on equity. A firm's profitability is determined by the amount of profit it generates from the capital provided by its owners. It is calculated as follows:

$$\text{Return on Equity} = \frac{\text{Net income}}{\text{Shareholders' equity}} \times 100$$

(2) Return on Capital Employed: The connections between the firm's capital and profit are established by the return on capital employed. This is the most widely used primary ratio to measure the overall profitability of a firm. The formula used to determine the return on capital employed is as follows:

$$\text{Return on capital employed} = \frac{\text{Net Profit}}{\text{Capital Employed}} \times 100$$

Findings and Discussion

(1) *Correlation Analysis:* Correlation analysis is used to test the relationship between the capital structure and profitability of an enterprises.

Table 2: Correlation analysis

Variables	Debt-Equity ratio	Debt-Total capitalisation ratio	Return on Equity	Return on capital employed
Debt-Equity ratio	1	0.875** (.000)	0.021 (0.536)	-0.017 (0.632)
Debt-Total Capitalisation ratio	.0875** (.000)	1	0.561 (0.039)	0.436 (0.046)
Return on Equity	0.012 (0.536)	0.561 (0.039)	1	0.901 (0.021)
Return on capital employed	-0.017 (0.632)	0.436 (0.046)	0.901 (0.021)	1

*** Correlation is significant at the 0.01 level*

Source: *Author's own computation*

From the above table 2, it is seen that there is a positive correlation (r = 0.021) between the debt-equity ratio and return on equity, which is statistically insignificant (p = 0.536) > 0.05. However, as observed in Table 1, there is a low degree of negative correlation between the debt-equity ratio and the return on capital employed, which is also insignificant (p = 0.632 > 0.05). The correlation between debt-total capitalization ratio and return on equity shows a positive degree of correlation (r = 0.561), which is significant. Moreover, there is a positive degree of correlation (r = 0.436) between the debt-total capitalisation ratio and the return on capital employed, which is also significant.

(2) *Regression Analysis:* To know the impact of capital structure on profitability of the enterprises regression analysis is used.

Model 1:

Return on Equity (y) $=\beta_0+\beta_1 D/E+ \beta_2 D/A$

Table 3: Coefficient

Variables	Coefficient	Coefficient
Constant	β_0	29.25
Debt -Equity Ratio (D/E)	β_1	0.0573
Debt-Total Capitalisation ratio	β_3	0.0921

Source: *Author's own computation*

Table 4: Model Summary

R	R Square	Adjusted R Square	Stand. Error of estimate
0.771	0.254	0.098	4.825

Source: *Author's own computation*

From the table 4, it is seen that R square value 0.254. This indicates that 25.4 percent of variation in return on equity is explained by capital structure (independent variables- debt-equity ratio, debt-total capitalisation ratio) of an enterprise. While remaining 74.6 percent variation on return on equity of the enterprises is explained by other factors.

Model 2:

Return on Capital Employed (y) =β_0+β_1D/E+ β_2D/A

Table 5: Coefficient

Variables	Coefficient	Coefficient
Constant	β_0	25.79
Debt -Equity Ratio (D/E)	β_1	0.0822
Debt-Total Capitalisation ratio	β_3	0.0628

Source: *Author's own computation*

Table 6: Model Summary

R	R Square	Adjusted R Square	Stand. Error of estimate
0.419	0.158	0.074	6.972

Source: *Author's own computation*

The above table 6 shows that the R square value is 0.158. This indicates that 15.8% of the variation in return on capital employed is explained by the capital structure (independent variables: debt-equity ratio, debt-total capitalisation ratio) of an enterprise. While the remaining 74.6% of the return on capital employed by an enterprise is explained by other factors.

The findings indicate that capital structure does influence profitability, though the extent varies across indicators. A higher debt-total capitalization ratio tends to enhance returns to equity and capital employed, suggesting that moderate leverage can improve financial performance by utilizing debt effectively.

However, the study also implies that capital structure alone cannot fully explain SME profitability. Other potential influences include:

- Managerial efficiency and cost control practices
- Market competitiveness and firm size
- Access to technology and innovation capacity
- Macroeconomic conditions, policy support and credit availability
- Operational risk and working capital management

These factors, though beyond the scope of this limited study, warrant further investigation in broader, multi-year analyses.

Conclusion

The present study explores the relationship between capital structure and profitability among Small and Medium Enterprises (SMEs) in the Kamrup district of Assam. The findings indicate that the debt-to-equity ratio has a weak positive correlation with return on equity (ROE) and a

negative correlation with return on capital employed (ROCE), though both relationships are statistically insignificant. In contrast, the debt-total capitalisation ratio exhibits a significant positive relationship with both ROE and ROCE, implying that moderate leverage can enhance profitability when debt is effectively utilised.

The regression results further reveal that capital structure variables (debt-equity ratio and debt-total capitalisation ratio) explain 25.4% of the variation in ROE and 15.8% of the variation in ROCE, suggesting that while capital structure plays an important role in determining profitability, other factors such as managerial efficiency, operational scale, market conditions and access to finance also have substantial influence.

However, the study's conclusions should be interpreted with caution due to its methodological limitations. The analysis is based on a small sample of only ten enterprises confined to a single district (Kamrup, Assam) and a short two-year period (2021–22 to 2022–23). Such a limited and region-specific dataset restricts the generalizability of findings to the wider MSME population in India. The results, therefore, provide indicative rather than conclusive evidence of the capital structure profitability relationship.

Future research should expand the sample size to include multiple regions and industries over a longer period to obtain a more representative understanding of how capital structure decisions affect profitability across diverse MSME contexts. Incorporating qualitative dimensions such as managerial attitudes toward risk, access to credit facilities and industry-specific financial constraints could further enrich the analysis.

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THE ROLE OF EMOTIONS IN CONSUMER DECISION MAKING – A COMPARATIVE STUDY OF ONLINE AND OFFLINE SHOPPING

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Abstract

This research delves into the pivotal position of emotions in consumer decision-making, with special reference to comparative study of online and offline shopping experiences. Emotions are vital to shape the consumer perceptions, dictating the manner in which consumers judge products, build trust, and ultimately make buying decisions. While technology has powerfully reshaped the retailing environment, emotional stimulation provided by conventional brick-and-mortar stores remains a powerful determinant of consumer behaviour. This study examines salient emotional dimensions like excitement, anxiety, trust, regret, impulse buying, and post-purchase satisfaction in both shopping scenarios. In this mixed-method research design, primary data was gathered through structured questionnaires, complemented by secondary data from reputable psychological and marketing literature. Theoretical frameworks like the Affect Infusion Model and the Stimulus-Organism-Response (S-O-R) model are employed to explain how emotional cues affect consumer decision-making. The results show that although online shopping is convenient and diverse, it tends to be deprived of sensory involvement and instant satisfaction that offline shopping provides, which can affect emotional satisfaction and loyalty. On the other hand, online platforms can induce increased impulsivity or anxiety because of uncertainty or absence of haptic feedback. This research provides actionable insights for marketers and retailers to create emotionally engaging strategies specific to each platform. It highlights the importance of integrating emotional intelligence into marketing strategies, creating enhanced customer experiences through personalization, trust engines, and experiential engagement tools. Finally, knowledge of emotional dynamics in both offline and online spaces helps companies better respond to changing consumer expectations and create deeper brand-consumer relationships.

Keywords: Consumer Decision-Making, Online Shopping, Offline Shopping, Consumer Behaviour, Emotional Engagement, Impulse Buying, Emotional Satisfaction, Emotional Intelligence, Marketing Strategy

JEL Classification: M31, D91, D87, D12, L81, M37, Z13

Introduction

Consumer decision-making is a complex process that is affected not just by rational consideration but also by mood and emotional responses (Pham, 2007). With the changing consumer markets, the binary opposition of online and offline retailing brings distinct emotional experiences (Rose, Clark, Samouel, & Hair, 2012). Physical stores provide haptic interaction, human support, and instant pleasure, which create strong emotional bonds (Tomar, Tomar, & Khattri, 2020). In contrast, online channels thrive on convenience, diversity, and customization, which trigger varying emotional reactions such as thrill, nervousness, or wonder (Prashar, Vijay, & Parsad, 2017). Understanding how emotions function in such situations aids firms in adapting approaches that appeal to consumer emotions (Sharma, Mohan, & Gupta, 2023). Emotions are central to behavioural economics and psychology (Shiv & Fedorikhin, 1999). The Affect Infusion Model (AIM) defines how mood and emotions may come to impact decision-making processes, particularly under unclear or complex circumstances (Pham, 2007). The Somatic Marker Hypothesis theorizes that emotions serve as markers that influence

behaviour and decision making (Shiv & Fedorikhin, 1999). Emotional prompts such as music, lighting, design, or even digital aesthetics can cue consumer decisions in retail environments (Peters, Bodkin, & Bristow, 2013). Emotional intelligence, mood states, and affective forecasting also shed light on how emotions guide attention and memory and, in turn, affect purchase intentions (Kapil, 2022). These models offer a framework for understanding emotional behaviours across diverse shopping environments (Sharma et al., 2023).

Emotional dynamics in offline shopping involve multiple senses, providing a rich emotional spectrum. Feeling products, interacting with sales assistants, and experiencing the atmosphere of a shop all contribute to an intensified emotional experience (Mehta & Manjrekar, 2021). Consumers tend to rely on emotional satisfaction that stems from social interactions or the joy of window shopping (Singh & Gupta, 2021). Perceived control and faith in product quality are usually stronger with direct inspection (Gupta & Shukla, 2019). Physical presence also evokes nostalgia, belongingness, and pride, especially in high-end or heritage retail settings (Roy & Datta, 2022). Feelings of happiness, excitement, and contentment take on overriding roles in determining offline consumer behaviour (Tomar et al., 2020). Emotional topography of internet shopping, though devoid of bodily sensory involvement, compensates through tailored experiences, location-based advertising, and algorithmic suggestions (Rose et al., 2012). Online consumer behaviour is typified by emotions like curiosity, surprise, and even fear (e.g., fear of scams or delivery problems) (Agarwal, Chahar, & Bhati, 2021). Convenience and time-savings tend to induce happiness and satisfaction, but decision fatigue and over choice may lead to frustration (Vijay, Prashar, & Sahay, 2019). Emotional design, ease of user interface, and online community involvement are instrumental to emotional attractiveness (Peters et al., 2013). Moreover, the immediacy of mobile commerce and social media-based shopping platforms amplifies emotional attachment with brands and products (Jang, Ko, & Koh, 2019).

Review of Literature

Shiv & Fedorikhin (1999) discuss the conflict between emotional and cognitive processes in decision making. They demonstrate that affective impulses will dominate rational judgments, especially under time pressure - a universal characteristic of both online flash sales and in-store impulse buying.

Pham (2007) is critical of the emotion-rationality dualism found in consumer behaviour. He contends that emotions are not inherently irrational; rather, they can bring adaptive benefits to decision making. This knowledge facilitates a comparison between emotional stimuli in online promotions and sensory stimulation in stores.

Rose et al. (2012) present a thorough review of customer online experiences, suggesting that emotional reactions i.e., frustration due to usability or delight due to personalization—straightforwardly affect purchasing decisions. This is different from offline experiences, where human interaction and atmosphere are strong emotional stimuli.

Peters et al. (2013) demonstrate that online shopping spaces can trigger both positive and negative emotions, contingent on website appearance, navigation, and perceived risk. Offline shopping, on the other hand, provides haptic reassurance and social approval that influence more favourable affective outcomes.

Prashar, Vijay, & Parsad (2017) used the Stimulus-Organism-Response (S-O-R) model to examine the impact of online shopping values and cues on purchase behaviour. The study revealed that affective stimuli such as website appearance and interactivity have a positive influence on consumers' purchase intentions in the Indian market.

Jang, Ko, & Koh (2019) find that emotion-driven purchasing is greater in offline environments because of immediate product experience, whereas online shoppers are more impacted by emotional narratives in product descriptions and imagery, highlighting the interface design's importance in evoking emotional reactions.

Vijay, Prashar, & Sahay (2019) explored the impact of values of online shopping and web atmospheric cues on e-loyalty, with e-satisfaction as a mediator. The study pointed out that affective aspects such as entertainment and beauty of websites play a strong role in augmenting customer satisfaction and loyalty in the Indian market.

Gupta & Shukla (2019) investigated online retail format choice behaviour of Indian consumers from a cultural viewpoint. The research found that collectivist cultural values affect emotional reactions, which influence online shopping behaviours and attitudes.

Tomar, Tomar, & Khattri (2020) examined how brand trust mediates cognitive dissonance between online and offline consumers. The research indicated that brand trust lowers cognitive dissonance, especially in online shopping situations where the lack of physical contact may contribute to ambiguity.

Singh & Gupta (2021) discussed consumer preference in retail in Haryana, India, emphasizing the trends of offline and online shopping. The research pointed out that consumers are greatly affected by emotional aspects like comfort and trust when it comes to consumer preference and channel choice.

Mehta & Manjrekar (2021) explored the comparative research of consumer attitudes toward online and offline shopping options in India. In their work, they demonstrated offline shopping preferences through the use of touch and the instant experience with a strong emphasis on the emotional fulfilment offered through physical store atmospheres.

