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Journal of Management and Technology

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Address for Editorial Correspondence:
Chief Editor, JIM QUEST Journal of Management and Technology, Jaipuria Institute of Management, Ghaziabad, Block A Gate No 2, Shakti Khand - IV, Uttar Pradesh, India, 201014

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As the Chief Editor of JIM QUEST Journal of Management and Technology, I am pleased to present Volume 21 Issue 2 of the journal, which brings together thirteen insightful research papers spanning Finance, Marketing, Human Resource Management, Digital Technologies, and Sustainability. Collectively, the contributions reflect the evolving challenges and opportunities faced by organizations, markets, and societies mainly within the Indian context. The issue showcases theoretical frameworks, methodological rigor, and practical relevance for scholars, practitioners, and policymakers alike.

The opening paper *"Factors Influencing Financial Performance: A Comparative Study of Public Sector Non-Life Insurers in India"*, offers a comprehensive longitudinal analysis of public sector insurance companies. By examining key determinants such as claims incurred, net premium earned, commissions, and operating expenses, the study provides valuable insights into profitability and performance dynamics within India's non-life insurance sector, highlighting implications for financial sustainability and policy reform.

The growing influence of digital marketing and technology-enabled persuasion is examined in the *"The Effects of Virtual Influencers on Customer Perceptions and Purchase Intention"*. This empirical study sheds light on how social presence, anthropomorphism, and performance expectancy shape consumer responses to virtual influencers, offering timely insights for marketers navigating AI-driven branding strategies in the Indian market.

Workplace behaviour and organizational culture are addressed in the *"Effect of Organizational Silence on Organizational Citizenship Behaviour. Focusing on India's Service Sector"*, the study demonstrates how acquiescent and defensive silence negatively affect extra-role behaviours, while pro-social silence enhances them. The findings underscore the importance of open communication climates and supportive leadership in fostering employee engagement.

The issue also engages with emerging financial technologies and decentralized systems through *"Mapping Blockchain's Impact: A Bibliometric Analysis of Decentralized Finance's Future"*. By analyzing global research trends in blockchain and DeFi, this study identifies key contributors, collaboration networks, and security-focused research themes, offering a valuable roadmap for future scholarship in the digital economy.

Sustainability and green consumerism take center stage in *"Building Trust for Green Consumerism: Examining the Influence of Green Marketing Strategies on Online Purchase Intention in India's FMCG Sector"*. Drawing on Signaling and Trust theories, the study highlights the mediating role of green brand trust in translating eco-friendly initiatives into consumer purchase intentions, providing actionable insights for marketers in price-sensitive emerging markets.

The transformative role of artificial intelligence is explored in *"Rising Above the AI Line: Charting a Collaborative Future"*. This conceptual paper reframes AI as a collaborative partner rather than a disruptive force, emphasizing human-centric design, ethical deployment, and the need for localized AI models aligned with India's cultural and linguistic diversity.

Human capital development in education is examined in *"Exploring the Interplay of Emotional Intelligence and Teacher Performance"*. The study reveals the mediating role of self-efficacy in linking emotional intelligence to teaching performance, offering practical implications for faculty development and institutional effectiveness in higher education.

The intersection of values, inclusivity, and sustainability is addressed in *"Fostering Sustainable HRM through the Integration of Workplace Spirituality with Diversity, Equity, and Inclusion (DEI)"*. This conceptual and qualitative review proposes a holistic framework that integrates workplace spirituality with DEI initiatives, advocating for ethical leadership, employee well-being, and sustainable HRM practices.

Financial innovation and investor behavior are further explored in *"Transformative Fintech Innovations Enhancing Retail Investor Confidence and Satisfaction"*. Focusing on Fintech tools such as mobile trading apps and AI-driven analytics, the study highlights their role in shaping investor confidence, trust, and satisfaction in a developing economy context.

The role of sustainable finance in addressing environmental challenges is examined in the *"Role of Green Bonds in Promoting Eco-Finance for a Sustainable Future"*. This review paper underscores the effectiveness of green bonds in financing renewable energy and climate mitigation initiatives while identifying regulatory and transparency challenges that must be addressed for wider adoption.

Social media marketing dynamics are analyzed in the *"Impact of Credibility in Social Media Influencing: A Study on Consumer Engagement"*. The study demonstrates how influencer credibility and trust significantly enhance consumer engagement on Instagram, offering practical insights for brands leveraging influencer-led campaigns.

Issues of equity and empowerment are foregrounded in *"Empowering Tribal Women Through Digital Financial Inclusion"*. This review highlights the role of digital finance, microfinance, and policy interventions in overcoming structural barriers faced by tribal women, emphasizing culturally sensitive approaches to inclusive growth.

The issue concludes with *"Personalizing Digital Banking: A UX/UI and Customer Analytics Approach to SBI's YONO Platform"*, which examines how usability, safety, time efficiency, and service diversity shape user satisfaction and perceived effectiveness. The findings provide actionable guidance for optimizing digital banking platforms in India's rapidly evolving financial landscape.

Together, the papers in this issue reflect a strong commitment to addressing contemporary challenges through interdisciplinary perspectives. They collectively emphasize the importance of trust, sustainability, technological innovation, and human-centric approaches in shaping the future of business and society. We hope this issue stimulates meaningful academic discourse and offers practical insights for decision-makers navigating an increasingly complex and dynamic environment.

Happy Reading!

Chief Editor

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Factors Influencing Financial Performance: A Comparative Study of Public Sector Non-Life Insurers in India

*Srinivasa H T
**K Venkidasamy

Abstract

With a well-established and efficiently functioning insurance sector is crucial for fostering an inclusive economy and driving a country's growth. Basically in India, the insurance industry has witnessed steady and gradual expansion over the years. Since it is an essential financial service, insurance provides financial security to both individuals and businesses. Generally the efficiency of insurance companies is assessed using various techniques, including financial performance analysis, technical efficiency, purely technical efficiency, and scale efficiency.Basically this research study shall try to examine the financial performance of public sector non-life insurance companies in India and identifies key factors influencing their performance. The determining factor considered shall include commissions, claims incurred, investment income, net premium earned, management soundness, and operating expenses. Generally data from the financial years 2011-12 to 2023-24 were analyzed to evaluate financial performance, with normality and stationarity tests conducted using E-Views statistical software. Basically the findings shall try to indicate that the New India Insurance Company Limited exhibits the strongest financial performance, followed by United India Insurance Company Limited. Basically among the key determinants of net profit after tax for public sector non-life insurers, claims incurred and net premium earned play a significant role.

Keywords: *Financial Performance, Net Profit after Tax, Non-life Insurance, Return on Equity.*

JEL Classifications*:G22, L25, N20*

Introduction

Generally insurance serves as a crucial risk management tool, offering various products and services to individuals and businesses to ensure financial security (**Krishnamurthy et al., 2005**). basically the Indian insurance industry is divided into two main categories: the life insurance sector and the non-life insurance sector (**Mandal & Ghosh Dastidar, 2014**). since India's economy opened to private players in 1992, it was only in 2000, with the enactment of the *Insurance Regulatory and Development Authority Act*, that private insurers were officially allowed to operate in the Indian market (**Ashraf & Faiz, 2018**). Since then, the industry has grown consistently, playing a vital role in economic development (**Chakraborty & Harper, 2017; Sinha, 2007**). since the presence of private players in both life and non-life insurance segments has increased significantly (**Chakraborty, 2017**). In Despite of this, public sector insurance companies continue to dominate the Indian insurance market, even with the entry of private firms through foreign collaborations and investments (**Ray et al., 2020**).

During the COVID-19 pandemic led to an economic slowdown and inflationary pressures worldwide (**IRDAI, 2022**). This decline in economic growth resulted in lower demand for insurance but an increase in claims (**IRDAI, 2022**). Since 2021, global real insurance premiums grew by 3.4%, with the life insurance sector expanding by 4.5% and the non-life sector by 2.6%. Basically India's insurance market, however, outpaced the global average, with the life insurance sector growing at 8.5% and the non-life sector at 5.8% **(IRDAI, 2022)**. Since this growth is attributed to rising awareness of insurance products, supportive government policies, financial inclusion initiatives, and increasing financial literacy. In 2022, India's insurance penetration (premium as a percentage of GDP) stood at 4.2%,

*Research scholar, Assistant Professor, Department of commerce, GFGC Nagamangala, karnataka-571432, Email: htsrinivasa86@gmail.com
**Research Supervisor, Assistant Professor, Department of commerce, MGR College, Hosur-635130, Email: venkidasamy.2010@gmail.com

while insurance density (premium per capita) was $91 (**IRDAI, 2022**).

The evolving landscape of the insurance industry presents both challenges and opportunities, Regulators, customers, and investors seek efficient insurers, as inefficient companies struggle to provide adequate financial security and high-quality insurance products (**Ilyas & Rajasekaran, 2019**). Evaluating and analyzing insurer efficiency is essential, as it reflects their ability to adapt to industry challenges (**Amanti & Siregar, 2019**). Efficiency, in this context, refers to the optimal use of available resources to produce maximum output, compared to the most efficient firms in the industry (**Bhatia & Mahendru, 2021**). It is a key indicator of an insurer's performance, commonly measured through technical efficiency (**Sinha, 2007**).

Financial performance (FP) assesses a company's earnings, profitability, and overall value (**Mwangi & Murigu, 2015**). In the insurance industry, profitability is determined by factors such as premiums earned, returns on investment, and return on equity (**Mwangi & Murigu, 2015**). Additionally, insurance companies play a significant role in financing long-term projects, contributing to economic development (**Morara & Sibindi, 2021**). A sustainable insurance market is essential for overall economic stability, and its sustainability is closely tied to the financial performance of insurers (**Morara & Sibindi, 2021**). Profitability is typically measured using variables such as net profit after tax (NPAT), return on equity (ROE), and return on net earnings (RONE).

Basically this study aims to identify the factors influencing the financial performance of public-sector general insurers in India, both at an industry-wide level and at the company level. Additionally, it provides a comparative analysis of the financial performance of public sector general insurance companies in the country.

Review of the Existing Research Works:-

A well-functioning insurance system plays a crucial role in a country's economic development by safeguarding businesses against financial risks (**Chakraborty & Harper, 2017**). The general insurance sector accounts for approximately 30% of total industry premiums (**Ray et al., 2020**). Several studies have examined the efficiency of insurers (**Bawa & Ruchita, 2011**; **Nikita Kumari, 2018**; **Ofori-Boateng et al., 2022**; **Siddiqui, 2020**; **Sinha, 2007**), focusing on different types of efficiency, such as technical, purely technical, and scale efficiencies (**Bhatia & Mahendru, 2021**). Additionally, environmental variables have been found to influence the efficiency scores of life insurers (**Shieh et al., 2020**).

Prominent methods for measuring efficiency include *Data Envelopment Analysis* (DEA) and *Stochastic Frontier* analysis (**Bawa & Ruchita, 2011**). DEA is categorized into two concepts: the traditional approach, which does not account for multiple inputs, and the modern approach, which incorporates multiple inputs (**Bawa & Ruchita, 2011**). To improve efficiency, general insurance companies should invest in workforce development and technology adoption (**Ofori-Boateng et al., 2022**). However, technical efficiency does not consider cost and revenue analysis, leading researchers to focus on revenue efficiency instead (**Bhatia & Mahendru, 2021; Morara & Sibindi, 2021; Muthulakshmi, 2018**). Revenue efficiency measures an insurer's ability to deliver services effectively using available resources (**Bhatia & Mahendru, 2021**). Insurers' productivity efficiency is assessed using *constant returns to scale* and *variable returns to scale* methods (**Mandal & Ghosh Dastidar, 2014**), which fluctuate based on economic conditions.

Studies on insurers' financial performance reveal that companies with high leverage and low liquidity tend to perform better (**Nikita Kumari, 2018**). The profitability of general insurance companies is influenced by both internal and external factors. Internal factors include company-specific characteristics, while external factors encompass industry dynamics and macroeconomic variables (**Mwangi & Murigu, 2015**). Determinants of insurers' economic performance include company size and age, equity capital, underwriting risk, retention ratio, and ownership structure (**Mwangi & Murigu, 2015**). Financial performance (FP) is a subjective measure of an organization's ability to maximize revenues and profits using its assets (**Morara & Sibindi, 2021**). Commissions significantly impact FP and are critical in determining an insurer's market share (**Mulchandani et al., 2017**). Additionally, a direct relationship exists between equity capital and financial performance (**Kaur Bawa & Chattha, 2013**). Public insurance companies must focus on capital adequacy and reinsurance to ensure financial stability (**Vijay, 2019**).

Existing research emphasizes the need to evaluate insurers' performance, as it reflects the efficient utilization of resources. Performance is measured through various analyses, including financial, technical, purely technical, and scale efficiency assessments. While numerous studies examine the performance of life and non-life insurers in India, limited research has been conducted on the financial performance of public-sector non-life insurers. Therefore, this study aims to provide a comparative analysis of the financial performance of public-sector non-life insurers in India.

Research Objectives:-

The objectives of the study are as follows:-

1. To assess and analyze the differences in the financial performance of public-sector non-life insurers in India at an overall level.
2. To identify and evaluate the key factors influencing the financial performance of public-sector non-life insurers in India.
3. To measure and examine the financial performance of public-sector non-life insurers in India, along with its key determinants, at the company level.
4. To conduct a comparative analysis of the financial performance of public-sector non-life insurers in India.

Based on the study objectives, the following hypotheses have been formulated:-

H_{01}: There is no significant difference in the financial performance of public-sector non-life insurers.

H_{02}: Commission does not have a significant impact on the financial performance of public-sector non-life insurers at the overall level.

H_{03}: Net premium earned does not have a significant impact on the financial performance of public-sector non-life insurers at the overall level.

H_{04}: Investment income does not have a significant impact on the financial performance of public-sector non-life insurers at the overall level.

H_{05}: Claims incurred do not have a significant impact on the financial performance of public-sector non-life insurers at the overall level.

H_{06}: Operating expenses do not have a significant impact on the financial performance of public-sector non-life insurers at the overall level.

H_{07}: Management soundness does not have a significant impact on the financial performance of public-sector non-life insurers at the overall level.

H_{08}: Commission does not have a significant impact on the financial performance of public-sector non-life insurers at the company level.

H_{09}: Net premium earned does not have a significant impact on the financial performance of public-sector non-life insurers at the company level.

H_{10}: Investment income does not have a significant impact on the financial performance of public-sector non-life insurers at the company level.

H_{11}: Claims incurred do not have a significant impact on the financial performance of public-sector non-life insurers at the company level.

H_{12}: Operating expenses do not have a significant impact on the financial performance of public-sector non-life insurers at the company level.

H_{13}: Management soundness does not have a significant impact on the financial performance of public-sector non-life insurers at the company level.

Research Methodology:-

Basically this descriptive study relies on secondary data to analyze the financial performance (FP) of public-sector non-life insurers in India. The study includes all four public-sector non-life insurance companies: National Insurance Company Limited (NICL), New India Insurance Company Limited (NIICL), The Oriental Insurance Company Limited (TOICL), and United India Insurance Company Limited (UIICL). The analysis covers the financial years from 2011-12 to 2023-24using secondary data sourced from the annual reports of the Insurance Regulatory and Development Authority of India (IRDAI).

In order to assess and analyze FP, the study considers key financial variables such as commission, net premium earned, investment income, claims incurred, operating expenses, and management soundness as determinants of financial performance. The performance itself is measured using Net Profit After Tax (NPAT), Return on Net Worth (RONW), and Return on Equity (ROE). The methodology for computing these variables is detailed in Table 1.

Based on the measurement framework in Table 1, the study computes the financial variables for each public-sector non-life insurance company for each financial year from 2011-12 to 2023-24. To identify the determinants of financial performance, the study employs Ordinary Least Squares (OLS) regression analysis. Additionally, differences in FP among public-sector non-life insurers are examined using mean-variance analysis.

The regression equation used in the study is as follows:

$$Y= \alpha + \beta 1\ COM + \beta 2 NPE + \beta 3\ II + \beta 4\ OE + \beta 5\ MS + \varepsilon$$

Where Y = NPAT or ROE or RONW

Where:

- Y = NPAT, ROE, or RONW
- COM = Commission
- NPE = Net Premium Earned
- II = Investment Income
- OE = Operating Expenses
- MS = Management Soundness
- α = Intercept
- ε = Error Term

Table 1 showing the Variables and their measurement

Particulars	Measurement or Computation
Commission (COM)	Commission paid to the agents during a year
Net Premium Earned (NPE)	Insurance premiums underwritten – Reinsurance ceded + Reinsurance accepted
Investment Income (II)	Income raised from investments in sources other than insurance
Claims Incurred (CI)	Direct claims + Reinsurance claim paid – Reinsurance claim received
Operating Expenses (OE)	Office and administration expenses, selling, and distribution expenses related to insurance products
Management Soundness (MS)	Operating expenses incurred divided by gross premium earned
Net Profit After Tax (NPAT)	Operating profit after tax
Return on Equity (ROE)	Net profit after tax divided by shareholders' equity
Return on Net Worth (RONW)	Net worth divided by shareholders' equity

(**Source:** Compiled by the authors)

Results of Data Analysis:-

The financial performance of Indian public sector non-life insurers was first analyzed at the overall level. Table 2 presents the descriptive statistics of key financial variables, including commission, net premium earned, investment income, claims incurred, operating expenses, management soundness, NPAT, ROE, and RONW.

The results indicate that operating expenses, management soundness, NPAT, ROE, and RONW exhibit negative skewness, while commission, net premium earned, investment income, and claims incurred show positive skewness. Kurtosis values suggest that commission, net premium earned, investment income, claims incurred, operating expenses, management soundness, and Return on Equity exhibit negative kurtosis, whereas NPAT and RONW exhibit positive kurtosis.

The Jarque-Bera p-values for all variables—including commission, net premium earned, investment income, claims incurred, operating expenses, management soundness, NPAT, ROE, and RONW—are greater than 0.05, confirming that these variables follow a normal distribution.

Additionally, differences in NPAT, ROE, and RONW across public sector non-life insurance companies were assessed using a test of means for equality. The results of this analysis are summarized in Table 3.

Table 2: showing the Descriptive Statistics of Key Financial Variables

Particulars	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	P-Value
Commission (COM)	753.227	332.48	1.395	-1.160	0.945	0.623
Net Premium Earned (NPE)	10137.935	4013.63	5.023	-1.274	0.799	0.670
Investment Income (II)	678.746	120.72	7.270	-1.577	1.168	0.557
Claims Incurred (CI)	9323.907	3920.98	8.050	-1.742	1.217	0.544
Operating Expenses (OE)	2614.858	864.10	-0.008	-1.230	0.763	0.682
Management Soundness (MS)	22.262	72.964	-0.329	-0.445	0.438	0.802
Net Profit After Tax (NPAT)	110.188	675.491	-1.302	1.167	2.604	0.271
Return on Equity (ROE)	0.311	4.359	-0.849	-0.295	1.300	0.521
Return on Net Worth (RONW)	-49.278	100.840	-1.787	2.212	5.269	0.071

(**Source:** Computed based on secondary data)

Interpretation:-

1. **Measures of Central Tendency & Dispersion**
   - ✓ **Mean: Represents the average value for each variable.**
   - ✓ **Standard Deviation:** Indicates the variability or dispersion in the data. A higher value suggests more fluctuation.
   - ✓ **Net Premium Earned (NPE)** has the highest mean (10,137.935), indicating it's the largest financial figure in the dataset.
   - ✓ **Return on Net Worth (RONW)** has a negative mean (-49.278), indicating overall losses in this metric.
   - ✓ **Net Profit After Tax (NPAT)** shows a low mean (110.188) compared to its high standard deviation (675.491), suggesting high volatility.