Agarwal, Chahar, & Bhati (2021) created and established a scale measuring online impulse buying behaviour of customers in North India's small towns. Hedonic motivation and marketing stimuli were seen as emotional triggers that had major impacts on impulse online purchases according to the research.

Roy & Datta (2022) integrated consumer shopping behaviour towards offline and online shopping in South Asian nations, such as India. The study revealed that emotional aspects such as perceived enjoyment and risk perception have important roles to play in channel choice and purchase behaviour.

Kapil (2022) studied the influence of cognition and emotions on consumer loyalty in India's Online-to-Offline (O2O) business model. The research revealed that consumer loyalty is greatly affected by both cognitive and emotional aspects, making it crucial to include emotional engagement strategies in O2O platforms.

Sharma, Mohan, & Gupta (2023) offered a systematic literature review of the contribution of emotions in retail environments. The research highlighted that store atmospherics, crowding, and interpersonal relationships stimulate emotional reactions that shape consumer behaviour in offline retail environments.

Research Gap

The reviewed literature highlights that emotions significantly influence consumer decision-making across both online and offline contexts. While online experiences are shaped by website design, usability, and personalization, offline shopping offers sensory and social fulfilment through human interaction and atmosphere. Indian studies further reveal the impact of cultural

and affective cues on consumer loyalty and impulse buying. However, a clear research gap remains in understanding how emotional stimuli vary in intensity and influence across online, offline, and hybrid shopping environments within the Indian context, especially regarding how these emotions translate into purchase satisfaction, loyalty and long-term behavioural intentions.

Objectives of the Study

- To identify emotional factors influencing consumer choices during online and offline shopping
- To compare the intensity and impact of specific emotions across both platforms
- To analyse emotional satisfaction and regret levels after purchases that contributes to consumer loyalty and brand recall

Significance of the Study

This study holds significant importance in understanding the evolving role of emotions in consumer decision-making within the rapidly transforming retail landscape. By comparing online and offline shopping contexts, it provides valuable insights into how emotional factors such as excitement, anxiety, trust, regret, and post-purchase satisfaction influence consumer choices, loyalty, and brand perception. The statistically significant findings from the Chi-square test confirm that emotional responses vary notably between shopping modes, establishing emotions as a critical determinant of consumer behaviour rather than a secondary influence.

The study contributes meaningfully to marketing psychology and consumer research by integrating theoretical models such as the Affect Infusion Model and the Stimulus-Organism-Response (S-O-R) framework, thereby linking emotional stimuli with behavioural outcomes. Its results highlight that while offline shopping evokes stronger emotional intensity through sensory engagement and human interaction, online shopping stimulates emotions related to convenience, anticipation, and impulsivity. This dual perspective enables retailers and marketers to design strategies that enhance emotional satisfaction across platforms—whether through immersive offline experiences or trust-building mechanisms in digital environments. Practically, the research offers actionable implications for businesses seeking to cultivate emotional connections with customers, improve user experience, and strengthen brand loyalty. Moreover, it sets the foundation for future exploration into emerging domains like Emotion AI, AR-based retail, and ethical emotional marketing. By emphasizing emotional intelligence in marketing strategy, this study not only advances academic understanding but also supports the development of more empathetic, consumer-centred retail ecosystems.

Methodology

The current research employs a mixed-method study design to investigate emotional factors that affect consumer choice-making in offline and online shopping. The primary data were gathered using a 5-point Likert scale structured questionnaire to quantify emotions such as excitement, anxiety, satisfaction, regret, and impulse buying. Purposive sampling was applied to participants who were familiar with both shopping mediums. Quantitative analysis used descriptive statistics, weighted means, and the Chi-Square Test to determine associations between emotions and shopping contexts ($p < 0.05$). Secondary data derived from peer-reviewed articles underpinned theoretical foundation through the Affect Infusion Model and the Stimulus-Organism-Response (S-O-R) framework. Emotional intensity, post-purchase emotions, brand loyalty and satisfaction were the primary variables. The use of a mixed-method

design ensures validity and richness, providing comparative information on emotional dynamics in virtual and physical store environments.

Findings and Discussions

Emotional Factors in Online Shopping

Table 1 presents the responses of participants regarding various emotional factors influencing their shopping experiences. It highlights differences in emotional engagement, confidence, excitement, and satisfaction across online and offline shopping contexts, as measured through a five-point Likert scale.

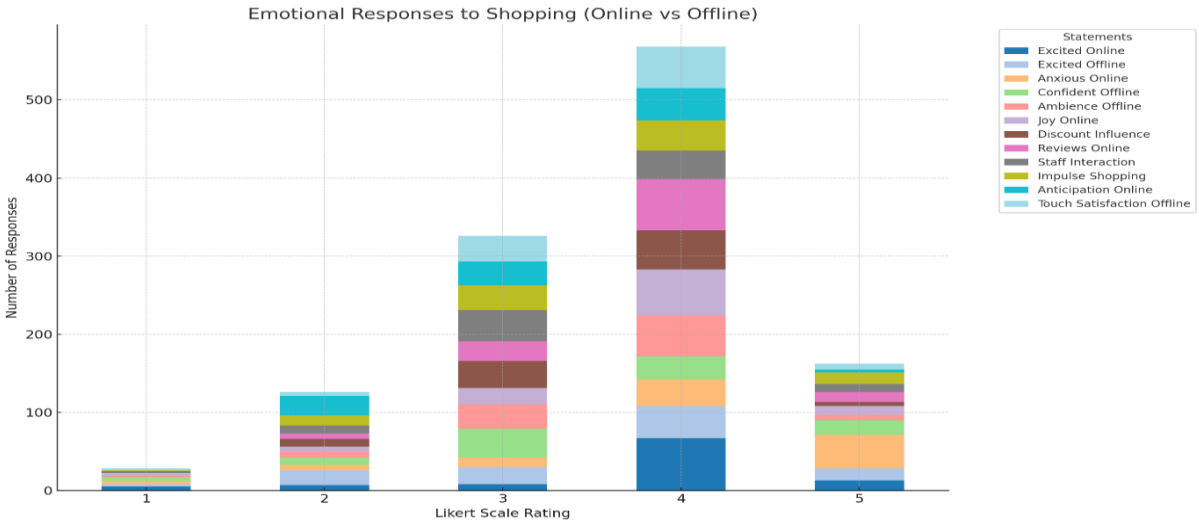
Table 1: Emotional Factors in Shopping

Statements	1	2	3	4	5
I often feel excited while shopping online	5	7	8	67	13
I often feel excited while shopping offline	3	19	22	41	15
I feel anxious when I cannot physically examine products online	4	7	12	34	43
I feel more confident buying from physical stores	5	9	37	30	19
The shopping environment (ambience, layout) enhances my emotions in offline stores	2	8	31	52	7
I experience joy when I receive packages from online purchases	3	6	21	59	11
I am emotionally influenced by discounts and limited-time offers	0	10	35	50	5
Positive product reviews boost my emotional trust in online platforms	0	7	25	65	13
Personal interactions with staff affect my emotions during offline shopping	3	10	40	37	10
I rely on gut feeling or emotional impulses more than logic when shopping	1	13	32	39	15
The anticipation of receiving a product adds emotional value to online shopping	0	25	30	41	4
The ability to touch or try products creates emotional satisfaction in offline shopping	2	5	33	53	7

Likert Scale: 1-Strongly Disagree, 2-Disagree, 3-Nutral, 4-Agree, 5-Strongly Agree

Source: *Primary data collected by author*

Figure 1: Emotional Responses to Shopping



Source: *Prepared by author*

Statistical Analysis

Building on the findings from the reviewed literature, which emphasize that emotions play a pivotal role in influencing consumer behaviour across both online and offline settings, it becomes essential to statistically examine whether these emotional responses truly differ between the two contexts. To explore this relationship, a Chi-Square Test of Independence was applied to Likert-scale data gathered from respondents, enabling the assessment of whether emotional factors are associated with the mode of shopping. The hypothesis is -

Null Hypothesis

(H_0): There is no significant association between emotional factors and the shopping context i.e. consumers' emotional responses are independent of the mode of shopping (online or offline).

Alternative Hypothesis

(H_1): There is a significant association between emotional factors and the shopping context i.e. Emotional responses vary depending on whether the shopping experience is online or offline.

The results of the Chi-Square test ($\chi^2 = 212.94$, df = 44, $p < 5.23 \times 10^{-26}$) clearly indicate a highly significant association between shopping context and consumers' emotional responses. Since the p-value is far below the conventional alpha level of 0.05, the null hypothesis is rejected, confirming that emotional reactions vary considerably between online and offline shopping environments. This suggests that consumers experience distinct emotional intensities depending on the platform. The findings are consistent with prior research, revealing that online shopping tends to evoke feelings of anticipation, excitement, trust, and satisfaction upon delivery, whereas offline shopping elicits emotions such as confidence, tactile pleasure, social engagement, and a stronger sense of instant gratification through direct product experience.

Emotional Intensity & Impact

Table 2 illustrates respondents' perceptions of emotional intensity and its impact on shopping behaviour across different contexts. It examines how factors such as physical presence, human

interaction, convenience, and impulsive decisions shape the emotional depth of both online and offline shopping experiences.

Table 2: Emotional Intensity & Impact

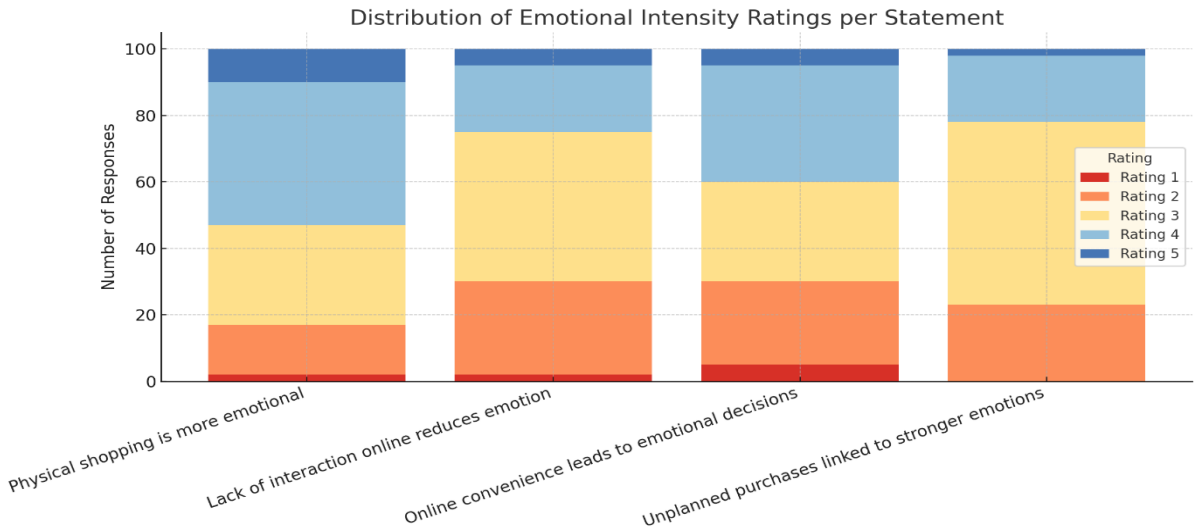
Statements	1	2	3	4	5	Weighted Avg. Mean
My emotions are more intense when shopping in a physical environment	2	15	30	43	10	3.44
The absence of human interaction online reduces emotional engagement	2	28	45	20	5	2.98
The convenience of online shopping leads to impulsive and emotion-driven decisions	5	25	30	35	5	3.10
I often associate stronger emotions with unplanned purchases	0	23	55	20	2	3.01
Overall Weighted Average Mean Score						3.13

Likert Scale: 1-Strongly Disagree, 2-Disagree, 3-Nutral, 4-Agree, 5-Strongly Agree

Source: *Primary data collected by author*

The graphical presentation of intensity ratings of emotions, along with the weighted mean scores, helps to gain better insights into consumers' perceptions within various shopping contexts. Respondents have a strong affinity towards physical shopping and intensified emotional experiences as indicated by the highest weighted mean score of 3.44 and a prevailing majority of "Agree" and "Strongly Agree" responses.

Figure 2: Distribution of Emotional Intensity Ratings



Source: *Prepared by author*

Conversely, the fact that a lack of human interaction on the web diminishes emotional involvement garnered a lower weighted mean score of 2.98 and expresses a moderate level of agreement and more spread-out viewpoint. Likewise, the fact that online convenience generates

impulse, emotionally driven purchases had a mean rating of 3.10, which points to a modest level of emotional influence. The correlation between stronger emotions and impulse buying resulted in a mean of 3.01, again supporting the mixed yet significant emotional significance of spontaneous buying behaviour. In total, the findings and statistical analyses together indicate that emotions are most strongly experienced in physical shopping environments, yet emotional involvement in online shopping is influenced by situational factors such as convenience and impulsiveness.

Post-Purchase Emotions, Loyalty & Brand Recall

Table 3 presents respondents' views on post-purchase emotions, brand loyalty, and brand recall in both online and offline shopping contexts. It explores how satisfaction, regret, and emotional fulfilment influence consumer trust, repeat purchases, and overall attachment to brands.

Table 3: Post-Purchase Emotions, Loyalty & Brand Recall

Statements	1	2	3	4	5	Weighted Avg. Mean
I feel satisfied after making an online purchase	0	4	37	51	8	3.63
I feel satisfied after making an offline purchase	4	14	37	41	4	3.27
I have experienced regret after shopping online	10	30	41	14	5	2.74
I have experienced regret after shopping offline	5	35	55	10	2	2.71
Positive emotions after a purchase increase my loyalty to the brand	2	3	31	39	25	3.82
Negative emotions after a purchase make me avoid the brand in the future	2	5	30	38	25	3.79
Emotional satisfaction contributes to how well I recall a brand	0	9	55	33	5	3.33
I recommend brands based on how good I feel about the shopping experience	3	7	49	32	9	3.37
I am more likely to become a repeat customer if I had a pleasant emotional experience	0	9	32	41	18	3.68
I feel emotionally rewarded when the product meets or exceeds my expectations	0	9	32	41	18	3.68
Regret after a purchase decreases my trust in the brand	2	5	30	38	25	3.79
Emotions I feel after purchase influence whether I remember the brand later	0	9	55	31	5	3.32
Overall Weighted Average Mean Score						3.52

Likert Scale: 1-Strongly Disagree, 2-Disagree, 3-Nutral, 4-Agree, 5-Strongly Agree

Source: *Primary data collected by author*

The overall weighted mean of 3.52 indicates that respondents generally agree with the statements related to positive post-purchase emotions, brand loyalty, and emotional

satisfaction. Consumers experience greater satisfaction and emotional fulfilment when their purchases meet expectations, which strengthens their trust, brand recall, and likelihood of repurchase. The higher means for loyalty-related statements (around 3.8) suggest that positive emotions significantly enhance repeat purchase intentions and brand advocacy.

Figure 3: Weighted Mean Scores of Post Purchase Emotions

Source: *Prepared by author*

Meanwhile, the lower means for regret-related items (around 2.7) imply that negative emotions are less prevalent but can still diminish brand trust and future purchase likelihood. Overall, the findings underscore that emotional experiences play a crucial role in shaping consumer loyalty and long-term brand attachment.

Future Trends in Emotion-Centric Shopping

With changing consumer behaviour, incorporation of emotions into shopping experiences has become more sophisticated by the day. New technologies and changing values are influencing the future of emotion-based shopping in the following ways:

Emotion AI: Artificial intelligence technologies that can detect and interpret human emotions - like facial recognition, eye tracking, and sentiment analysis are becoming increasingly sophisticated. Retailers can leverage these technologies to personalize digital and in-store experiences in real-time. For instance, a website could change its interface or product recommendations based on a user's facial expression, or a store display could adjust lighting or music based on perceived customer moods. This personalization is more likely to strengthen emotional involvement and enhance conversion potential.

Augmented Reality (AR): AR is revolutionizing online shopping by enabling customers to "try before they buy" using immersive simulations. For example, customers can see how a piece of furniture would appear in their living room or how makeup would look on their face. This minimizes uncertainty and maximizes emotional satisfaction, essentially bridging the experiential gap between online and offline shopping.

Voice Commerce: With the emergence of intelligent assistants such as Alexa, Siri, and Google Assistant, voice commerce is set to become an important player in emotional interaction. Natural language processing enables more natural, intuitive conversation, echoing human

speech. This creates a feeling of familiarity and emotional closeness, especially for habitual or emotionally-motivated purchases.

Sustainable and Ethical Shopping: Consumers nowadays care more about emotional causes like environment sustainability, fair trade, and animal protection. Brands sharing a similar commitment will tend to engage their consumers at an emotional level. Labels, certifications, and open supply chains speak to the consumer's sense of morality and result in richer and more fulfilling purchase choices.

Challenges in Measuring Emotional Impact in Consumer Decision-Making

Subjectivity of Emotions: Emotions are highly individualistic and can differ greatly between individuals. The same stimulus to marketing can cause different emotional reactions based on the background, mood, or expectation of a person. This subjectivity hinders the creation of standardized procedures to measure emotional impact precisely.

Limitations of Conventional Metrics: Measures such as the Net Promoter Score (NPS), though popular, only give a general idea of customer satisfaction. They fail to capture the entire range of emotional subtleties like excitement, curiosity, or anxiety that can motivate or discourage buying behaviour. Therefore, important emotional insights can be lost.

Context Sensitivity and Cultural Variability: Emotional reactions are extremely context-sensitive. Environmental, timing, and cultural factors can have a considerable impact on the way consumers feel while shopping. What triggers positive feelings in one situation can trigger negative feelings in another, making emotional measurement even more challenging. New Biometric and Analytical Tools: To address these limitations, companies are leveraging new advanced tools like face recognition, eye-tracking, galvanic skin response (GSR), and voice tone analysis. These techniques enable objective, real-time understanding of consumer emotion by measuring physiological reactions, increasing the richness of emotional knowledge.

Integration with Real-Time Analytics: Integrating biometric tools with AI-powered sentiment analysis allows marketers to monitor emotional changes in real time. This enables more responsive and personalized customer experiences, thus enhancing engagement and conversion rates.

Ethical and Practical Issues: Even with technology, issues related to data privacy, consent, and ethical application of emotional data are still central. Furthermore, making sense of and integrating emotional intelligence into marketing efforts needs cross-disciplinary know-how from data science, psychology, and consumer behaviour.

Conclusion

Emotions are at the heart of the consumer decision-making process. Both online and offline channels elicit different emotional reactions, influencing how consumers experience, choose, and stick with brands. While offline retailing promotes emotional gratification through bodily presence and social contact, online channels depend on personalization and emotional design. It is crucial for retailers to grasp these emotional currents in order to maximize consumer experiences. A well-balanced, emotionally intelligent retail strategy can maximize customer satisfaction, loyalty, and profitability in the new marketplace. The combination of emotion-aware technologies and empathetic marketing will shape the next era of consumer interaction.

Recommendations

Future studies need to monitor how emotional brand loyalty changes over time based on events in life, changes in the market, or marketing efforts. Through consumer diaries and CRM measures, researchers can contrast short-term attachment and long-term emotional loyalty across industries and age segments. Cross-Cultural Emotional Preferences: Emotional expression differs among cultures, impacting the perception of marketing. Cross-regional comparative studies (e.g., Europe vs. Asia) can analyse emotional triggers, trust mechanisms, and cultural reactions to branding, informing global emotional UX and AI design. As AI emulates human emotion in stores, research needs to examine its effect on consumers' trust, perceived manipulation, and emotional truthfulness. Research should evaluate emotional AI by age, chatbot personas, and hybrid (human-AI) retail settings.

Augmented Reality generates immersive shopping experiences. Studies must examine how AR influences emotional engagement, trust, and post-purchase satisfaction. Comparison studies between AR and in-store experiences can inform emotional design for virtual shopping. Consumers tend to make choices based on emotional connection by influencers. There should be an evaluation of the emotional effects of real content, parasocial connection, and category-level emotional connection by demographics and influencer types. Rapid delivery and instant service have an influence on emotional satisfaction and loyalty. There should be research into emotional responses to speed, reminders, and reward structures, with a comparison of impulsivity and anticipation by industry and age. High-tech methods such as fMRI, EEG, and eye-tracking can reveal the brain's reaction to emotional cues while shopping. Studies can chart neural activity for various product types and investigate memory recall and emotional desensitization over time. Emotional connection to ethical values (e.g., guilt, pride) drives purchasing. Research ought to quantify emotional fulfilment in sustainable consumption, investigate green fatigue, and study the impact of storytelling differently by culture and generation.

Social shopping sites intensify emotions such as envy and urgency. Future studies must investigate how social interactions, feedback, and live shopping events influence emotional decisions, employing behavioural analytics and comparative studies by age and gender. Too much stimulation on the internet may lead to emotional exhaustion. Empirical work could investigate decision fatigue, simplicity of interfaces, notice overload, and comparison of platforms. Emotional fatigue can help inform more empathetic digital design.

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MARKETING-LED RURAL DEVELOPMENT: ANALYZING SHG CHALLENGES IN GARGAON

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Abstract

The revival of rural economies significantly hinges on the effectiveness of marketing strategies, with Self-Help Groups (SHGs) playing a pivotal role in this transformation. SHGs engage in collective economic activities, but their long-term success is largely determined by their ability to market their products and connect with wider markets. This case study investigates the marketing approaches employed by SHGs in the Gargaon Gaon Panchayat and the strategic challenges they encounter. The research also examines the contributions of government agencies and non-governmental organizations (NGOs) in supporting the marketing efforts of SHGs. Using an exploratory research design, the study draws insights from surveys, interviews, and field observations focused on SHGs within the region. Findings reveal that although SHGs adopt methods such as direct sales and participation in local exhibitions, they lack awareness and access to digital marketing tools that could significantly boost their visibility. Consequently, despite possessing strong skills and producing high-quality rural goods, these SHGs often fail to tap into broader customer bases and improve their sales outcomes. The study concludes with practical recommendations aimed at strengthening the marketing capabilities of SHGs, thereby contributing to rural economic development and self-reliance.

Keywords: Self-Help Groups, Rural Marketing, Rural Development

JEL Classification: R51, 018, M31

Introduction

Rural revitalization has emerged as a critical agenda for India's socio-economic development, driven by the need to address persistent disparities between urban and rural areas. With over 65% of India's population residing in rural regions, revitalizing these economies is essential for inclusive growth. Government initiatives such as the National Rural Livelihoods Mission (NRLM) and Bharat Nirman emphasize empowering rural communities through entrepreneurship, infrastructure development, and access to markets. Despite these efforts, challenges such as fragmented value chains, limited market access, and inadequate technological adoption hinder sustainable progress.

Marketing serves as a bridge between rural producers and consumers, enabling value creation, income generation, and market expansion. Effective marketing strategies can amplify the visibility of rural products, foster brand loyalty, and integrate informal rural enterprises into formal supply chains. However, rural marketing in India remains underdeveloped due to infrastructural gaps, lack of digital literacy, and insufficient awareness of contemporary consumer trends. Strengthening marketing capabilities is thus pivotal for unlocking the economic potential of rural industries.

Self-Help Groups (SHGs), as community-based collectives, have been instrumental in fostering rural entrepreneurship and women's empowerment. By pooling resources, skills, and labour, SHGs engage in activities ranging from handicraft production to agro-processing. Their

collective model reduces individual risk, enhances bargaining power, and promotes financial inclusion. However, the sustainability of SHGs hinges on their ability to navigate competitive markets, which demands strategic marketing interventions.

Literature Review

Understanding the dynamics of rural marketing and its relevance to Self-Help Groups necessitates an interdisciplinary examination of theories, empirical studies, and policy frameworks. Table 1 makes insights from key academic sources spanning various dimensions of rural marketing including digital adoption, value chain integration, social capital, and gender roles. These studies collectively reveal how SHGs operate at the intersection of local socio-cultural traditions and evolving market strategies.

Table 1: Theoretical Foundations of Rural Marketing

Author(s), Year	Key Focus	Methodology	Key Findings	Relevance to Study
Kashyap & Raut (2016)	4Ps in rural markets	Conceptual analysis	Rural marketing requires localization of product, pricing, and distribution.	Supports need for SHGs to adapt 4Ps strategies.
Gupta & Singh (2018)	Digital marketing in rural India	Mixed methods	Limited digital literacy hinders e-commerce adoption.	Explains SHGs' lack of digital platform usage.
Porter (1985)	Value chain theory	Theoretical framework	Strengthening producer-market linkages enhances profitability.	SHGs need better integration into value chains.
Prahalad (2012)	Bottom-of-pyramid markets	Qualitative research	Affordability and accessibility are critical for rural consumer engagement.	Aligns with SHGs' focus on low-cost pricing.
Kotler et al. (2020)	Marketing mix adaptation	Case studies	Promotion in rural areas relies on word-of-mouth and community trust.	Highlights SHGs' reliance on interpersonal networks.
Chandra & Rao (2017)	Cultural influences on marketing	Ethnographic study	Local traditions shape product preferences; cultural sensitivity boosts sales.	SHGs must align products with regional customs.
Dutta & Banerjee (2019)	Rural supply chain dynamics	Quantitative survey	Fragmented supply chains increase costs; collective logistics reduce expenses.	SHGs can benefit from collaborative distribution.
Joshi & Sharma (2020)	Social capital in rural markets	Interviews	Trust-based networks reduce transaction costs for rural sellers.	SHGs' community ties can enhance market access.

Author(s), Year	Key Focus	Methodology	Key Findings	Relevance to Study
Sinha & Tripathi (2018)	Rural consumer behaviour	Experimental research	Rural buyers prioritize durability over branding.	SHGs should emphasize product quality in marketing.
Reddy & Patel (2021)	Mobile technology adoption	Action research	Mobile apps for rural sellers improved market reach by 40%.	Suggests potential for SHGs to adopt mobile tech.

Source: *Review of Literature*

The literature emphasizes that SHGs must not only develop localized marketing techniques but also address systemic barriers such as limited digital infrastructure, fragmented supply chains, and informational asymmetries. Government support, NGO facilitation, and targeted training are repeatedly cited as enablers in expanding SHG market access and profitability in rural India.