2. **Skewness (Symmetry of Data Distribution):-**
   - ✓ **Positive Skewness (>0):** Right-skewed distribution, meaning extreme values on the higher end.
   - ✓ **Commission (1.395),** Net Premium Earned (5.023), Investment Income (7.270), and Claims Incurred (8.050) are significantly right-skewed, suggesting a few very high values in these categories.
   - ✓ **Negative Skewness (<0):** Left-skewed distribution, meaning extreme values on the lower end.
   - ✓ **Net Profit After Tax** (-1.302), Return on Equity (-0.849), and Return on Net Worth (-1.787) indicate that lower values dominate in these areas.

3. **Kurtosis (Tailedness of Distribution)**
   - ✓ **Negative Kurtosis (<0, Platykurtic):** Indicates a flatter distribution with fewer extreme outliers.
   - ✓ Most variables have negative kurtosis, meaning they are more evenly spread with fewer extreme values.
   - ✓ Claims Incurred (-1.742) and Investment Income (-1.577) have the lowest kurtosis, meaning these data points are widely spread.
   - ✓ **Positive Kurtosis (>0, Leptokurtic):** Indicates a peaked distribution with extreme outliers.
   - ✓ Net Profit After Tax (1.167) and Return on Net Worth (2.212) have positive kurtosis, suggesting the presence of extreme values.

4. **Jarque-Bera Test (Normality Check) & P-Value**
   - ✓ Jarque-Bera test is used to check if the data follows a normal distribution. A higher value suggests deviation from normality.
   - ✓ **P-Value (>0.05 indicates normality):**
   - ✓ Most variables have P-values > 0.05, suggesting that they follow a normal distribution.
   - ✓ Return on Net Worth (P=0.071) is borderline non-normal, meaning it may have some extreme variations.
   - ✓ Net Profit After Tax (P=0.271) and Return on Equity (P=0.521) show reasonable normality.

Table 3: showing the ANOVA Analysis for Financial Performance

	F-Value	P-Value
Net Profit After Tax	21.511	0.014
Return on Equity	18.203	0.018
Return on Net Worth	705.101	0.001

(Source: Computed based on secondary data)

Interpretation:-

Analysis of Financial Variables (F-Value & P-Value)

1. **Understanding the F-Value:-**

   The **F-Value** represents the test statistic from an **ANOVA (Analysis of Variance)** or **regression analysis**, which measures how much variation in the dependent variable is explained by the independent variable(s).

   Higher F-values indicate a stronger relationship or significant variance among groups.

2. **Significance Testing (P-Value):-**

   The **P-Value** measures statistical significance. A **P-value < 0.05** typically indicates strong evidence against the null hypothesis, meaning the variable significantly affects the outcome.

3. **Interpretation of Each Variable:-**
   - ✓ **Net Profit After Tax (NPAT)**
   - **F-Value:** 21.511 (moderately high)
   - **P-Value:** 0.014 (< 0.05) → **Statistically significant**
   - **Insight:** NPAT has a significant impact, meaning changes in NPAT are not random but influenced by key financial drivers.

   - ✓ **Return on Equity (ROE)**
   - **F-Value:** 18.203 (moderately high)
   - **P-Value:** 0.018 (< 0.05) → **Statistically significant**
   - **Insight:** ROE is a significant factor, suggesting that variations in return on equity are influenced by specific financial or operational decisions.

   - ✓ **Return on Net Worth (RONW):-**
   - **F-Value:** 705.101 (extremely high)
   - **P-Value:** 0.001 (**Highly significant**)
   - **Insight:** RONW has the **strongest statistical significance**, indicating that it is the most influenced variable in the analysis. The large F-value suggests a substantial effect of independent factors on RONW.

Table 4 showing the OLS Regression – Overall Level

Variable	NPAT P-Value	ROE P-Value	RONW P-Value
Commission (COM)	0.0864	0.8685	0.2992
Claims Incurred (CI)	0.0071	0.0016	0.0204
Investment Income (II)	0.0191	0.0406	0.1525
Management Soundness (MS)	0.4593	0.2852	0.3501
Net Premium Earned (NPE)	0.0268	0.0429	0.2715
Operating Expenses (OE)	0.7654	0.5920	0.4612
Constant	0.6767	0.3256	0.4462
R^2	0.9200	0.9470	0.8730

(Source: Computed based on secondary data**)**

Interpretation:-

The above table-4 shall try to provide **p-values** for different variables in relation to **Net Profit After Tax (NPAT), Return on Equity (ROE), and Return on Net Worth (RONW)**, along with the **R^2 values** indicating the explanatory power of the models.

1. **Understanding P-Values:-**
   - **P-values < 0.05** → Statistically significant impact on the dependent variable.
   - **P-values > 0.05** → No statistically significant relationship.

2. **Key Observations:-**

A. Impact on NPAT (Net Profit After Tax)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (CI) → 0.0071**
  - **Investment Income (II) → 0.0191**
  - **Net Premium Earned (NPE) → 0.0268**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.0864)
  - Management Soundness (0.4593)
  - Operating Expenses (0.7654)

Key Insight: NPAT is significantly influenced by **Claims Incurred, Investment Income, and Net Premium Earned**. Other variables do not show a strong direct relationship.

B. Impact on ROE (Return on Equity)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (CI) → 0.0016**
  - **Investment Income (II) → 0.0406**
  - **Net Premium Earned (NPE) → 0.0429**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.8685)
  - Management Soundness (0.2852)
  - Operating Expenses (0.5920)

Key Insight: ROE is **significantly impacted** by **Claims Incurred, Investment Income, and Net Premium Earned**. Other variables do not have a strong statistical impact.

C. Impact on RONW (Return on Net Worth)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (CI) → 0.0204**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.2992)
  - Investment Income (0.1525)
  - Management Soundness (0.3501)
  - Net Premium Earned (0.2715)
  - Operating Expenses (0.4612)

Key Insight: Only Claims Incurred significantly affects RONW. Other variables do not have a statistically significant impact.

3. **R^2 Values (Model Fit)**
   - **NPAT (0.9200 or 92%)** → Model explains 92% of the variation in NPAT, indicating a strong fit.
   - **ROE (0.9470 or 94.7%)** → Model explains 94.7% of ROE variation, showing an excellent fit.
   - **RONW (0.8730 or 87.3%)** → Model explains 87.3% of RONW variation, which is a good fit but slightly weaker than the others.

Analysis of ANOVA and OLS Regression Results

The ANOVA results indicate significant differences in NPAT, ROE, and RONW among public sector non-life insurers. Consequently, the null hypothesis is rejected, confirming that financial performance, as measured by NPAT, ROE, and RONW, varies across insurers at the overall level.

To identify the key determinants of financial performance, Ordinary Least Squares (OLS) regression analysis was conducted (Table 4). The results highlight that:-

- **Net Profit After Tax (NPAT):** Significantly influenced by claims incurred, investment income, and net premium earned, explaining 92.0% of the variation. However, commission, management soundness, and operating expenses do not have a significant impact.
- **Return on Equity (ROE):** Claims incurred, investment income, and net premium earned significantly affect ROE, accounting for 94.7% of the variation. Conversely, commission, management soundness, and operating expenses do not contribute significantly.
- **Return on Net Worth (RONW):** Primarily driven by claims incurred, which explains 87.3% of the variation. Other variables, including commission, investment income, management soundness, net premium earned, and operating expenses, do not have a significant effect.

These findings suggest that NPAT and ROE across public sector non-life insurers are predominantly influenced by claims incurred, investment income, and net premium earned. However, the key determinant of RONW is claims incurred.

Financial Performance and Determinants of NICL

Table 5 showing the OLS Regression – NICL

Variable	NPAT (P-value)	ROE (P-value)	RONW (P-value)
Commission	0.0732	0.0374	0.3416
Claims incurred	0.0128	0.0006	0.0404
Investment Income	0.0052	0.0033	0.0500
Management Soundness	0.4341	0.0211	0.4696
Net Premium Earned	0.0006	0.0006	0.9018
Operating Expenses	0.3959	0.0287	0.1356
Constant	0.2824	0.0109	0.5320
R^2	0.972	0.977	0.734

(**Source:** Computed based on secondary data)

Interpretation:-

This table provides **p-values** for different variables related to **Net Profit After Tax (NPAT), Return on Equity (ROE), and Return on Net Worth (RONW)**, along with **R^2 values** that indicate how well the model explains these dependent variables.

1. Understanding P-Values

- **P-values < 0.05** → The variable has a statistically significant impact.
- **P-values > 0.05** → The variable does not have a significant impact.

2. Key Observations

A. Impact on NPAT (Net Profit After Tax)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (0.0128)**
  - **Investment Income (0.0052)**
  - **Net Premium Earned (0.0006)**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.0732)
  - Management Soundness (0.4341)
  - Operating Expenses (0.3959)
  - Constant (0.2824)

Key Insight: Claims Incurred, Investment Income, and Net Premium Earned have a significant effect on NPAT, while other variables do not.

B. Impact on ROE (Return on Equity)

- **Significant Variables (p < 0.05):**
  - **Commission (0.0374)**
  - **Claims Incurred (0.0006)**
  - **Investment Income (0.0033)**
  - **Management Soundness (0.0211)**
  - **Net Premium Earned (0.0006)**
  - **Operating Expenses (0.0287)**
  - **Constant (0.0109)**

Key Insight: All variables except Management Soundness are significant for ROE, meaning many financial elements play a role in determining return on equity.

C. Impact on RONW (Return on Net Worth)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (0.0404)**
  - **Investment Income (0.0500, borderline significance)**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.3416)
  - Management Soundness (0.4696)
  - Net Premium Earned (0.9018)
  - Operating Expenses (0.1356)
  - Constant (0.5320)

Key Insight: Only Claims Incurred has a clear significant effect on RONW, while Investment Income is borderline significant.

3. R^2 Values (Model Fit)

- **NPAT (0.972 or 97.2%)** → The model explains 97.2% of NPAT variations, indicating a strong fit.
- **ROE (0.977 or 97.7%)** → The model explains 97.7% of ROE variations, showing an excellent fit.
- **RONW (0.734 or 73.4%)** → The model explains 73.4% of RONW variations, which is moderate but weaker compared to NPAT and ROE.

Since the Table 5 shall try to depict the financial performance and key determinants of NPAT, ROE, and RONW for National Insurance Company Limited (NICL):

- **NPAT:** Significantly influenced by claims incurred, investment income, and net premium earned, with an explanatory power of 97.2%. Commission, management soundness, and operating expenses do not have a notable impact.
- **ROE:** Affected by multiple factors, including commission, claims incurred, investment income, management soundness, net premium earned, and operating expenses, explaining 97.7% of the variation.
- **RONW:** Primarily determined by claims incurred and investment income, accounting for 73.4% of the variation. Other variables exhibit an insignificant impact.

Finally, these results shall try to emphasize the pivotal role of claims incurred and investment income in shaping the financial performance of NICL, while other factors have varying degrees of influence.

Following is some of the various Determinants of NPAT, ROE, and RONW of New India Insurance Company Limited (NIICL) are presented in Table 6.

Table 6 showing the OLS Regression – NICL

Variable	NPAT (P-value)	ROE (P-value)	RONW (P-value)
Commission	0.0732	0.0374	0.3416
Claims Incurred	0.0128	0.0006	0.0404
Investment Income	0.0052	0.0033	0.0500
Management Soundness	0.4341	0.0211	0.4696
Net Premium Earned	0.0006	0.0006	0.9018
Operating Expenses	0.3959	0.0287	0.1356
Constant	0.2824	0.0109	0.5320
R^2	0.972	0.977	0.734

(**Source:** Computed based on secondary data)

Interpretation:-

From the above table-6 shall present the **p-values** for the impact of various variables on **Net Profit After Tax (NPAT), Return on Equity (ROE), and Return on Net Worth (RONW)**, along with **R^2 values**, which measure the explanatory power of the models.

1. Understanding the P-Values

- **P-values < 0.05** → Statistically significant impact.
- **P-values > 0.05** → Not statistically significant.

2. Key Observations

A. Impact on NPAT (Net Profit After Tax)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (0.0128)**
  - **Investment Income (0.0052)**
  - **Net Premium Earned (0.0006)**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.0732)
  - Management Soundness (0.4341)

- Operating Expenses (0.3959)
- Constant (0.2824)

Key Insight: Claims Incurred, Investment Income, and Net Premium Earned have a strong impact on NPAT, while the other variables do not.

B. Impact on ROE (Return on Equity)

- **Significant Variables (p < 0.05):**
  - **Commission (0.0374)**
  - **Claims Incurred (0.0006)**
  - **Investment Income (0.0033)**
  - **Management Soundness (0.0211)**
  - **Net Premium Earned (0.0006)**
  - **Operating Expenses (0.0287)**
  - **Constant (0.0109)**

Key Insight: ROE is influenced by multiple factors, including Commission, Claims Incurred, Investment Income, Net Premium Earned, Management Soundness, and Operating Expenses. All these variables have a statistically significant impact.

C. Impact on RONW (Return on Net Worth)

- **Significant Variables (p < 0.05):**
  - **Claims Incurred (0.0404)**
  - **Investment Income (0.0500) → borderline significance**
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.3416)
  - Management Soundness (0.4696)
  - Net Premium Earned (0.9018)
  - Operating Expenses (0.1356)
  - Constant (0.5320)

Key Insight: Only Claims Incurred significantly affects RONW, with Investment Income being borderline significant. Other factors do not show a strong impact.

3. R^2 Values (Model Fit)

- **NPAT (0.972 or 97.2%)** → The model explains 97.2% of the variation in NPAT, indicating a strong fit.
- **ROE (0.977 or 97.7%)** → The model explains 97.7% of the variation in ROE, showing an excellent fit.
- **RONW (0.734 or 73.4%)** → The model explains 73.4% of the variation in RONW, which is moderate but weaker compared to NPAT and ROE.

Since the net profit after tax (NPAT) of NIICL is been significantly influenced by various factors such as commission, claims incurred, management soundness, and net premium earned, accounting for 96.9% of the variation. However, investment income and operating expenses do not have a significant impact on NPAT. The Return on Equity (ROE) of NIICL is primarily affected by claims incurred, with a significant influence of 84%, while all other variables remain insignificant. The Return on Net Worth (RONW) of NIICL is significantly impacted by net premium earned, explaining 74.2% of the variation, whereas all other variables do not show a significant effect.

Following is some of the various determinants of NPAT, ROE, and RONW for The Orient Insurance Company Limited (TOICL) are presented in Table 7.

Table 7: showing the OLS Regression – TOICL

Variable	NPAT (P-value)	ROE (P-value)	RONW (P-value)
Commission	0.8571	0.6553	0.4224
Claims incurred	0.0015	0.0001	0.0374
Investment Income	0.0724	0.3483	0.0301
Management Soundness	0.6344	0.0213	0.6789
Net Premium Earned	0.0022	0.0008	0.4657
Operating Expenses	0.0085	0.0038	0.7809
Constant	0.7333	0.0274	0.9561
R^2	0.971	0.985	0.934

(**Source**: Computed based on secondary data)

Interpretation:-

This table presents p-values for the impact of various variables on Net Profit After Tax (NPAT), Return on Equity (ROE), and Return on Net Worth (RONW), along with R^2 values, which measure the explanatory power of the models.

1. Understanding the P-Values

- **P-values < 0.05** → Statistically significant impact (strong evidence of effect).
- **P-values > 0.05** → Not statistically significant (weak or no evidence of effect).

2. Key Observations

A. Impact on NPAT (Net Profit After Tax)

- **Significant Variables (p < 0.05):**
  - Claims Incurred (0.0015)
  - Net Premium Earned (0.0022)
  - Operating Expenses (0.0085)
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.8571)
  - Investment Income (0.0724)
  - Management Soundness (0.6344)
  - Constant (0.7333)

Key Insight: NPAT is strongly influenced by Claims Incurred, Net Premium Earned, and Operating Expenses, while the other variables do not have a statistically significant impact.

B. Impact on ROE (Return on Equity)

- **Significant Variables (p < 0.05):**
  - Claims Incurred (0.0001)
  - Net Premium Earned (0.0008)
  - Operating Expenses (0.0038)
  - Management Soundness (0.0213)
  - Constant (0.0274)
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.6553)
  - Investment Income (0.3483)

Key Insight: ROE is significantly impacted by Claims Incurred, Net Premium Earned, Operating Expenses, and Management Soundness. Commission and Investment Income do not have a notable effect.

C. Impact on RONW (Return on Net Worth)

- **Significant Variables (p < 0.05):**
  - Claims Incurred (0.0374)
  - Investment Income (0.0301)
- **Non-Significant Variables (p > 0.05):**
  - Commission (0.4224)
  - Net Premium Earned (0.4657)
  - Operating Expenses (0.7809)
  - Management Soundness (0.6789)
  - Constant (0.9561)

Key Insight: RONW is primarily influenced by Claims Incurred and Investment Income, while all other factors are not statistically significant.

3. R^2 Values (Model Fit)

- **NPAT (0.971 or 97.1%)** → The model explains 97.1% of NPAT variation, indicating a strong fit.
- **ROE (0.985 or 98.5%)** → The model explains 98.5% of ROE variation, showing an excellent fit.
- **RONW (0.934 or 93.4%)** → The model explains 93.4% of RONW variation, which is also very strong.

Since the net profit after tax (NPAT) of TOICL is significantly influenced by claims incurred, net premium earned, and operating expenses, accounting for 97.1% of the variation. However, commission, investment income, and management soundness do not have a significant impact on NPAT. The Return on Equity (ROE) of TOICL is primarily affected by claims incurred, management soundness, net premium earned, and operating expenses, with a significance level of 98.5%, while all other variables remain insignificant. The Return on Net Worth (RONW) is significantly impacted by commission and investment income, explaining 93.4% of the variation, whereas the remaining variables do not exhibit a notable effect.

Following are the determinants of NPAT, ROE, and RONW for United India Insurance Company Limited (UIICL) are presented in Table 8.

Table 8: showing the OLS Regression – UIICL

Variable	NPAT P-value	ROE P-value	RONW P-value
Commission	0.4076	0.5360	0.5138
Claims incurred	0.0029	0.0043	0.0500
Investment Income	0.9103	0.7480	0.0756
Management Soundness	0.9262	0.0405	0.8334
Net Premium Earned	0.0087	0.0095	0.5092
Operating Expenses	0.8067	0.0241	0.5277
Constant	0.9886	0.0362	0.3107
R^2	0.5800	0.9330	0.9040

(**Source**: Computed based on secondary data)

Interpretation:-

This table provides **p-values** for the impact of various variables on **Net Profit After Tax (NPAT), Return on Equity (ROE), and Return on Net Worth (RONW)**, along with **R^2 values**, which measure how well the model explains each dependent variable.

1. **Understanding P-Values:-**
   - P-values < 0.05 → Statistically significant impact (strong evidence of effect).
   - P-values > 0.05 → Not statistically significant (weak or no evidence of effect).

2. **Key Observations**

A. **Impact on NPAT (Net Profit After Tax)**
   - **Significant Variables (p < 0.05):**
     - **Claims Incurred (0.0029)**
     - **Net Premium Earned (0.0087)**
   - **Non-Significant Variables (p > 0.05):**
     - Commission (0.4076)
     - Investment Income (0.9103)
     - Management Soundness (0.9262)
     - Operating Expenses (0.8067)
     - Constant (0.9886)

Key Insight: Claims Incurred and Net Premium Earned significantly influence NPAT, while other factors do not have a statistically significant impact.

B. **Impact on ROE (Return on Equity)**
   - **Significant Variables (p < 0.05):**
     - Claims Incurred (0.0043)
     - Net Premium Earned (0.0095)
     - Management Soundness (0.0405)
     - Operating Expenses (0.0241)
     - Constant (0.0362)
   - **Non-Significant Variables (p > 0.05):**
     - Commission (0.5360)
     - Investment Income (0.7480)

Key Insight: ROE is **significantly influenced by Claims Incurred, Net Premium Earned, Management Soundness, and Operating Expenses**. Commission and Investment Income do not show a strong impact.