Government agencies and NGOs play a crucial role in facilitating market access for SHGs through policy support, capacity building, and infrastructure development. Table 2 summarizes research findings on institutional support mechanisms.

Table 2: Institutional and Policy Support for SHGs

Author(s), Year	Key Focus	Methodology	Key Findings	Relevance to Study
NITI Aayog (2020)	Deendayal Antyodaya Yojana	Policy analysis	Funding and training improved SHG scalability.	Shows government support mechanisms.
Ghosh & Sen (2020)	Public-private partnerships	Case studies	Collaborations with private firms expanded SHG market access.	Suggests PPP models for SHGs.
Sharma & Das (2018)	SHG skill development programs	Longitudinal study	Training in marketing techniques raised productivity.	Advocates for targeted capacity-building.
World Bank (2022)	Rural development policies	Quantitative analysis	Infrastructure gaps limit SHG market reach.	Contextualizes challenges in Rohdoi Gaon.
Pradan (2021)	NGO interventions in Odisha	Impact assessment	E-commerce partnerships increased SHG incomes.	Demonstrates NGO role in market linkages.
Dutta (2015)	Government and NGO roles in SHGs	Policy overview	NGOs bridge credit and marketing gaps for rural SHGs.	Explains external support systems.
Chakraborty et al. (2024)	Rural marketing & SHGs	Case review	Cooperative banks and NGOs critical for SHG marketing.	Highlights collaborative structures.

Source: *Review of Literature*

The literature consistently emphasizes that institutional support is most effective when it combines financial assistance with skill development and market linkages. However, there are gaps in coordinating different support mechanisms and ensuring their reach to all SHGs, particularly in remote areas like Gargaon Gaon Panchayat.

Objectives of the Study

1. To analyse the marketing strategies adopted by SHGs in Gargaon Gaon Panchayat
2. To identify the challenges faced by SHGs in implementing effective marketing practices
3. To evaluate the role of government and NGOs in supporting SHGs' market integration

Research Questions

1. What marketing strategies are employed by SHGs in Gargaon Gaon Panchayat?
2. What are the key challenges hindering the adoption of advanced marketing techniques by SHGs?
3. How do government and NGO initiatives facilitate or constrain SHGs' marketing efforts?

Significance of the study

The study holds significance as it provides field-based evidence from all 88 SHGs in Gargaon Gaon Panchayat, offering a holistic view of marketing-led rural development in an under-researched region of Assam. While numerous studies have focused on SHG performance in southern India, empirical insights from the Northeast remain scarce. This research fills that gap by analyzing both traditional and digital marketing practices within a local context. The findings have policy relevance for enhancing SHG sustainability through marketing innovation, capacity-building, and institutional coordination.

Research Methodology

The study follows a descriptive research design aimed at systematically understanding the marketing strategies, challenges, and support mechanisms influencing the 88 Self-Help Groups in Gargaon Gaon Panchayat, Sivasagar district, Assam. Case studies, journals and distinguished articles are also examined thoroughly to get an insight into the efforts for marketing strategies adopted by SHGs in India. The research sought to generate both quantitative and qualitative insights into SHG practices and their level of institutional support.

The study employed a census approach by including all 88 SHGs operating within Gargaon Gaon Panchayat, ensuring comprehensive coverage of the target population. This approach eliminated sampling bias and provided a complete picture of SHG marketing practices in the region. Data was collected from all 88 SHGs under the Gargaon Gaon Panchayat using well-structured questionnaires. The questionnaires covered aspects such as marketing strategies employed, challenges faced, level of digital literacy, and support received from government and NGOs. The research incorporated:

- Surveys of all 88 SHG representatives
- In-depth interviews with selected SHG members
- Field observations of marketing practices

- Review of government and NGO documentation related to SHG support

The collected data was analysed using descriptive statistics to identify patterns and trends in marketing strategies, challenges, and support mechanisms. The analysis focused on percentage distributions and correlation analysis to understand the prevalence of various marketing practices and challenges among SHGs.

Analysis and Findings

Self-Help Groups in Gargaon Gaon Panchayat are increasingly engaged in income-generating activities, necessitating effective marketing strategies for sustainability and growth. The findings below are based on data collected from all 88 SHGs in the panchayat.

Current Marketing Strategies

Table 3: Marketing Strategies Employed by SHGs

Variable	Percentage (%)	Number of SHGs (out of 88)
Use Local Markets (Haats/Fairs)	88%	77
Rely on Word-of-Mouth Promotion	92%	81
Exhibitions	75%	66
Use social media (WhatsApp/Facebook)	24%	21
Use Branded Packaging	16%	14

Source: *Primary Data*

Use of Local Markets (Haats/Fairs)

The majority of SHGs (77 out of 88) rely on traditional local markets like weekly haats and fairs to sell their products. These markets provide direct access to customers but offer limited scale and exposure. The data reflects a heavy dependence on localized selling strategies with minimal integration into formal retail systems or larger urban markets.

Word-of-Mouth Promotion

A very high proportion of SHGs (92% or 81 groups) promote their products informally through community networks and personal contacts. While this approach is cost-effective, it restricts the potential customer base. The widespread use of word-of-mouth promotion indicates the absence of structured marketing tools or advertising strategies among SHGs.

Exhibitions

Approximately 75% of SHGs (66 out of 88) use local exhibitions as a key strategy to promote and sell their products. Exhibitions provide SHGs with temporary but focused market exposure, allowing them to reach a wider audience than their immediate local markets. These events often attract urban customers who might not otherwise access rural products.

Digital Platform Utilization

Only 24% (21) of SHGs leverage digital platforms like WhatsApp and Facebook for product promotion and sales. This low digital marketing adoption is likely due to limited digital literacy, lack of training, or insufficient access to smartphones and internet connectivity. The

underutilization of digital tools significantly constrains these groups' visibility and market expansion beyond the local level.

Branding and Packaging

Only 16% (14) of SHGs use any form of branded or professional packaging. The lack of branding reduces product appeal and consumer trust, especially in competitive or urban markets. This deficiency may stem from financial constraints, lack of awareness about branding's importance, or limited access to packaging materials and design services.

Challenges in Marketing Implementation

Table 4: Challenges Faced by SHGs

Variable	Percentage (%)	Number of SHGs (out of 88)
Reported Lack of Market Knowledge	76%	67
Face Infrastructure Challenges	68%	60
Received Marketing Training	20%	18
Have Digital Literacy	28%	25

Source: *Primary Data*

Lack of Market Knowledge

A significant proportion (76% or 67 SHGs) acknowledge that they lack understanding of market demands, pricing strategies, or consumer preferences. This knowledge gap limits their ability to adapt products, set competitive prices, or explore new markets, creating a substantial barrier to growth and market expansion.

Infrastructure Challenges

Approximately 68% (60) of SHGs face challenges such as poor transport, lack of storage facilities, inadequate packaging infrastructure, or electricity issues. These logistical constraints affect product quality, supply consistency, and market reach. Infrastructure development remains essential for scaling up operations and improving market access.

Limited Marketing Training

Only 20% (18) of SHGs have received formal training related to marketing or business development. This reflects a serious gap in capacity-building efforts. The majority of SHG members operate without structured knowledge of sales techniques, branding strategies, pricing methodologies, or customer engagement approaches.

Digital Literacy Constraints

Only 28% (25) of SHGs have members who are comfortable using digital tools for marketing, banking, or communication. The low level of digital literacy significantly hampers these groups' ability to leverage online platforms, access financial services, and scale their operations. This highlights the urgent need for digital inclusion initiatives targeted at rural entrepreneurs.

Table 5: Correlation between demography and challenges faced by SHGs

Variable Pair	Spearman's ρ	Sig. (p)	Interpretation
Education – Market Knowledge	-0.61	0.001	Strong negative correlation; educated SHGs better understand markets
Support – Marketing Training	+0.72	0.000	Highly significant; support linked to formal training
Education – Digital Literacy	+0.58	0.002	Moderate positive correlation
Age – Infrastructure Challenges	-0.33	0.045	Weak negative correlation; older SHGs face fewer infrastructure issues
Income – Market Knowledge	-0.42	0.010	Higher-income SHGs show stronger market understanding

Source: *Statistical Analysis*

From the above results it can be observed that educational level and support interventions significantly improve SHGs' market competence and digital readiness. Also, infrastructure challenges persist more among younger or recently formed SHGs. Further, training and digital inclusion are interlinked; digitally literate SHGs are better equipped for modern marketing.

Institutional Support Mechanisms

Table 6: Institutional Support for SHGs

Variable	Percentage (%)	Number of SHGs (out of 88)
Received Govt Scheme Support	40%	35
Received NGO Support (Training/Expo)	36%	32

Source: *Primary Data*

Government Support

Only 40% (35) of SHGs have benefited from government programs like the National Rural Livelihoods Mission (NRLM) or other rural development schemes. The remaining 60% (53) of SHGs are either unaware of available schemes, ineligible for support, or have not received adequate assistance despite eligibility. This points to a significant gap in the implementation or outreach of government support mechanisms.

NGO Support

Approximately 36% (32) of SHGs have received help from NGOs in the form of training sessions, exposure visits, or participation in exhibitions. While NGO involvement exists, it is not comprehensive or evenly distributed. Many SHGs still lack access to such external support mechanisms, which could enhance their marketing capabilities and market reach.

The findings reveal a stark contrast between traditional and digital marketing approaches among SHGs in Gargaon Gaon Panchayat. While traditional methods like local markets and word-of-mouth promotion are widely used (88% and 92% respectively), digital marketing adoption remains minimal (24%). This disparity aligns with Gupta and Singh's (2018) observation that limited digital literacy significantly hinders e-commerce adoption in rural areas.

The prevalence of traditional marketing strategies reflects both cultural patterns and infrastructural limitations. As noted by Kotler et al. (2020), rural promotion often relies heavily on community trust and interpersonal networks. However, this dependence also restricts market reach and growth potential. Bhattacharya's (2022) case study of West Bengal SHGs demonstrated that Instagram marketing doubled urban customer engagement, suggesting significant untapped potential for digital platforms even in rural contexts.

The study identified significant capacity-building needs, with 76% of SHGs reporting a lack of market knowledge and only 20% having received marketing training. This knowledge deficit directly impacts marketing effectiveness and constrains innovation. Sharma and Das (2018) emphasized that training in marketing techniques substantially raises productivity among SHG members, yet such training remains largely inaccessible to SHGs in R Gargaon Gaon Panchayat.

The gap between knowledge needs and available training points to inadequacies in institutional support systems. Both government and NGO support mechanisms appear insufficiently coordinated or targeted, reaching only 40% and 36% of SHGs respectively. This finding supports Dutta's (2015) assertion that while NGOs and government programs can bridge critical gaps for rural SHGs, their implementation often lacks consistency and comprehensive coverage.

The study found that 68% of SHGs face infrastructure challenges, including transportation difficulties, storage limitations, and inadequate packaging facilities. These constraints align with the World Bank's (2022) analysis that infrastructure gaps significantly limit SHG market reach in rural India. Addressing these structural barriers requires coordinated investment in rural infrastructure alongside marketing capacity building.

Resource constraints also manifest in the limited adoption of branding and professional packaging (16%). As Kumar et al. (2017) demonstrated through their ethnographic study, improved branding and packaging significantly enhance the marketability of SHG products. The low implementation rate in Gargaon Gaon Panchayat suggests financial barriers to investing in these marketing elements, despite their potential return on investment.

The low digital literacy rate (28%) among SHGs represents a critical barrier to market integration in an increasingly digital economy. This digital divide restricts access to e-commerce platforms, online banking services, and digital marketing tools. Sengupta and Das (2022) found that only 18% of rural entrepreneurs nationwide use digital tools for marketing, indicating that Gargaon Gaon Panchayat's digital adoption rate (24%) is slightly above the national average but still insufficient for meaningful digital market integration.

Singh and Agarwal's (2021) action research demonstrated that e-commerce training for SHGs in Odisha boosted incomes by 25%, suggesting that targeted digital capacity building could yield significant returns. The success of WhatsApp-based ordering systems in Tamil Nadu's coir industry, which reduced inventory pileup by 30% (Sengupta & Nair, 2020), further illustrates how even basic digital tools can substantially improve marketing efficiency.

Conclusion

The study reveals that while SHGs in Gargaon Gaon Panchayat are actively involved in income-generating activities, their marketing strategies remain primarily traditional and limited in scope. The predominance of local markets and word-of-mouth promotion, coupled with minimal digital platform utilization, restricts their growth potential. Significant challenges persist in the form of inadequate market knowledge, infrastructure limitations, insufficient training, and low digital literacy.

Government and NGO support, though present, needs to be more systematic, inclusive, and coordinated to effectively address the multidimensional challenges facing SHGs. The recommendations proposed in this study offer a framework for enhancing SHG marketing capabilities through targeted capacity building, infrastructure development, digital integration, and strengthened institutional support.

By implementing these recommendations, SHGs in Gargaon Gaon Panchayat and similar rural areas can overcome existing marketing barriers and leverage their production expertise to achieve sustainable growth. Enhanced marketing capabilities will not only improve SHG incomes but also contribute significantly to rural economic revitalization and community empowerment. Future research should focus on evaluating the effectiveness of digital marketing interventions in rural contexts and developing scalable models for SHG market integration.