C. **Impact on RONW (Return on Net Worth)**
   - **Significant Variables (p < 0.05):**
     - **Claims Incurred (0.0500) → borderline significance**
   - **Non-Significant Variables (p > 0.05):**
     - Commission (0.5138)
     - Investment Income (0.0756)
     - Net Premium Earned (0.5092)
     - Management Soundness (0.8334)
     - Operating Expenses (0.5277)
     - Constant (0.3107)

Key Insight: Only Claims Incurred is marginally significant for RONW (0.0500), but all other variables do not have a strong impact.

3. **R^2 Values (Model Fit)**
   - **NPAT (0.580 or 58.0%)** → The model explains only 58% of NPAT variation, suggesting a moderate fit.
   - **ROE (0.933 or 93.3%)** → The model explains 93.3% of ROE variation, indicating a strong fit.
   - **RONW (0.904 or 90.4%)** → The model explains 90.4% of RONW variation, also a strong fit.

Since the Net Profit After Tax (NPAT) of UIICL is significantly influenced by claims incurred and net premium earned, accounting for 58% of the variation. However, commission, investment income, management soundness, and operating expenses do not have a significant impact on NPAT. The Return on Equity (ROE) of UIICL is significantly affected by claims incurred, management soundness, net premium earned, and operating expenses, contributing to 93.3% of the variation, while all other variables remain insignificant. Similarly, the Return on Net Worth (RONW) is primarily impacted by claims incurred, explaining 90.4% of the variation, with all other factors showing no significant effect.

Discussions

Basically this study aims to analyze and compare the financial performance (FP) of public sector non-life insurers in India. The FP of these companies is assessed using Net Profit After Tax (NPAT), Return on Equity (ROE), and Return on Net Worth (RONW).

Since the mean NPAT scores indicate that NIICL (930.50) and UIICL (150.69) outperform NICL (-435.60) and TOICL (-204.84). Similarly, in terms of ROE, NIICL (3.51) and UIICL (0.316) show better returns compared to NICL (-1.95) and TOICL (-0.63). Regarding RONW, NIICL has a positive score (8.05), while NICL (-102.62), TOICL (-13.53), and UIICL (-150.69) have negative mean scores. Overall, NIICL demonstrates the strongest financial performance, followed by UIICL, whereas NICL and TOICL show moderate performance in comparison. These findings highlight significant differences in the financial performance of non-life insurers in India.

This study shall align with the findings of Sinha and Bandopadhyay (2015), who concluded that financial performance varies significantly among public and private general insurers, as well as among individual public insurers. The key determinants of NPAT and ROE for public sector non-life

insurers are claims incurred, investment income, and net premium earned, while RONW is primarily influenced by claims incurred. However, the analysis of individual public insurers reveals that these determinants vary across companies.

Basic common factors influencing NPAT among public insurers include claims incurred and net premium earned. Similarly, ROE is predominantly affected by claims incurred, net premium earned, management soundness, and operating expenses. In contrast, RONW is influenced by multiple factors, varying across different insurers. This study differs from Morara and Sibindi (2021), who identified investment income as a major determinant of financial performance in Kenyan insurance companies.

Generally, the critical factors contributing to the financial performance of the selected insurers include claims incurred, investment income, net premiums earned, management soundness, and operating expenses.

Conclusions

Generally Insurance is a crucial financial service that provides policyholders with financial security. In India, the insurance sector was privatized in 2000, leading to the entry of several private insurers in both the life and non-life segments. Currently, the Indian insurance industry is in a growth phase.

The study shall aim to analyze and compare the financial performance (FP) of public sector non-life insurers in India. The findings reveal significant differences in the FP of these insurers, with NIICL emerging as the best performer, followed by UIICL. Additionally, the study highlights that the factors influencing financial performance vary across insurers.

Basically the common determinants of NPAT among public sector non-life insurers are claims incurred and net premium earned. Similarly, ROE is predominantly influenced by claims incurred, net premium earned, management soundness, and operating expenses.

This research study shall try to cover data up to March 31, 2024, and does not consider subsequent periods, which is a key limitation. Future research could focus on evaluating the financial performance of private sector non-life insurers and comparing it with that of public sector insurers, particularly in the pre- and post-pandemic periods.

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The Effects of Virtual Influencers on Customer Perceptions and Purchase Intention: An Empirical Investigation in the Indian Market

*Kritika
**Ishani Patharia
***Reeti Gupta

Abstract

The study examines customer awareness of virtual influencers, compares their effectiveness to human influencers in shaping customer perceptions, and provides statistically validated insights into the factors influencing customers' intention to purchase when interacting with virtual influencers. 487 responses were collected from customers who had ever encountered virtual influencers. The findings of PLS-SEM indicate that social presence, anthropomorphism, and performance expectancy are critical factors affecting purchase intention while encountering virtual influencers. Based on the empirical inferences of the study, several pragmatic implications have been suggested for marketers.

Keywords: *consumer behaviour, influencer marketing, PLS-SEM, purchase intention, technology adoption.*

Introduction

In the current digital era, influencer marketing has emerged as a pivotal strategy for brands to engage their target audiences (Liu, 2021). Consumers increasingly rely on influencer recommendations, perceiving them as more trustworthy and relatable than traditional advertisements (Mishra & Ashfaq, 2023). Influencers shape public opinion by leveraging social media and other digital platforms (Yefanov, 2022), fostering authentic connections that enhance the credibility of marketing messages. Their impact extends beyond purchasing decisions, influencing followers' beliefs and lifestyles (Paul et al., 2024). The rise of VIs, also known as digital personas, has gained significant attention from both marketers and scholars (Arsenyan & Mirowska, 2021), signaling a paradigm shift in digital marketing strategies.

A transformative shift in this landscape is the rise of Virtual Influencers (VIs) i.e. computer-generated personas managed by AI or creative teams (Jhawar et al., 2023; Alam et al., 2022). Unlike human influencers, VIs offer brands consistency, scandal-free endorsements, and the ability to cater to diverse demographics. These digital avatars exhibit anthropomorphized traits, blurring the lines between reality and simulation (Skaltsa, 2023). Global brands such as Prada, Samsung, and Calvin Klein have harnessed their potential, with VIs like Lil Miquela, an AI-driven persona advocating inclusivity through collaborations with luxury brands and magazine features (Azim & Nair, 2021; Diksha & Shipra, 2024). Similarly, Shudu Gram, a CGI supermodel, has redefined aspirational marketing for labels like Balmain (Bhattaru & Suvarsha, 2024), while Rozy, Korea's first AI influencer, promotes sustainability and tech-driven messaging (Kannan & Li, 2017). Surveys indicate that 58% of users follow at least one VI, and 35% have purchased products promoted by them (Chatterjee & Ashwin, 2021), underscoring their marketing efficacy.

India's digital economy, with 700 million internet users and a $150 billion online retail market, is witnessing a surge in VIs adoption (Bansal et al., 2024; Srivastava et al., 2024; Sharma & Khanchandani, 2021). Indian brands are actively experimenting with AI-driven influencers to appeal to younger demographics, with lifestyle brands particularly using virtual models for product showcases and brand storytelling (Cornellia et al., 2024). As the country advances toward becoming the fifth-largest global economy (Raj & Sundar, 2024), brands are leveraging VIs in sectors like fashion, FMCG, and technology (Deshwal, 2023). Unlike global counterparts, Indian VIs

*Research Scholar, Department of Commerce, Bhagat Phool Singh Mahila Vishwavidyalaya, Khanpur Kalan, Sonipat, Haryana, India. Email: kritikagahlawat17@gmail.com
**Associate Professor, Department of Commerce, Bhagat Phool Singh Mahila Vishwavidyalaya, Khanpur Kalan, Sonipat, Haryana, India. Email: Ishani@bpswomenuniversity.ac.in
***Assistant Professor, Department of Commerce, Government College for Girls, Sector-14, Gurugram, Haryana, India. E-mail: rs.reeti@gmail.com

emphasize cultural localization, using regional languages, traditional attire, and socially relevant themes. For instance, Kyra, a prominent Indian VI, partners with brands like boAt and Titan Eye+ (David, 2024), while others promote ethnic fusion wear or eco-friendly products, resonating deeply with local values (Lal & Sharma, 2021; Fathima, 2023). Campaigns featuring VIs explaining product usage in regional languages or endorsing regional crafts during festivals like Diwali further highlight their adaptability (Deshwal, 2023).

Despite their growing traction, limited research explores Indian consumers' perceptions of VIs, particularly in comparison to human influencers. While studies suggest that VIs offer unique advantages such as consistency and cultural adaptability, it remains unclear how Indian consumers perceive their authenticity, relatability, and influence on purchase decisions. Furthermore, the factors driving consumer preferences between virtual and human influencers are yet to be thoroughly examined in the Indian context.

To address these gaps, this study aims to:

1. Assess customers' awareness and perceptions of virtual influencers (RO1),
2. Compare customer preferences for virtual versus human influencers and identify the underlying reasons (RO2), and
3. Explore the factors influencing customer purchase intention when interacting with virtual influencers (RO3).

By exploring these aspects, the research will provide practical insights for marketers aiming to leverage VIs within India's rapidly evolving digital ecosystem. The paper comprises six sections. Following this introduction, subsequent sections cover the theoretical background, methodology, findings, managerial implications, and conclusions that address limitations and future directions.

Theoretical Background

The digital marketing landscape has witnessed a significant shift with companies increasingly adopting influencer marketing as a cost-effective promotional strategy (Dao, 2023). Contemporary research identifies influencers as modern opinion leaders who shape consumer behavior through their persuasive content (Singer et al., 2023). The rapid advancement of technology has led to the emergence of virtual identities (VIs) as a novel marketing tool, with notable examples including Lil Miquela and Imma (Byun & Ahn, 2023). These computer-generated avatars, while not fully autonomous, represent a growing market segment projected to expand by 26% by 2025 (Dao, 2023).

Virtual influencers offer distinct advantages such as controllability and alignment with campaign objectives, but simultaneously raise concerns regarding ethics, transparency, and credibility (Kadekova & Holienčinova, 2018; Gerlich, 2023). In contrast, human influencers present authenticity through their organic content creation but introduce unpredictability in brand collaborations (Byun & Ahn, 2023; Robinson, 2020). Generation Z's comfort with digital environments suggests potential receptiveness to VIs (Robinson, 2020; Khuat, 2023), though comprehensive understanding requires further investigation.

H1: There is no significant association between consumer preference for a specific type of influencer and the general attributes associated with influencers.

The effectiveness of influencer marketing hinges on multiple attributes that shape consumer perceptions. Anthropomorphism, defined as attributing human characteristics to non-human entities, plays a pivotal role in VI acceptance (Epley et al., 2008). Research indicates that enhanced anthropomorphism correlates with increased perceived authenticity and trustworthiness (Seymour et al., 2020; Wolff, 2022). However, the uncanny valley phenomenon suggests excessive human-likeness may provoke discomfort (Wirtz et al., 2018; Cottrell, 2023).

Trustworthiness emerges as a fundamental factor, with consumers showing greater receptivity to messages from credible sources (Chiu & Ho, 2023). Studies emphasize that trust significantly impacts message effectiveness, with consumers often preferring influencer content over traditional advertisements (Woods, 2016; Skaltsa, 2023). Additional attributes including expertise, attractiveness, and social connection contribute to campaign success (Lou & Yuan, 2019; Kapitan & Silvera, 2016), though their relative importance varies between VI and human influencers.

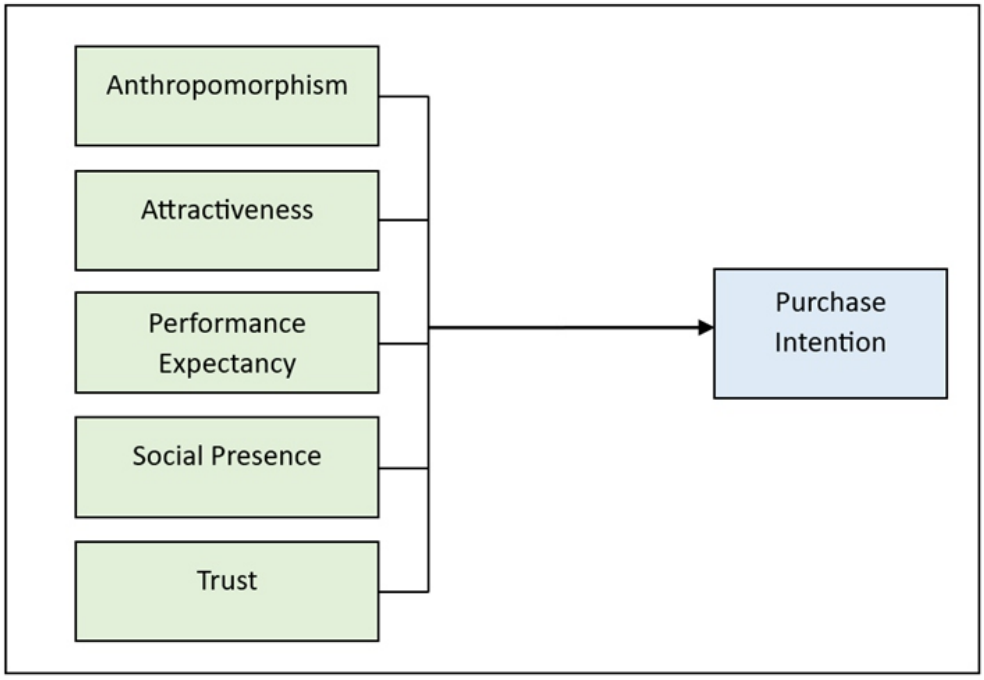
H2: There is no significant association between consumer preference for a specific type of influencer and attributes a) attractiveness b) expertise c) experience d) knowledge e) appeal f) trustworthiness g) impactfulness and h) social connection.

The ultimate measure of influencer marketing effectiveness lies in its ability to drive purchase intentions. Credibility establishment proves particularly challenging for VIs initially, though once achieved, can significantly enhance conversion likelihood (Gerlich, 2023). Authenticity concerns persist regarding VIs, as their artificial nature limits genuine consumer relationships (Conti et al., 2022; Khuat, 2023). Human influencers benefit from stronger social presence through real-time interactions (Hofeditz et al., 2022; Lu et al., 2016). Performance expectancy and social presence emerge as critical determinants of purchase behavior (Oliveira & Chimenti, 2021). While VIs offer novelty in advertising (Franke et al., 2023), their

limited social presence results in lower consumer ratings compared to human influencers (Hofeditz et al., 2022). The Indian market presents a particularly interesting context for study due to its emerging status in VI adoption and limited existing research.

H3: There is no significant influence of attributes a) anthropomorphism b) attractiveness c) performance expectancy d) social presence e) trust on purchase intention.

Figure 1: Theoretical Model for Influence of VI attributes on Purchase Intention



Source: Authors' theoretical model.

Research Methodology

To achieve the objectives, a well-structured questionnaire consisting of 40 statements was prepared. The survey instrument contains three distinct sections. The first section captures respondents' background information including gender, age, region, and highest level of education. The second section assesses respondents' awareness of VIs and their perceptions of both virtual and human influencers. Finally, the third section focuses on factors influencing consumer preferences, measured through statements measured on a five-point Likert scale (1=Strongly Disagree to 5=Strongly Agree).

The online questionnaire was distributed to respondents via multiple digital platforms, including WhatsApp, email, and Facebook Messenger. Using snowball sampling, we acquired 487 complete responses. Participants were selected based on their active engagement with influencer content across various social media platforms.

Statistical analysis was conducted with IBM-SPSS software (version 22) to ensure a robust statistical examination of the collected data. A trial study was performed to develop and optimize the questionnaire for clarity and reliability. Descriptive statistics, including frequency percentages and pie charts, were utilized to analyze respondent preferences and visualize the results. Additionally, chi-square tests were employed to examine significant associations between customers' preferences for virtual versus human influencers and the factors underlying these preferences.

The research utilized Structural Equation Modeling (SEM) to examine hypothesized relationships among key constructs. To verify measurement quality, the analysis incorporated reliability assessments (Cronbach's α and Composite Reliability) and evaluated discriminant validity through Average Variance Extracted (AVE) metrics. Data collection involved a standardized survey instrument featuring 5-point Likert scale items ranging from strong disagreement to strong agreement. The sample was drawn from individuals who actively engage with social media and are familiar with virtual influencers. Statistical methods were applied to validate the measurement model and test hypotheses (Table 1).

Table 1: Statistical Validation Techniques Applied

Reliability Testing
Cronbach's Alpha (≥ 0.7 acceptable, ≥ 0.9 excellent)
Composite Reliability (CR ≥ 0.7)
Validity Testing
Convergent Validity (Average Variance Extracted, AVE > 0.5)
Discriminant Validity (Fornell-Larcker Criterion, HTMT Ratio)
Model Analysis
Path coefficients (β values) for examining direct effects
T-statistics and p-values to test significance ($p < 0.05$ considered significant)

Source: Authors' methodological framework.

Results and Discussions

Out of 487 respondents, 66.12% were male and 33.88% female, indicating a higher male participation rate. In terms of location, 53.10 of respondents resided in rural regions compared to 46.9% from urban areas, reflecting the demographic distribution and rural-urban technology access gap. The average respondent age was 24.59 years (median = 22), ranging from 15 to 60 years, with a standard deviation of 8.512, highlighting a predominantly young sample. Most consumers were already aware of VIs, with 79.1% having heard of them as news anchors, endorsers, or advisors. Additionally, 62.4% had recently seen a VI on TV promoting a product or idea, and 75.6% had encountered a VI on social media before completing the survey.

Additionally, 72.3% of the respondents found human influencers more effective than VIs, though over 75% believe VIs could eventually replace them. While VIs are seen as moderately trustworthy (mode = 6, mean = 18.68) and knowledgeable (mode = 5, mean = 14.70), they are viewed as less human-like (mode = 16) and socially relatable (mode = 16). Purchase intention for VIs is moderate (mode and median = 9, mean = 9.26). The study found no significant link between preference and attributes like attractiveness, expertise, or impact. However, human influencers were rated higher in trustworthiness and social connection. VIs were seen as less trustworthy and relatable, suggesting that boosting their authenticity and social engagement could improve consumer perceptions.

The reliability and validity analysis under SEM shows excellent internal consistency, with Cronbach's alpha and composite reliability values above 0.9. Convergent validity is confirmed by AVE values (0.778–0.885), while the Fornell-Larcker Criterion and HTMT ratios confirm distinct constructs. Some HTMT values exceed 0.85 (e.g., Trust → Performance Expectancy = 0.933), indicating potential construct overlap. However, the Fornell-Larcker Criterion confirms discriminant validity, as the square root of AVE for each construct is higher than its correlations with others. Outer loadings are all above 0.866, confirming strong item reliability.

Table 2: Structural Model Analysis (Hypothesis Testing)

Hypothesis	Path	Path Coefficient (β)	T-Statistic	P-Value	Result
H3a	Anthropomorphism → Purchase Intention	0.132	2.424	0.015	Supported
H3b	Attractiveness → Purchase Intention	0.033	0.545	0.586	Not Supported
H3c	Performance Expectancy → Purchase Intention	0.166	2.369	0.018	Supported
H3d	Social Presence → Purchase Intention	0.450	7.355	0.000	Strongly Supported
H3e	Trust → Purchase Intention	0.191	3.723	0.000	Strongly Supported

Source: Authors' Analysis

The inferences of the study support the results by previous studies that VIs positively effects purchase intention (Angmo et al., 2025; Lou & Yuan, 2019). The analysis shows that social presence has the strongest influence on purchase intention (β = 0.450, p = 0.000), followed by trust (β = 0.191, p = 0.000) and performance expectancy (β = 0.166, p = 0.018). Anthropomorphism (β = 0.132, p = 0.015) has a modest positive effect, while attractiveness (β = 0.033, p = 0.586) shows no significant impact, indicating that visual appeal alone does not drive purchase decisions (Table 2).