Recommendations

Based on the findings and discussion, the following recommendations are proposed to enhance the marketing capabilities of SHGs in Gargaon Gaon Panchayat:

Capacity Building and Training:

1. Targeted Marketing Training Programs: The government may develop comprehensive marketing training modules specifically designed for SHG members, covering aspects of product positioning, pricing strategies, promotion techniques, and customer relationship management.
2. Digital Literacy Initiatives: It is advisable to implement structured digital literacy programs focusing on practical applications such as social media marketing, digital payments, and e-commerce platform usage.
3. Mentorship Programs: The government in collaboration with educational institutions must establish mentorship connections between successful SHGs and those struggling with marketing, fostering peer learning and knowledge transfer.

Infrastructure and Resource Support

1. Community Marketing Centers: Shared facilities should be developed to provide Self-Help Groups (SHGs) with access to essential resources such as packaging equipment, storage space, and digital tools—facilities that are often unaffordable for individual SHGs.
2. Transport Cooperatives: SHGs may be encouraged to form transport cooperatives in order to reduce logistics costs and improve connectivity to distant markets.
3. Packaging and Branding Support: Professional support in packaging and branding should be made available at subsidized rates through government schemes or in collaboration with public-private partnerships.

Market Linkages and Digital Integration

1. E-commerce Onboarding: Efforts should be made to facilitate the onboarding of SHGs onto established e-commerce platforms as well as government marketplaces such as the Government e-Marketplace (GeM).
2. Mobile Marketing Solutions: SHGs should be encouraged to adopt user-friendly mobile-based marketing tools such as WhatsApp Business, which require minimal technical expertise.
3. Collective Digital Presence: A district-level digital platform showcasing products from all local SHGs can be created and maintained by digitally skilled community members, thereby enhancing online visibility.

Institutional Support Enhancement

1. Coordinated Support Mechanisms: There is a need to improve coordination among various government departments and non-governmental organizations (NGOs) to ensure comprehensive support for SHGs and to avoid duplication of efforts.
2. Awareness Campaigns: Regular awareness campaigns should be conducted to inform SHGs about the various government schemes and institutional support systems available to them.
3. Performance-Based Incentives: Incentive mechanisms should be introduced to reward SHGs that adopt modern marketing practices and demonstrate measurable market growth.

Public-Private Partnerships

1. Corporate Partnerships: SHGs should be linked with corporate buyers to facilitate bulk purchasing agreements and long-term procurement partnerships.
2. Academic Collaborations: Collaborations can be initiated with marketing departments of academic institutions to provide research insights, consultancy, and practical guidance to SHGs.
3. Marketing Innovation Fund: A dedicated fund should be established to support innovative marketing efforts by SHGs, with contributions from government bodies, corporate social responsibility (CSR) programs, and international development organizations.

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BALANCING BUSINESS ETHICS AND PROFITABILITY: A THEORETICAL PERSPECTIVE

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Abstract

This study explores the dynamic relationship between business ethics and profitability, addressing the long-standing question of whether ethical responsibility constrains or facilitates business growth. The principal objectives are to analyse how ethical business practices influence long-term profitability and to identify the ethical dimensions that significantly contribute to sustainable business performance.

Adopting a qualitative and descriptive research design, the study employs the case study method to examine three organizations that have successfully integrated ethical practices within profitable business models. Based on secondary data, the study used thematic analysis to identify patterns linking ethical orientation, stakeholder trust and financial outcomes.

The findings reveal that ethics and profitability are not contradictory but complementary. Ethical governance enhances corporate reputation, fosters customer and employee loyalty, mitigates risk, and builds stakeholder trust—all of which strengthen financial performance. The case analyses show that companies embedding social responsibility, sustainability, and fairness into their operations achieve enduring profitability and competitive advantage.

The study contributes to the growing discourse on sustainable growth of business by demonstrating that ethical values serve as catalysts for long-term financial success. It provides a strategic framework for harmonizing ethical conduct and profitability, emphasizing that in the contemporary marketplace, ethical integrity is not only a moral imperative but a strategic asset for business sustainability.

Keywords: Business ethics, Profitability, Corporate social responsibility (CSR), Ethical practices, Sustainable growth, Fair trade practices

JEL Classification: M14, M21, L21

Introduction

Business is fundamentally a means of earning a livelihood, established with the objective of generating income. Profit serves as the primary driving force for sustaining and expanding business activities. Without profitability, businesses cannot ensure survival, let alone growth and value creation.

In today's competitive environment, while profitability ensures success of business firms, it can be the sole parameter of success. The business firms are scrutinized not only on the basis of profitability but also on the bases of ethical conduct and social contribution. It becomes necessary for the business to address broader business and ethical issues to remain competitive in the long-term. The changing expectations of stakeholders is greatly influencing the debate on the relationship between business ethics and profit. Some researchers argue that an emphasis on ethics may constrain profit maximization, while others contend that embedding ethics at the core of business functions fosters sustainable success and long-term profitability (Ferrell et al., 2019; Schwartz, 2021).

The focal point of this study lies in reconciliation of the trade- off between business ethics and profit maximisation and thus raises the fundamental research question- how business firms can sustain profitability while adhering to ethical norms in this ever- changing business environment.

The study tried to facilitate the framing of strategies to balance the dilemma between profitability vis-a-vis ethical conduct and moral responsibility towards customers, employees, investors, government, environment and the society at large. Profit earning is essential for the survival, growth and protection of financial interest of the investors. At the same time, ethical failures, moral degradation and socially irresponsible behaviour results in loss of public faith, gradual reduction of customer base, investor restraint, government sanctions etc. jeopardising the operations and financial performance of the business.

While profitability is essential for the short-term survival and long-term growth of businesses, a sole focus on maximizing profits without considering ethical responsibilities leads to negative outcomes. Balancing short-term profitability with long-term sustainability requires embedding ethics into core business strategies (Crane & Matten, 2016). Businesses that align profitability with ethical commitments are better positioned to strengthen stakeholder relationships, foster brand loyalty, and ensure enduring growth.

In this context, it becomes a necessity for business to frame balanced strategies to harmonise profitability and ethics; financial performance and social responsibility. The principal objective of this study is to examine whether ethics acts as constraint or facilitator for long-term growth of business and how businesses can integrate ethical principles into their corporate strategies. This study is expected to throw lights on the dynamics of corporate governance and sustainable growth.

Review of Literature

The relationship between business ethics, corporate social responsibility (CSR), and profitability has been widely debated in academic and business circles. Earlier works emphasized that CSR activities, such as community development and environmental sustainability, enhance corporate reputation and stakeholder trust, which in turn contribute to long-term financial performance (Carroll & Shabana, 2010; Crane & Matten, 2016). Similarly, Ferrell et al. (2019) and Schwartz (2021) highlight that ethical practices not only reduce reputational and legal risks but also improve customer loyalty, employee commitment, and investor confidence, thereby strengthening profitability.

More recent scholarship has explored the role of ethical orientations in shaping governance and financial outcomes. Rakesh and Srivastava (2024) provide significant insights by distinguishing between two ethical approaches: Ethics of Care and Ethics of Justice. Their study finds that firms adopting the Ethics of Care—emphasizing empathy, stakeholder well-being, and relationship building—develop stronger and more resilient governance structures. This orientation aligns closely with Ethical CSR, which integrates moral responsibility into business operations. In contrast, the Ethics of Justice, while positively associated with Legal CSR (compliance-driven) and Economic CSR (profit-focused responsibilities), is less effective in contributing to holistic governance outcomes.

The findings suggest that while Legal and Economic CSR are necessary, they are insufficient when considered in isolation. Instead, Ethical CSR and the Ethics of Care emerge as the most influential predictors of strong governance and sustainable profitability. Rakesh and Srivastava (2024) further argue that embedding values of care into governance requires firms to move beyond compliance and adopt principle-based approaches. This involves creating dynamic key

performance indicators (KPIs) to measure care-driven outcomes, enhancing transparency grounded in ethical values, and investing in training programs that integrate ethics into organizational culture.

Freeman's (1984) Stakeholder Theory, states that businesses must create value for all stakeholders rather than only for shareholders. Recent studies by Harrison and Wicks (2021) reaffirm that organizations embracing a stakeholder-centric model show higher levels of innovation, customer satisfaction, and brand loyalty. These factors lead to better financial performance. However, business firms that prioritize short-term shareholder wealth encounter ethical lapses and reputational crises, leading to only short- term profitability.

Similarly, Porter and Kramer (2019) advocate the concept of "Shared Value," which calls for ethical practices and social progress as the part of competitive advantage. They are of the view that companies fulfilling societal needs—such as sustainability, equitable wages, and responsible sourcing perform better than the competitors that treat ethics as a compliance obligation.

Kotsantonis et al. (2022) suggest that firms integrating ESG strategies (Environmental, Social and Governance) demonstrate lower capital costs, reduced volatility and higher Return on Assets (ROA).

Eccles & Stroehle, 2020 remarked that the integration of ethical and environmental standards into governance frameworks shows ethical responsibility and this is an essential driver of resilience and profitability.

Elkington's (1997) suggests that businesses firms undergo scrutiny from conscious consumers and investors. Companies that successfully balance People, Planet, Profit, known as Triple Bottom Line demonstrate superior financial stability and stakeholder loyalty.

Overall, the literature underscores that sustainable growth and profitability are best achieved when ethics are not treated as peripheral or compliance-driven, but rather embedded into the very core of business strategies. While prior research has extensively examined the relationship between Corporate Social Responsibility (CSR) and profitability, limited attention has been given to how ethical principles can be systematically embedded within profitability-driven strategies. This study seeks to bridge that gap by exploring the integration of ethics into core business functions, thereby highlighting pathways through which firms can achieve sustainable growth without compromising their moral responsibilities.

Objectives of the Study

1. To analyse how ethical business practices influence profitability in the long run
2. To evaluate ethical dimensions that significantly contribute towards sustainable business performance

Rationale of the Study

The rationale for this study arises from the fact that in the context of a globalized and socially conscious marketplace, profitability alone cannot serve as the only standard of measuring business success. Organizations are now judged not only by their financial results but also by their ethical behaviour and social responsibility. The persistent debate between profit maximization and ethical responsibility forms the foundation of this study.

Profitability remains essential for survival and growth of any business. However, an exclusive focus on this may lead to ethical compromises. Consequently, the business will face challenges

in the form of reputational damage and stakeholder distrust. Conversely, ethical governance and social responsibility can foster customer loyalty, investor confidence, and employee commitment. These factors are essential for strengthening profitability in the long-term.

This study, therefore, seeks to explore the interdependence between ethics and profitability, addressing the idea that these two goals are contradictory. It aims to state that ethical conduct is not merely a moral obligation but a strategic asset that build-up competitiveness and sustainability of business. By analysing real-world case studies of companies, the study provides empirical insights into how ethical business practices can drive profitability and can secure stakeholder trust.

Research Methodology

The present study is a descriptive and analytical study. The study adopts a qualitative approach to examine the inter-connectedness between business ethics and profit. The study concentrates on ethical practices and how these can facilitate long-term business performance with sustainable growth.

Case study method has been adopted to further supplement the findings of the qualitative analysis. Cases of selected organizations have been considered based on their successful integration of ethics and profitability. Three companies—Patagonia, Ben & Jerry's, and Starbucks—were purposively selected as representative cases for the study. These organizations were chosen based on the following considerations-

- Ability to integrate ethics and sustainability into business strategy.
- Demonstrating financial success with ethical practices.
- The comparative analysis of these cases provides practical insights into the mechanisms through which ethics and profitability can be balanced.

Sources of Data

Secondary sources of data have been used in the study, which have been collected from the published books and academic journals on business ethics, corporate governance, and sustainability; Company reports and official websites of selected case study organizations.

Data Analysis Method

The study used thematic analysis to identify the patterns across the case studies, focusing on:

- Ethical dimensions in organizational culture
- Impact of ethical practices on stakeholders' trust, brand loyalty and financial performance
- Challenges faced in maintaining a balance between ethics and profitability
- Measures adopted to integrate ethics into corporate decision-making

Findings and Discussion

The perception that ethics and profitability are inherently in conflict is a common misconception. In fact, adopting ethical business practices can even enhance the profitability in uncountable ways. Research has also shown that the companies with strong ethical standards often stay ahead of their competitors in the long run (Ferrell et al., 2019). Here are some key ways in which, ethics can positively impact the profitability of a business:

1. *Reputation and Trust:* Businesses that operate ethically tend to build a positive reputation, which in turn fosters trust among consumers, employees, and investors. Trust, driver of customer loyalty and long-term business relationships, contributes to repeat purchases, employee retention, and favourable partnership, all of which have a direct impact on the business profitability (Crane & Matten, 2016). Reputation and customer trust are intangible properties of a company which helps in building a strong and sustainable business.

2. *Risk Management:* Ethical practices significantly reduce the risk of legal issues, scandals, and penalties. Businesses that avoid unethical behaviours like, fraud, discrimination, or environmental violations, are less likely to face costly fines, lawsuits, or public relations crises, which can be financially devastating (Schwartz, 2021). Ethical business practices provide safeguard against these financial and reputational risks.

3. *Long-Term Growth:* Companies that prioritize ethical business practices, including corporate social responsibility (CSR) initiatives, are more likely to achieve sustainable growth. Ethical companies tend to attract socially conscious consumers and investors, creating a competitive advantage that supports long-term financial performance (Carroll & Shabana, 2010). Value-driven customers are more likely to associate with those businesses which show higher ethical norms in their business operations.

4. *Employee Morale and Productivity:* Ethical companies often cultivate positive work environments, leading to higher employee satisfaction and productivity. When employees are motivated and feel respected, they are more likely to provide superior customer service and contribute to innovation, all of which enhance profitability (Schwartz, 2021). The human resource of an organisation is very important and ethical business operations cultivate a sense of respect and fairness among the employees. All these enhance employee morale and productivity.

Challenges in Balancing Ethics and Profitability

Despite the clear benefits of ethical practices, balancing ethics with profitability can be challenging. Some of the key challenges include:

1. *Short-Term Financial Pressure:* Businesses, particularly publicly traded companies, are often under pressure to deliver short-term financial results to satisfy shareholders. This pressure can sometimes lead to ethical compromises, such as cutting corners on product quality, neglecting environmental regulations, or exploiting labor in low-cost regions (Brigham & Ehrhardt, 2016).

2. *Cost of Ethical Practices:* Implementing ethical practices like, using sustainable materials, paying fair wages, or investing in local communities that often comes with increased costs. For small and medium-sized businesses, these additional costs may seem like a financial burden in the short term (Crane & Matten, 2016).

3. *Globalization and Cultural Differences:* In a globalized marketplace, businesses operate across regions with varying ethical norms and legal standards. What is deemed ethical in one country may not be considered as such in another, making it difficult to maintain consistent ethical practices globally (Ferrell et al., 2019).

4. *Competitive Pressure:* In highly competitive industries, some companies may feel compelled to engage in unethical behaviour like, misleading advertising, tax evasion,

or environmental negligence, to cut costs or gain market share. These practices can temporarily boost profitability but pose significant long-term risks (Schwartz, 2021).

Strategies for Balancing Ethics and Profitability

Businesses can adopt various strategies to balance ethics with profitability, ensuring that their ethical values are aligned with financial objectives. Some effective strategies include:

1. *Embedding Ethics into Corporate Culture:* To achieve long-term success, companies must develop a corporate culture that emphasizes ethical behaviour. This can be done through regular ethics related training programs, leadership that promotes ethical decision-making, and a clear code of ethics that outlines acceptable practices. When ethics are deeply integrated into the organizational culture, employees are more likely to align their decisions with both ethical and business goals (Carroll & Shabana, 2010).
2. *Transparency and Accountability:* Organizations should cultivate a culture of transparency and accountability, ensuring that employees, customers, and stakeholders have confidence in the company's integrity. This includes being transparent in financial reporting, marketing efforts, and communications. Companies that are accountable for their actions often build strong relationships with stakeholders, which can lead to long-term profitability (Schwartz, 2021).
3. *Corporate Social Responsibility (CSR) Initiatives:* CSR is a powerful tool for balancing ethical principles with profitability. By engaging in CSR activities like, reducing carbon emissions, improving labour conditions, and supporting local communities, businesses demonstrate their commitment to the social good. These initiatives not only enhance the company's reputation but also opens new market opportunities along with increased customer loyalty (Elkington, 1997).
4. *Sustainability Focus:* Investing in sustainability initiatives, such as eco-friendly products, renewable energy, and waste reduction, can result in long-term financial gains. As consumers become more environmentally conscious, they are drawn to businesses that prioritize sustainability. Moreover, sustainable practices often result in cost savings through energy efficiency and reduced waste (Crane & Matten, 2016).
5. *Ethical Supply Chain Management:* Companies must ensure that their supply chains are ethically managed. This involves partnering with suppliers who comply with labour laws, environmental regulations, and fair-trade practices. Ethical supply chain management helps businesses avoid potential scandals and contribute to building a positive brand image (Brigham & Ehrhardt, 2016).
6. *Stakeholder Engagement:* Actively engaging with stakeholders like, employees, customers, investors, and local communities, businesses make informed decisions that align with both ethical standards and profitability goals. Incorporating stakeholder feedback into decision-making ensures that companies maintain ethical integrity while pursuing financial success (Ferrell et al., 2019).

Case Studies: Ethical Businesses Driving Profitability

Several companies have successfully balanced business ethics and profitability, showing that it is possible to achieve both. And moreover, equal importance to both has added benefits in the long- run of the business.

1. *Patagonia: Commitment to Environmental Sustainability*

Patagonia, an outdoor clothing company founded in 1973, is well-known for its deep commitment to environmental responsibility and sustainability. The company has taken bold steps to ensure that their products and operations are eco-friendly, making sustainability an important component of its business model (Patagonia, n.d.).

Ethical Practices:

- *Use of Eco-friendly Materials:* Patagonia prioritizes the use of organic cotton, recycled polyester, and other sustainable materials. They had further reduced their environmental impact by improving water usage, lowering carbon emissions, and adopting renewable energy (Lutz, 2019).
- *Repair and Recycling Programs:* Patagonia runs the Worn Wear program, which encourages customers to repair their products rather than buying new ones. It also offers recycling services for old gear, reducing landfill waste (Patagonia, n.d.).
- *Environmental Activism:* The brand takes direct action on environmental issues, such as donating 1% of its, through the "1% for the Planet" initiative. It also promotes responsible consumption with campaigns like "Don't Buy This Jacket" (Patagonia, n.d.).

Patagonia's emphasis on ethics has built a loyal customer base that shares its values, leading to steady growth. Its customers are willing to pay premium prices for products aligned with sustainability. Patagonia's revenue surpassed $1 billion in 2018, and the company has continued to experience success without sacrificing its ethical principles (Lutz, 2019). Thus, from the case, it is evident that focusing on environmental ethics not only protects the planet but also strengthens customer loyalty and drives long-term profitability.

2**.** *Ben & Jerry's: Social Responsibility and Activism*

Ben & Jerry's, founded in 1978, is an iconic ice cream company known for incorporating social justice and sustainability into its business strategy. The company has taken initiative on various social and environmental issues, often integrating activism directly into its marketing and operations (Cavanagh, 2020).

Ethical Practices:

- *Fair Trade Commitment:* Ben & Jerry's uses Fairtrade-certified ingredients in its products, ensuring that farmers in developing countries receive fair compensation and work under safe conditions. This commitment applies to ingredients such as cocoa, vanilla, and sugar (Ben & Jerry's, n.d.).
- *Environmental Sustainability:* The company implements eco-friendly practices, such as reducing greenhouse gas emissions at its facilities and using environmentally responsible packaging (Ben & Jerry's, n.d.).
- *Social Justice:* Ben & Jerry's actively campaigns for causes such as racial justice, climate change action etc. This social activism is embedded in the company's DNA and shapes its brand identity (Cavanagh, 2020).

Despite being acquired by Unilever in 2000, Ben & Jerry's has maintained its ethical core. The company has enjoyed continued growth and profitability while staying true to its values. Its alignment with socially conscious consumers has helped it maintain a strong market presence, expanding to over 30 countries (Cavanagh, 2020).

Ben & Jerry's demonstrates that a business can stay profitable while maintaining a strong commitment to social and environmental ethics. Integrating activism into the core strategy can further foster brand loyalty and differentiation in the marketplace.

3**.** *Starbucks: A Commitment to Fair Trade and Employee Welfare*

Starbucks, the world's largest coffeehouse chain, has set an example for integrating ethical business practices with profitability. Founded in 1971, Starbucks has grown into a global powerhouse by blending a commitment to social responsibility with its business operations (Gallo, 2020).

Ethical Practices:

- *Fair Trade Coffee:* Starbucks is one of the largest buyers of Fairtrade-certified coffee globally. It aims to source 100% ethically sourced coffee through its Coffee and Farmer Equity (C.A.F.E.) practices, which ensure fair wages, better working conditions, and sustainable farming methods for coffee farmers (Starbucks, n.d.).
- *Employee Benefits:* Starbucks is known for offering comprehensive benefits to its employees (whom it refers to as "partners"), including health insurance, stock options, and tuition coverage. These benefits help reduce turnover and foster employee loyalty (Gallo, 2020).
- *Sustainability Initiatives:* Starbucks has made significant efforts to reduce its environmental footprint, including reducing plastic waste, implementing recycling programs, and investing in renewable energy. The company has committed to becoming resource-positive, aiming to give more than it takes from the planet by 2030 (Starbucks, n.d.).

Starbucks' ethical practices have not only built a trusted global brand but also contributed to its financial success. Starbucks shows how a strong focus on ethical sourcing, employee welfare, and sustainability can drive brand loyalty, consumer trust, and long-term profitability.

Findings from the Case Studies

1. ***Patagonia: Commitment to Environmental Sustainability***
    - Eco-friendly Materials: Utilizes organic cotton and recycled polyester.
    - Repair and Recycling Programs: Encourages product repair through the Worn Wear program.
    - Environmental Activism: Donates 1% of profits to environmental causes.
    - Financial Success: Revenue surpassed indicates that ethical practices can lead to profitability.
2. ***Ben & Jerry's: Social Responsibility and Activism***
    - Fair Trade Commitment: Sources Fairtrade-certified ingredients to ensure fair compensation for farmers.
    - Eco-friendly Practices: Reduces greenhouse gas emissions and uses sustainable packaging.
    - Active Campaigning: Advocates for social justice issues, including racial equality and climate change.

- Continued Growth: Maintains profitability and a strong market presence even after acquisition by Unilever.

3. *Starbucks: A Commitment to Fair Trade and Employee Welfare*

- Ethical Sourcing: Aims to source 100% ethically sourced coffee through C.A.F.E. practices.
- Comprehensive Employee Benefits: Offers health insurance, stock options, and tuition coverage to partners.
- Sustainability Initiatives: Reduces plastic waste and invests in renewable energy.
- Financial Performance: increased revenues shows that ethical practices enhance consumer trust and brand loyalty.

Findings of the Study

The findings derived from the qualitative analysis and the case studies of Patagonia, Ben & Jerry's, and Starbucks reveal that ethical business practices and profitability are not mutually exclusive; rather, they are mutually reinforcing. The study identifies key thematic insights as follows:

1. Integration of Ethics Enhances Long-Term Profitability

Firms that embed ethical values into their organizational culture achieve sustained financial performance. Ethical conduct enhances brand reputation, customer loyalty, and stakeholder confidence—all of which translate into consistent profitability and competitive advantage over time.

2. Ethical Conduct Strengthens Corporate Reputation and Stakeholder Trust

Companies that demonstrate integrity, transparency, and responsibility in their operations attract consumer trust and investor confidence. This trust serves as a significant intangible asset that improves customer retention, market share, and overall financial health.

3. Risk Mitigation through Ethical Practices

Ethical firms experience fewer regulatory penalties, legal disputes, and public controversies. Compliance with moral and legal standards helps avoid costly litigation and reputational damage, ensuring business continuity and stability.

4. Employee Morale and Productivity Improve with Ethical Governance

An ethical workplace culture fosters fairness, respect, and motivation among employees. The study finds that companies like Starbucks demonstrate higher employee engagement, which enhances productivity and reduces turnover—contributing positively to profitability.

5. Corporate Social Responsibility (CSR) as a Profit Driver

CSR activities, when aligned with business strategy, foster community goodwill and open new market opportunities. Initiatives such as environmental conservation, fair trade practices, and community development contribute to brand differentiation and consumer preference.

6. Challenges Persist in Balancing Ethics and Profitability

Despite evident benefits, businesses face challenges such as short-term profit pressure, high costs of sustainable operations, and differing global ethical standards. However, firms that prioritize long-term ethical commitments successfully overcome these challenges through innovation and stakeholder collaboration.

7. Case Study Findings

- Patagonia demonstrates that environmental ethics and sustainability can coexist with profitability. Its eco-friendly initiatives and activism have built strong consumer loyalty and steady revenue growth.
- Ben & Jerry's integrates social justice and fair trade into its brand identity, maintaining profitability while advancing global ethical causes.
- Starbucks exemplifies ethical sourcing, employee welfare, and sustainability as core drivers of brand trust and financial performance.

8. Strategic Synergy Between Ethics and Profit

The study concludes that ethical strategies act as facilitators—not constraints—of profitability. Businesses that institutionalize ethics through transparent governance, sustainable supply chains, and stakeholder engagement secure both financial success and social legitimacy.

Conclusion

The example of Patagonia, Ben & Jerry's, and Starbucks illustrates that businesses can effectively balance ethical practices with profitability. Each of these companies has demonstrated a profound commitment to social responsibility and environmental sustainability, integrating these values into their core business strategies.

Patagonia's dedication to eco-friendly materials and environmental activism not only enhances its brand loyalty but also drives significant financial success. Similarly, Ben & Jerry's has successfully aligned its product offerings with social justice initiatives, maintaining profitability while advocating for important causes. Starbucks exemplifies how ethical sourcing and comprehensive employee benefits can contribute to a trusted global brand, resulting in robust financial performance.