Managerial implications of the study

Most consumers are familiar with VIs, mainly encountering them on social media, indicating a need for brands to expand their presence on broadcast media to boost awareness. Awareness is significantly lower in rural areas, highlighting the need for targeted campaigns using broadcast and localized advertising. Consumers generally perceive VIs as trustworthy, attractive, and expert, but are skeptical about their human-like traits and social connection. Despite this, there is moderate willingness to follow VI recommendations. To enhance marketing effectiveness, brands should prioritize authenticity, expertise, and interactive communication, similar to platforms like Alexa or Siri. The study also reveals that while consumers find VIs trustworthy, human influencers are considered more reliable and socially engaging. To strengthen trust and connection with VIs, brands should focus on transparency, direct audience interaction (e.g., live sessions or in-store robotic VIs), and genuine partnerships (Angmo et al., 2025; Khan, 2023).

Additionally, marketers designing virtual influencers should focus on building richer, more interactive social environments and credible narratives rather than solely emphasizing visual appeal. Enhancing social presence and trust could, therefore, be prioritized to boost purchase intention The analysis reveals social presence as the most significant determinant of consumers' purchase intention. This underscores the importance of an engaging, interactive, and socially rich experience even for virtual influencers. In addition, trust and performance expectancy play considerable roles. Although relatively modest, human-like characteristics (anthropomorphism) do add value in shaping consumer behavior, likely by fostering a sense of familiarity or relatability. The fact that attractiveness is not a significant predictor suggests that mere visual appeal, while important for initial engagement, must be complemented by deeper relational and functional qualities to drive actual purchase decisions (Table 3).

Table 3: Practical Implications of the study

Factor	Definition	Result	Implications
Anthropomorphism	The degree to which virtual influencers are perceived as having human-like traits (e.g., emotions, gestures, voice).	Virtual influencers with human-like features (e.g., facial expressions, voice modulation) can mildly enhance purchase intent, but they are less critical than trust or social presence.	Brands should design virtual influencers to exhibit human-like characteristics (facial expressions, emotions, and personality) to increase consumer connection and purchase intention.
Attractiveness	The aesthetic appeal of virtual influencers (e.g., visual design, style).	Unlike human influencers, virtual influencers' aesthetic appeal is irrelevant to purchase decisions. Focus on functionality over looks.	Brands should use attractive VIs for initial engagement but prioritize social presence and trust to drive purchase intention.
Performance Expectancy	The perceived utility of products promoted by virtual influencers (e.g., effectiveness, usefulness).	Highlighting product effectiveness (e.g., reviews, demos) through virtual influencers is critical.	Marketers should ensure that the products endorsed by virtual influencers meet consumer expectations to drive higher purchase intention.

Social Presence	The perception that virtual influencers are "socially real" and interactive (e.g., responsiveness, relatability).	Virtual influencers must feel "alive" (e.g., interactivity, real-time engagement) to maximize consumer buy-in.	Virtual influencers should actively engage with consumers through interactive content, Q&A sessions, and personalized recommendations to enhance social presence.
Trust	Confidence in the virtual influencer's credibility and honesty (e.g., transparent endorsements).	Building trust (e.g., authentic reviews, consistency) is crucial for virtual influencers.	Brands should ensure transparency regarding the AI nature of virtual influencers, providing authentic and relatable content to foster consumer trust.

Source: Authors' Compilation.

Moreover, brands should prioritize interactive experiences by creating immersive campaigns with real-time interactions, live Q&A sessions, and virtual events to enhance social presence. Fostering community engagement through two-way communication on platforms like Instagram and TikTok, along with user-generated content, can strengthen consumer relationships. To boost narrative authenticity, brands should develop story-driven content that makes VIs feel relatable. Transparency and disclosure about the VI's digital nature and brand collaborations will build trust. Partnering with reputable brands and showcasing product benefits through tutorials or real-life scenarios can enhance credibility. Customized interactions with human-like traits, such as empathy and humor, can deepen connections. However, visual appeal should be balanced with relational factors like trust and engagement to drive conversions. Finally, a data-driven, multi-channel approach that integrates social media, interactive content, and consumer feedback will help refine VIs for stronger purchase influence.

Limitations and future recommendations

Study limitations include a sample size of 487 respondents, potentially influencing external validity and introducing selection bias. Time constraints also restricted deeper data analysis. Additionally, self-reported survey responses may not fully reflect true consumer preferences.

Future work could examine different types of influencers, target specific segments (e.g., gamers or younger audiences), and investigate cultural influences on preferences. Studies on key attributes like trust and authenticity and their impact on consumer behavior would add further insights. Comparative research between developing and developed countries could reveal how technological advancement shapes influencer effectiveness.

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Appendix:

Table 1: Frequencies (in per cent) of awareness about virtual influencers

Sr. No.	Mode	Yes	No
1.	I have heard about human like computer generated characters i.e., virtual influencers (VIs) that appear as news anchors, endorsers, advisors.	79.1	20.1
2.	I have recently seen a virtual influencer on T.V. promoting a product or an idea	62.4	37.6
3.	I have recently seen a virtual influencer on social media before felling this questionnaire.	75.6	24.4

Source: Authors' Analysis.

Table 2: Awareness of virtual vs. human influencers

Variable	Pearson Chi-Square Value	p-value	Phi Correlation Coefficient	Significance Level
Gender and Awareness of Virtual Influencers	0.084	0.773	-0.013	Not Significant
Place of Residence and Awareness of Virtual Influencers	18.850	0.000	0.197	Significant
Gender and Exposure to Virtual Influencers on TV	0.857	0.355	-0.040	Not Significant
Place of Residence and Exposure to Virtual Influencers on TV	2.640	0.104	-0.074	Not Significant
Gender and Exposure to Virtual Influencers on social media	2.463	0.117	0.071	Not Significant
Place of Residence and Exposure to Virtual Influencers on social media	0.081	0.776	0.013	Not Significant

Source: Authors' Analysis.

Table 3: Perceptions towards virtual influencers

Attribute	Mode	Median	Mean	Interpretation
Trustworthiness	6	18	18.68	Moderate trust in virtual influencers.
Trustworthiness	6	12	18.68	Virtual influencers are considered as trustworthy by most respondents.
Expertise	5	15	14.70	Virtual influencers are considered as experts by most respondents.
Attractiveness	8	11	11.30	Virtual influencers are seen as attractive by most respondents.
Anthropomorphism	16	12	11.81	Respondents disagree with human-like features in virtual influencers.
Social Connect influencers.	16	13	12.46	Respondents disagree with having a social connection with virtual
Purchase Intention	9	9	9.26	Moderate purchase intention for endorsements by virtual influencers.

Source: Authors' Analysis.

Table 3: Perceptions towards virtual influencers

Attribute	Virtual Influencers	Human Influencers	P-Value	Phi Value	Association
Attractiveness	Standardized Residual: 0.9	Standardized Residual: -0.5	0.056	-0.087	Weak Negative Association (No Significant)
Expertise	Standardized Residual: -0.6	Standardized Residual: 0.3	0.267	0.050	Weak Positive Association (No Significant)
Experience	Standardized Residual: -0.8	Standardized Residual: 0.5	0.118	0.071	Weak Positive Association (No Significant)
Knowledge	Standardized Residual: 0.4	Standardized Residual: -0.2	0.459	-0.034	Weak Negative Association (No Significant)
Appeal	Standardized Residual: 0.5	Standardized Residual: -0.3	0.287	-0.048	Weak Negative Association (No Significant)
Trustworthiness	Standardized Residual:-3.30	Standardized Residual: 2.1	0.000	-	Significant Positive Association (Reject Null)
Impact	Standardized Residual: 0.2	Standardized Residual: -0.2	0.507	-0.024	Weak Negative Association (No Significant)
Social Connection	Standardized Residual: -2.0	Standardized Residual: 1.3	0.000	0.207	Weak Positive Association (Reject Null)

Source: Authors' Analysis.

Table 5: Measurement Scales and Construct Indicators

Construct	Items
Anthropomorphism	AN1 – AN4
Attractiveness	AT1 – AT4
Performance Expectancy	E1 – E5
Social Presence	SP1 – SP4
Trust	T1 – T6
Purchase Intention	PI1 – PI3

Source: Authors' Analysis.

Table 6: Reliability and Validity

Construct	Cronbach's Alpha	Composite Reliability (CR)	AVE
Anthropomorphism	0.922	0.945	0.811
Attractiveness	0.944	0.960	0.857
Performance Expectancy	0.939	0.953	0.804
Purchase Intention	0.935	0.959	0.885
Social Presence	0.929	0.950	0.825
Trust	0.943	0.955	0.778

Source: Authors' Analysis.

Table 7: Discriminant Validity

Constructs	Anthropo-morphism	Attractiveness	Performance Expectancy	Purchase Intention	Social Presence	Trust
Anthropomorphism	-					
Attractiveness	0.854	-				
Performance Expectancy	0.860	0.926	-			
Purchase Intention	0.888	0.856	0.892	-		
Social Presence	0.910	0.862	0.876	0.948	-	
Trust	0.868	0.877	0.933	0.903	0.896	-

*The HTMT test ensures that each construct is distinct.
Source: Authors' Analysis.

Table 8: Path Analysis Results

Anthropomorphism -> Purchase Intention (β=0.132, p=0.015): Anthropomorphism significantly influences purchase intention, indicating that consumers perceive virtual influencers with human-like characteristics as more persuasive.
Attractiveness -> Purchase Intention (β=0.033, p=0.586): The relationship was not statistically significant, suggesting that mere physical attractiveness does not drive purchase intention.
Performance Expectancy -> Purchase Intention (β=0.166, p=0.018): Consumers are more likely to purchase if they expect the promoted product to perform as advertised.
Social Presence -> Purchase Intention (β=0.450, p=0.000): Social presence had the strongest impact, indicating that virtual influencers who can mimic social interactions are more effective.
Trust -> Purchase Intention (β=0.191, p=0.000): Trust significantly impacts purchase intention, highlighting that consumers are more likely to buy products endorsed by virtual influencers they trust.