The findings from these case studies highlight several key insights: first, consumer trust and loyalty are cultivated through genuine ethical commitments, which can lead to a competitive advantage in the market. Second, integrating social and environmental ethics into business models enables differentiation, attracting a growing segment of ethically-conscious consumers. Lastly, these cases affirm that a strong ethical foundation can result in long-term sustainability, ensuring not only the viability of the business but also a positive impact on society and the environment.

In conclusion, the case presented demonstrates that prioritizing ethics does not conflict with profitability; rather, it can enhance a company's success and reputation in today's increasingly conscious marketplace. As consumers continue to seek brands that align with their values, the lessons learned from these companies will serve as a blueprint for future businesses aiming to harmonize profitability with ethical responsibility.

Recommendations

The following recommendations may be put forwarded based on the study-

- *Strengthen Corporate Governance and Accountability:* The norms of corporate governance and accountability must be followed by the internal stakeholders. Firms must ensure the implementation transparent governance structures, ethical audits and accountability to ensure adherence to ethical standards by all employees.
- *Develop a Value-Based Corporate Culture:* Value- based corporate culture is utmost important in the context of ethics and profitability paradox. Ethical awareness and moral sensitivity should be cultivated and reinforced among the staff through regular training programmes.
- *Adopt Sustainable and Responsible Practices:* Being an indispensable part of the society, businesses should embrace environmentally sustainable practices, fair trade practices and community welfare initiatives that contribute to long-term profitability while fulfilling moral responsibilities toward the society.
- *Engage Stakeholders Proactively:* Organizations must adopt a stakeholder-centric approach that recognizes the interests of employees, consumers, investors, suppliers and communities. Continuous dialogue with stakeholders enhances trust and reduces ethical risks.
- *Implement Ethical Performance Metrics:* Ethical standards need to be made an essential part of performance appraisal. Business should incorporate ethical performance indicators- such as, transparency, employee well-being and environmental impact etc. into performance evaluation system alongside financial metrics.
- *Encourage Ethical Leadership:* Leadership must reflect ethical behaviour. Senior management must exemplify ethical behaviour, setting the tone for organizational conduct and cultivating ethical culture. Leadership integrity directly influences employee ethics and corporate reputation.
- *Promote Global Ethical Standards:* Businesses serving global customers should follow consistent ethical policies across regions. While maintaining cultural differences across regions, universal standards of fairness, transparency and accountability need to be inculcated in the organisations.

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RAMA DISTRIBUTED CASCADE MODEL WITH POISSON PROCESS

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Abstract

In the present paper time dependent n -cascade systems for $n=1,2,3,4$ have been considered where the number of impacts of stresses faced by the system is a Poisson process. For the estimation of cascade systems reliability R_n , it has been considered that both stress and strength follow Rama distribution. The expressions for the system reliability of the time dependent cascade systems, the mean and variance are given for single component. The numerical values of $R_1(t)$ and $R_2(t)$ have also been computed and provided in tabular forms for some specific values of the parameters. A simple case study is presented to illustrate the application of reliability concepts in structural engineering. Lastly, we have used graphs to gain a clear picture of the system reliability.

Keywords: Cascade system, Stress-Strength, Rama distribution, Poisson process, Reliability

JEL Classification: C4

Introduction

Cascade systems were first developed and studied by Pandit and Sriwastav (Pandit and Sriwastav, 1975). In the interference theory of reliability, a system with certain strength works under impact of stresses. Many authors (Frudenthal, 1966), (Pandit and Sriwastav, 1975), (Kapur and Lamberson, 1977), to name a few have studied interference models in reliability without taking time into consideration. They have studied single impact systems. In such models, reliability of the system depends only on the stress- strength of the system; passage of time has no effect in it. But time is an important factor to be considered for the study of reliability. In some studies (Sriwastav, 1994) time has come into the picture in an indirect way.

To bring time into the model directly, it is assumed that stresses impinging on the system arrive as a Poisson process with parameter β . Reliability can now be defined as the probability that the system working under impact of stresses will survive up to time t, when the stresses impinging on the system arrive as a Poisson process with intensity β . Here we have considered 2-cascade, 3-cascade and 4-cascade systems. Here system reliability at time‘t’ is defined as the probability that the system stands ‘r’ impacts i.e., at least one component is working at time‘t’.

This paper is divided into six sections. The first section of the paper is introductory in nature. In Section 2 the cascade model is presented mathematically where the number of impacts of stresses faced by the system is a Poisson process. In Section 3 the expressions for the reliability, mean and variance of time-dependent single component cascade system are obtained. In section 4 the numerical values of the reliability expressions are obtained. Graphical representations of the system reliability expressions are provided in section 5. The practical implications and applications of reliability across various fields are discussed in Section 6. A simple case study illustrating the application of reliability in Structural engineering (Bridge design) is presented in Section 7 and the conclusion of the paper is provided in Section 8.

Methodology

- Cascade Model

Let $X_1, X_2, ..., X_n$ be the strengths of n-components in the order of activation and let $Y_1, Y_2, ..., Y_n$ are the stresses working on them. In Cascade system (Doloi et al., 2010) after every failure the stress is modified by a factor k such that

$$Y_2 = kY_1,\ Y_3 = kY_2 = k^2 Y_1, \ldots,\ Y_i = k^{i-1} Y_1 \text{ etc.}$$

where, Y_1 is the stress on the first component.

Now the marginal reliability $R(1), R(2), R(3)$ and $R(4)$ may be obtained as

$$R(1) = \int_{-\infty}^{\infty} \overline{F}(y_1) g(y_1)\, dy_1 \tag{1}$$

$$R(2) = \int_{-\infty}^{\infty} F(y_1) \overline{F}(ky_1)\, g(y_1)\, dy_1 \tag{2}$$

$$R(3) = \int_{-\infty}^{\infty} F(y_1) F(ky_1) \overline{F}(k^2 y_1)\, g(y_1)\, dy_1 \tag{3}$$

$$R(4) = \int_{-\infty}^{\infty} F(y_1)\, F(ky_1)\, F(k^2 y_1) \overline{F}(k^3 y_1)\, g(y_1)\, dy_1 \tag{4}$$

The reliability of an n-cascade system (Pandit and Sriwastav, 1975) is given as

$$R_n = R(1) + R(2) + \ldots + R(n) \tag{5}$$

where, r[th] component marginal reliability may be given as

$$R(r) = P\left[X_1 < Y_1, X_2 < kY_1, \ldots, X_{r-1} < k^{r-2} Y_1, X_r \geq k^{r-1} Y_1\right] \tag{6}$$

The number r of impacts of stresses on the system during time $(0, t)$ following a Poisson distribution is given by (Gogoi et al., 2010)

$$p(r) = \frac{e^{-\beta t} (\beta t)^r}{r!}, \quad r = 0,1,2, \tag{7}$$

In an n-standby system, initially there are n components out of which only one is working under impact of stresses and the remaining $(n-1)$ are cold standbys. Here we would like to note that atleast one impact is required for the failure of a component and more than one component may fail in a single impact. We have to obtain first the probability that the system survives 'r' shocks. Here we have considered the case for $n \leq 4$, the expressions for higher values of n becomes cumbersome.

If $R_n(r)$, n = 1, 2, 3, 4 gives the reliability of an n-cascade system at the r^{th} attack then following (Sriwastav, 2003) we have

$$R_1(r) = R_1^{\,r} \tag{8}$$

$$R_2(r) = R_1^{\,r} + R(2)\binom{r}{1}R_1^{\,r-1} \tag{9}$$

$$R_3(r) = R_2(r) + R(3)\binom{r}{1}R_1^{\,r-1} + \{R(2)\}^2\binom{r}{2}R_1^{\,r-2} \tag{10}$$

$$R_4(r) = R_3(r) + R(4)\binom{r}{1}R_1^{\,r-1} + 2\,R(2)R(3)\binom{r}{2}R_1^{\,r-2} + \{R(2)\}^3\binom{r}{3}R_1^{\,r-3} \tag{11}$$

where, $R(1) = R_1$

Since the random variable r follows a Poisson distribution given in (7), reliability $R_n(t)$ at time t is given by

$$R_n(t) = \sum_{r=0}^{\infty} p(r)R_n(r) \tag{12}$$

Substituting the values of $p(r)$ from (2.7) and $R_n(r)$ from (8) to (11), we get

$$R_1(t) = e^{-\beta t(1-R_1)} \tag{13}$$

$$R_2(t) = R_1(t)\left[1 + \beta t\,R(2)\right] \tag{14}$$

$$R_3(t) = R_1(t)\left[1 + \beta t\{R(2) + R(3)\} + \frac{(\beta t)^2\{R(2)\}^2}{2!}\right] \tag{15}$$

$$R_4(t) = R_1(t)\left[1 + \beta t\{R(2) + R(3) + R(4)\} + \frac{(\beta t)^2 R(2)}{2!}\{R(2) + 2R(3)\} + \frac{(\beta t)^3\{R(2)\}^3}{3!}\right] \tag{16}$$

For some specific stress-strength distributions we can obtain $R(i)$, i =1, 2, 3, 4 from (6) and substituting these results in (13) to (16) we can get $R_n(t)$ for n ≤ 4.

Results and Discussions

- Stress-Strength follow Rama distributions

Let X and Y are independent strength and stress random variables having Rama distribution (Shanker, 2017) with parameter θ_1 and θ_2, respectively. Then, the stress-strength reliability R of Rama distribution can be obtained as

$$R = P(Y < X) = \int_0^{\infty} P(Y < X / X = x) f_x(x) dx$$

$$= \int_0^{\infty} f(x;\theta_1) F(x;\theta_2) dx$$

$$=1-\frac{\theta_1^4\begin{bmatrix}\theta_2^9+6\theta_1\theta_2^8+15\theta_1^2\theta_2^7+2\left(10\theta_1^3+9\right)\theta_2^6+3\left(5\theta_1^4+30\theta_1+411\right)\theta_2^5\\+6\left(\theta_1^4+31\theta_1+6\right)\theta_1\theta_2^4+\left(\theta_1^6+204\theta_1^3+36\theta_1^2+1260\right)\theta_1\theta_2^3\\+2\left(63\theta_1^3+6\theta_1^2+378\right)\theta_1\theta_2^2+42\left(\theta_1^3+6\right)\theta_1^2\theta_2+6\left(\theta_1^3+6\right)\theta_1^3\end{bmatrix}}{\left(\theta_1^3+6\right)\left(\theta_2^3+6\right)\left(\theta_1+\theta_2\right)^7}$$

The probability density function (p.d.f.) of a new one parameter life time distribution which is Rama distribution (Doloi et al., 2023) can be introduced as,

$$f(x,\theta)=\frac{\theta^4}{\theta^3+6}\left(1+x^3\right)e^{-\theta x}\ \ ;x>0,\ \theta>0$$

Now from (1) and (2) we have,

$$R(1)=\frac{1}{(\theta^3+6)^2}\left[\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right]$$

$$R(2)=\frac{1}{(\theta^3+6)^3}\begin{bmatrix}\frac{1}{\theta+\theta k}\left\{\theta^{10}+12\theta^7+36\theta^4\right\}+\frac{1!}{(\theta+\theta k)^2}\left\{6k\theta^8+36k\theta^5\right\}+\frac{2!}{(\theta+\theta k)^3}\left\{3k^2\theta^9+18k^2\theta^6\right\}\\+\frac{3!}{(\theta+\theta k)^4}\left\{\theta^{10}+k^3\theta^{10}+12\theta^7+18k^3\theta^7+72\theta^4\right\}+\frac{4!}{(\theta+\theta k)^5}\left\{6k\theta^8+36k\theta^5\right\}+\\\frac{5!}{(\theta+\theta k)^6}\left\{3k^2\theta^9+18k^2\theta^6\right\}+\frac{6!}{(\theta+\theta k)^7}\left\{k^3\theta^{10}+6k^3\theta^7\right\}-\frac{1}{2\theta+\theta k}\begin{Bmatrix}\theta^{10}+12\theta^7+\\36\theta^4\end{Bmatrix}\\-\frac{1!}{(2\theta+\theta k)^2}\left\{6\theta^8+6k\theta^8+36k\theta^5+36\theta^5\right\}-\frac{2!}{(2\theta+\theta k)^3}\begin{Bmatrix}6\theta^9+3k^2\theta^9+18\theta^6+\\36k\theta^6+18k^2\theta^6\end{Bmatrix}\\-\frac{3!}{(2\theta+\theta k)^4}\left\{2\theta^{10}+k^3\theta^{10}+18\theta^7+18k^3\theta^7+18k\theta^7+18k^2\theta^7+72\theta^4\right\}-\frac{4!}{(2\theta+\theta k)^5}\\\left\{12k\theta^8+9k^2\theta^8+6k^3\theta^8+36k\theta^5+36k\theta^5\right\}-\frac{5!}{(2\theta+\theta k)^6}\begin{Bmatrix}3\theta^9+6k^2\theta^9+k^3\theta^9+\\18k^2\theta^6+36k\theta^6+18\theta^6\end{Bmatrix}\\-\frac{6!}{(2\theta+\theta k)^7}\left\{\theta^{10}+2k^3\theta^{10}+6k^3\theta^7+18k^2\theta^7+18k\theta^7+6\theta^7\right\}-\\\frac{7!}{(2\theta+\theta k)^8}\begin{Bmatrix}6k^3\theta^8+\\9k^2\theta^8+6k\theta^8\end{Bmatrix}-\frac{8!}{(2\theta+\theta k)^9}\left\{3k^3\theta^9+3k^2\theta^9\right\}-\frac{9!}{(\theta+\theta k)^{10}}\left\{k^3\theta^{10}\right\}\end{bmatrix}$$

Substituting the marginal reliabilities $R(1)$ and $R(2)$ in (13) and (14) we get

$$R_1(t)=e^{-\beta t\left[1-\frac{1}{(\theta^3+6)^2}\left\{\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right\}\right]}$$

$$R_2(t)=e^{-\beta t\left[1-\frac{1}{(\theta^3+6)^2}\left\{\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right\}\right]}\left[1+\beta t\,A\right]$$

where,

$$A=\frac{1}{(\theta^3+6)^3}\left[\begin{array}{l}
\frac{1}{\theta+\theta k}\left\{\theta^{10}+12\theta^7+36\theta^4\right\}+\frac{1!}{(\theta+\theta k)^2}\left\{6k\theta^8+36k\theta^5\right\}+\frac{2!}{(\theta+\theta k)^3}\left\{3k^2\theta^9+18k^2\theta^6\right\}\\
+\frac{3!}{(\theta+\theta k)^4}\left\{\theta^{10}+k^3\theta^{10}+12\theta^7+18k^3\theta^7+72\theta^4\right\}+\frac{4!}{(\theta+\theta k)^5}\left\{6k\theta^8+36k\theta^5\right\}+\\
\frac{5!}{(\theta+\theta k)^6}\left\{3k^2\theta^9+18k^2\theta^6\right\}+\frac{6!}{(\theta+\theta k)^7}\left\{k^3\theta^{10}+6k^3\theta^7\right\}-\frac{1}{2\theta+\theta k}\left\{\begin{array}{l}\theta^{10}+12\theta^7+\\36\theta^4\end{array}\right.\\
-\frac{1!}{(2\theta+\theta k)^2}\left\{6\theta^8+6k\theta^8+36k\theta^5+36\theta^5\right\}-\frac{2!}{(2\theta+\theta k)^3}\left\{\begin{array}{l}6\theta^9+3k^2\theta^9+18\theta^6+\\36k\theta^6+18k^2\theta^6\end{array}\right.\\
-\frac{3!}{(2\theta+\theta k)^4}\left\{2\theta^{10}+k^3\theta^{10}+18\theta^7+18k^3\theta^7+18k\theta^7+18k^2\theta^7+72\theta^4\right\}-\frac{4!}{(2\theta+\theta k)^5}\\
\left\{12k\theta^8+9k^2\theta^8+6k^3\theta^8+36k\theta^5+36k\theta^5\right\}-\frac{5!}{(2\theta+\theta k)^6}\left\{\begin{array}{l}3\theta^9+6k^2\theta^9+k^3\theta^9+\\18k^2\theta^6+36k\theta^6+18\theta^6\end{array}\right.\\
-\frac{6!}{(2\theta+\theta k)^7}\left\{\theta^{10}+2k^3\theta^{10}+6k^3\theta^7+18k^2\theta^7+18k\theta^7+6\theta^7\right\}-\\
\frac{7!}{(2\theta+\theta k)^8}\left\{\begin{array}{l}6k^3\theta^8+\\9k^2\theta^8+6k\theta^8\end{array}\right.\}-\frac{8!}{(2\theta+\theta k)^9}\left\{3k^3\theta^9+3k^2\theta^9\right\}-\frac{9!}{(\theta+\theta k)^{10}}\left\{k^3\theta^{10}\right\}
\end{array}\right]$$

For this distribution we find that the moment generating function for single component cascade system i.e.,

$$M_1(\alpha)=\frac{\beta}{\beta\left[1-\frac{1}{(\theta^3+6)^2}\left\{\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right\}\right]-\alpha}\left[1-\frac{1}{(\theta^3+6)^2}\left\{\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right\}\right]$$

Hence,

$$\mu_1'=\frac{-1}{\beta\left[1-\frac{1}{(\theta^3+6)^2}\left\{\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right\}\right]}$$

Mean

$$\text{Variance}\quad \mu_2=\frac{1}{\beta^2\left[1-\frac{1}{(\theta^3+6)^2}\left\{\frac{\theta^6}{2}+\frac{41}{8}\theta^3+\frac{79}{128}\right\}\right]^2}$$

Numerical Evaluation

For some specific values of the parameters involved in the expressions of $R_n(t),\ n=1,2$ we evaluate $R_1(t)$ and $R_2(t)$ for different values of β, t and θ from their expressions obtained in the last section.

Table 1: Both stress and strength are follows Rama distribution for k =.5

β	t	θ	$R_1(t)$	$R_2(t)$
1	1	3	0.9213	0.9728
		4	0.9101	0.9531
		5	0.8565	0.9414
2	2	3	0.7204	0.8454
		4	0.6225	0.7230
		5	0.5671	0.6143
3	3	3	0.4781	0.7547
		4	0.3182	0.6347
		5	0.2503	0.5127

Source: *Authors' Self-construct*

From the tabulated values we observe that, when θ increases $R_1(t)$ and $R_2(t)$ decreases for fixed values of β and t. For example, when $\beta=1, t=1, \theta=3$ then system reliability $R_1(t)$ =0.9213 and $R_2(t)$=0.9728 and when $\beta=1, t=1, \theta=4$ then system reliability $R_1(t)$=0.9101 and $R_2(t)$=0.9531. Similarly, when $\beta=2, t=2, \theta=3$ then system reliability $R_1(t)$=0.7204 and $R_2(t)$=0.8454 and when $\beta=2, t=2, \theta=4$ then system reliability $R_1(t)$=0.6225 and $R_2(t)$ =0.7230. By proper choice of the different parameters, very high system reliability can be achieved.

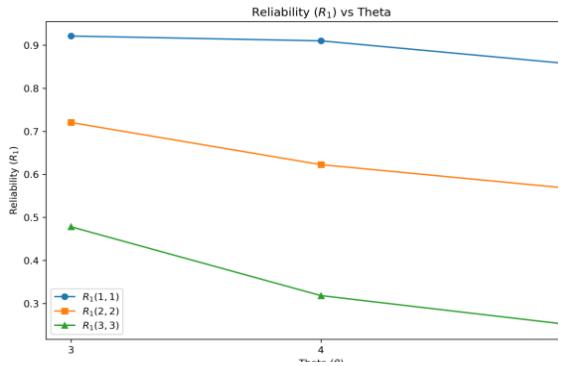
Graphical Representation

Graphs of $R_1(t)$ and $R_2(t)$ are drawn in Figure 1 and Figure 2 for different parametric values involved. Taking θ along the horizontal axis and the corresponding $R_1(t)$ and $R_2(t)$ along the vertical axis graphs are plotted for different pairs of β and t.

Figure 1 represents the curves for $R_1(t)$ where $\beta=1, t=1, \theta=3,4,5$; $\beta=2, t=2, \theta=3,4,5$ and $\beta=3, t=3, \theta=3,4,5$.

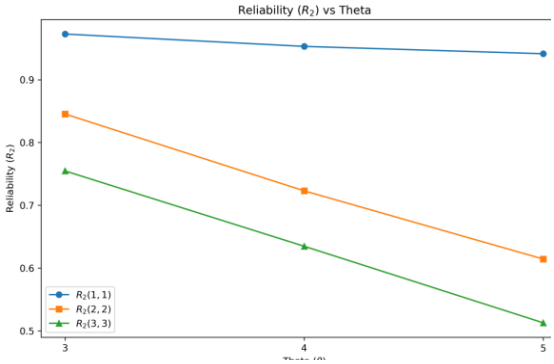
Again, Figure 2 represents the curves for $R_2(t)$ where $\beta=1, t=1, \theta=3,4,5$; $\beta=2, t=2, \theta=3,4,5$ and $\beta=3, t=3, \theta=3,4,5$.

Figure 1: System Reliability $R_1(t)$ vs θ



Source: *Authors' Self-construct*

Figure 2: System Reliability $R_2(t)$ vs θ



Source: *Authors' Self-construct*

Practical Implications and Applications

Reliability Engineering

Application: Ensures the long-term reliability of critical infrastructure systems, such as bridges, dams, or high-speed rail networks, which are subject to stresses like environmental forces, wear and tear and maintenance delays. For power grids, it forecasts blackout risks; in transportation, it evaluates subsystem reliability; and for structures, it supports real-time monitoring and resilience strategies against environmental stresses and delayed repairs, ensuring long-term system integrity.

Implication: By modeling the system's reliability with a time-dependent cascade model, engineers can predict time-dependent failure probabilities in critical infrastructure, enabling proactive maintenance and upgrades. This approach minimizes downtime, enhances safety, and optimizes resource allocation for sustained system reliability.

Manufacturing and Quality Control

Application: In a factory setting, production lines often undergo intermittent stresses (e.g., machinery breakdowns, material inconsistencies, or unexpected environmental factors). By considering and modifying both the strength of materials and the stochastic nature of stress events, manufacturers can improve product quality, predict failure rates, and optimize maintenance schedules to minimize downtime and enhance operational efficiency.

Implication: The RAMA Distributed Cascade Model with Poisson Process can effectively model the stress-strength interaction for product components in a factory setting. Engineers can predict when parts are likely to fail under intermittent stresses, enabling the design of more robust components and optimized manufacturing schedules, reducing waste and costs. Additionally, this approach supports proactive maintenance strategies, enhancing production line reliability and minimizing unexpected downtime.

Finance and Risk Management

Application: In financial systems and insurance markets, the RAMA Distributed Cascade Model with Poisson Process models economic shocks (e.g., market crashes, credit defaults) as Poisson-distributed events, with stress reflecting shock severity and strength representing the system's resilience. This enables risk assessment, predicts cascading failures, and optimizes strategies to enhance financial stability.

Implication: This model enables banks and insurance companies to better assess their exposure to significant losses over time, helping them allocate appropriate reserves and implement effective risk mitigation strategies.

Structural Engineering and Building Safety

Application: In the construction of tall buildings or skyscrapers, a time-dependent cascade system can model how the structure will respond to external forces such as earthquakes, wind, or gradual material degradation.

Implication: By analyzing stress and strength distributions over time, engineers can design structures with improved safety features, ensuring that buildings remain stable even under the cumulative effects of multiple smaller stresses.

Case Study: Application in Structural Engineering (Bridge Design)

Scenario

Consider a civil engineering company tasked with designing a bridge that will be subjected to varying levels of stress over its lifetime. These stresses may include traffic loads, seismic activity, temperature fluctuations, and wind forces, all of which can occur randomly and over time. The company uses the time-dependent cascade system model where the following assumptions are made:

The occurrence of stress events (traffic, wind, etc.) follows a Poisson process. Both the strength of the bridge (material durability) and the stress events follow the Rama distribution.

Steps in the Case Study

Modeling Stress and Strength

Stress: The intensity of stress (such as traffic, weather conditions, or external loads) can be modeled using a Poisson process. For instance, traffic intensity may fluctuate over time—showing higher rates during peak hours and significantly lower levels during off-peak periods.

Strength: The material strength (or durability) of the bridge is represented using the Rama distribution, which captures variations in material properties over time due to factors such as wear, aging, and fatigue.

Reliability Estimation

The reliability function for the bridge can be derived based on the time-dependent cascade model. The system's reliability R(t) is the probability that the system has not failed at time t. This function incorporates both the stress and the strength distribution, accounting for the cumulative effects of past stresses on the structure’s present strength.

Failure Prediction

Over time, as stresses accumulate from factors such as traffic, wind and environmental conditions, the probability of failure increases. By combining the cumulative distribution of stress events with the Rama distribution for material strength, engineers can estimate the expected time to failure and determine optimal intervals for maintenance or reinforcement.

Maintenance Scheduling

Based on the reliability estimation, the company schedules preventive maintenance. For example, if the probability of failure exceeds a critical threshold, the company might plan for reinforcement, repairs, or inspections.

Results

- The time-dependent cascade system model provides the engineers with a reliable estimate of when the bridge will likely fail based on expected stress events.
- This enables the company to perform cost-effective maintenance by minimizing the risk of catastrophic failure and the total maintenance cost throughout the bridge's lifetime.

Summary

In this case study, the time-dependent cascade system model—incorporating Poisson-distributed stress events and the Rama distribution for strength—enables the engineering team to accurately predict the bridge's failure likelihood and optimize its maintenance schedule. Such models are invaluable in sectors where reliability and failure prediction are critical, including infrastructure design, manufacturing, finance etc.

By applying these concepts in a real-world scenario, businesses can proactively and efficiently manage risks, improve system designs, and optimize resources, all while maintaining safety and reducing costs.

Conclusion

In this paper, we propose Rama distribution for both stress-strength to obtain Cascade system reliability where the number of impacts of stresses faced by the system is a Poisson process. As a result, for this distribution, moment generating function for single component cascade system has been obtained and also mean and variance are given for single component. Numerical values of the reliability expressions are obtained and it is found that the reliabilities lie between 0 to 1, which validates the reliability expressions. Also, some graphs are added to see the clear picture of the reliability. As the proposed distribution is the new probability distribution, a lot of works can be done in the future in reliability theory.

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