Source: Authors' Analysis.

Effect of Organizational Silence on Organizational Citizenship Behavior: A Study of Indian Service Sector

*Mandeep Singh
**Garima Bansal
***Mahak Garg
****B.K. Punia

Abstract

The present study aims to explore the relationship between Organizational Silence (OS) and Organizational Citizenship Behavior among service sector employees in India. A survey research method was deployed, and data was collected from 516 service sector employees using convenience sampling and analysed using SPSS AMOS 22.0. The key findings of this study indicate that acquiescent silence and defensive silence are associated with a detrimental impact on organizational citizenship behavior, while prosocial silence has a positive impact. This work makes a valuable contribution to the current body of literature by presenting empirical evidence that establishes a relationship between these two concepts and offers organizational recommendations to mitigate the negative effect of Organizational Silence on the Organizational Citizenship Behavior of employees. These findings may benefit future researchers, organizational managers, and leaders. Furthermore, the current study has limitations in terms of contextual features and the research methodology used.

Keywords: *Organizational Citizenship Behavior, Organizational Silence, Defensive Silence, Acquiescent Silence, Prosocial Silence, Employee Silence, Extra-role Behaviors, Civic virtue, Obedience, loyalty.*

Introduction

Employees in any organization, serve as primary catalysts for innovation, creativity, and transformation. As a result, they are invaluable assets that determine the success of organization. (Sulphey and Alkahtani, 2017). Contemporary organizations these days, have an increased expectation for employees who possess enhanced confidence and engagement, enabling them to assume additional tasks, express their opinions, and proactively navigate and thrive within an evolving corporate landscape. Conversely, it is observed that a subset of employees in organization exhibits a tendency to maintain silence and abstain from vocalizing their thoughts or opinions (Morrison, 2014). It can have many plausible reasons, and the whole scenario is described as organizational silence (hereafter referred to as OS) (Morrison and Milliken, 2000; Pinder and Harlos ,2001; Dyne et al, 2003). In the OB literature, it has been recognized as one of the critical areas of research, yet it is still in a nascent stage. (Morrison 2014; Sahabuddin et al, 2023). OS has recently garnered the interest of researchers as a distinctive phenomenon in which individuals choose to keep their opinions, worries, or suggestions to themselves, resulting in an absence of open interaction at the workplace. This scenario can have far-reaching consequences for employee behavior and the organization as a whole (Morrison and Milliken, 2000; Morrison, 2023). Organizational silence is created at organizational level and is influenced by variety of organizational attributes i.e., management structures, decision making process, and, organizational culture, describing the exhibition of silence behavior of every employee as per their perception (Morrison and Milliken, 2000; Vakola and Bouradas, 2005).

Consequently, organizations often prioritize the cultivation of employee commitment towards achieving organizational objectives and promoting civil behavior within the workplace. The phenomenon of engaging in pro-social and civil behavior within an organization is sometimes referred to as Organizational citizenship Behavior (OCB). OCB conceptually refers to volunteer employee behaviors beyond their assigned job responsibilities that can have positive impact on overall organizational effectiveness (Organ, 1997; Ocampo et al.,201; Bansal et al., 2025). Many studies have found that helping

*Research scholar, Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar-125001. E-mail- mandeepmalik3168@gmail.com
**Research scholar, Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar-125001. E-mail- bansalgarima15@gmail.com
***Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar-125001. E-mail- mahakgarg139@gmail.com
****Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar-125001. E-mail- bkpunia@rediffmail.com

behaviors and altruism contribute to the social functionality of social systems and institutions. These selfless and helpful acts have been proven to possess significance for modern-day organizations, in addition to their broad societal relevance (Vigoda-Gadot, 2006; Yadav and Punia, 2021). OCB has numerous descriptions in literature and it is stated as those sets of behavioral aspects that focus on social context along with the job requirements and performance (Todd and Kent, 2006; Indarti and Hakim 2017). It is observed that as opposed to other organizations in service industry, we find increased need of OCB and there are more instances where such behaviors can be displayed. In India, service industry is of prime importance and has a considerable relevance as a part of the whole economy. It has grown significantly in the recent past but despite its expansion and significance, the service industry is not free from the problems posed by organizational silence. Employees in this industry frequently experience unusual work conditions that can influence their readiness to express themselves and engage in OCB. It is widely acknowledged that employees participate in organizational activities freely, and according to Organizational Citizenship Behavior theory, employees avoid disclosing their opinions in organizational decision making. As a result, employees that engage in organizational silence are less likely to conduct organizational citizenship behavior. Both OS and OCB can be viewed as the critical aspects for organizations to achieve their goals.

The afore-mentioned discussion presents a compelling research problem that this study aims to pursue. It examines the relationship between OS and OCB among employees in Indian service industry. Managers can obtain useful insights into the negative effects of OS and its propensity to obstruct OCB and ultimately impact the whole organizational systems. Furthermore, the primary objective of this study is to contribute novel insights to the existing corpus of scholarly literature by discovering the unexplored dynamics between OS and OCB, as well as shed light on the specific setting of the Indian service industry. The subsequent sections of this paper are structured as follows: Section 2 will provide a comprehensive overview of the relevant literature and present the research framework; Section 3 will discuss the research methods; and Section 4 will present the analysis's findings. After Section 4, the paper concludes with a discussion of the findings, and insights are drawn for practical suggestions and future research directions. Ultimately, the study is concluded, mentioning the key contributions and limitations.

Theoretical Background

Organizational Silence (OS)

The emergence of organizational silence (OS) can be perceived as being cut off from communication; however, in reality, it manifests as an essential form of communication. In accordance with Pinder and Harlos 2001; Brinsfield, 2013; Srivastava et al., 2019; AL-Abrrow 2022), silence is the absence of voice, but it includes a range of mental states, such as disagreement and endorsement, and can be considered a form of communication. In other words, Silence is defined by Knoll and van Dick (2013),

"A state in which employees refrain from calling attention to issues at work such as illegal or immoral practices or developments that violate personal, moral, or legal standards."

In fact, silence relates to a multitude of actions like avoidance of writing, failure to attend, being negative, not being heard, or disregarding others (Akbarian et al., 2015; Pirie 2016). A notable research study in this particular domain asserts that when a substantial proportion of individuals within an organization opt to refrain from expressing their opinions or concerns regarding organizational affairs (Burris et al. 2010), this silence assumes the character of collective action (Morrison and Milliken, 2000). In practice, employees usually have opinions for improving the organization in one way or another and sometimes they voice those ideas and opinions, other times they remain silent. Interestingly, both actions appear to be completely contradictory because silence means avoiding to speak, whereas voicing is speaking out about critical issues at the workplace (Zehir and Erdogan, 2011). Morrison and Milliken (2000) introduced the concept of employees' willingness to withhold their viewpoints and concerns about organizational problems, naming it "organizational silence". OS is influenced by organizational characteristics such as organizational culture, structure, policies and the environment (Cetin, 2020). Consciously keeping views, opinions and critiques to themselves can have detrimental effect on both employees and organizations. In such scenario, sometimes employees feel undervalued that further leads to lesser job satisfaction (Ehtiyar and Yanardağ, 2008). Moreover, OS obstructs the advancement of the organization (Morrison and Milliken, 2000), harms adaptation to learning organizations and environments and limit communication (Premeaux and Bedeian, 2003; Tangirala and Ramanujam, 2008).

Earlier OS researchers focused their attention to the central aspect of withholding information but when reasons for such behavior were explored and explained, it was found that OS is a multi-dimensional construct (Dyne et al., 2003). Silence has historically been linked to passive behavior but it is not always true (Scott, 1993) and it can also be characterized as active, aware, purposeful, and deliberate (Pinder and Harlos, 2001; Cetinkaya and Karayel 2019). In a similar vein, silence may also be used strategically and proactively. For instance, when employees withhold intimate information about the company from others, the silence is strategic. Building upon a comprehensive literature review of relevant scholarly works, this research focuses on three essential elements of OS. The

subsequent sub-sections delineate these three dimensions of silence, namely defensive silence, acquiescent silence, and prosocial silence (Sulphey 2020; Chou and Chang 2020).

Acquiescent Silence (AS)

Morrison and Milliken (2000) claimed that employees often refrain from sharing their views due to the notion that their opinions are not wanted or valued by their supervisors and the upper management. In accordance with the perspective of Dyne et al. (2003), employees consider their contributions as lacking significance when superiors disregard them or when management actively discourages them from expressing themselves. As a result of this perception, employees start to be acquiescently silent. Pinder and Harlos (2001) found that acquiescent silent individuals are unwilling to intervene in their environment. More specifically, acquiescent silence implies detached behavior that is more unreceptive (Kahn, 1990; Kazmi 2022). Van Dyne et al. (2003) illustrated some examples of acquiescent silence (AS), such as withholding opinions and facts to themselves due to perceived inability to influence the situation at workplace. Employees engage in such behavior due to factors beyond their direct control as they perceive that they are unable to change anything with their opinions.

Defensive Silence (DS)

Defensive silence can be understood as a deliberate effort to withhold relevant information (Van Dyne et al., 2003). It is a proactive strategy aimed to intentionally protect oneself from minor risks (Schlenker and Weigold, 1989). In contrast to acquiescent silence, defensive silence is characterized by a proactive and deliberate approach. It means that when people choose to stay quiet, they are doing so on purpose after thinking it as the best thing to be done at that moment (Rai and U. A., 2018; Qi and Ramayah, 2022). Previous studies list examples of defensive silence i.e., for instance, someone might not share certain information because they are worried that speaking up could be dangerous for them if important information is left. Moreover, the Mum Effect is consistent with the conception of defensive silence, which is driven by deliberate avoidance and self-protective motivations. The Mum Effect refers to a phenomenon wherein individuals decline to deliver unfavorable information or postpone its communication in an effort to prevent any personal consequences, commonly referred to as “killing the messenger" (Van Dyne et al., 2003). Defensive silence is like a protective shield people use to hide their flaws. When employees at a company feel isolated by their bosses, it can affect how creative they are. So, when workers cut off their social connections in the workplace, they start behaving differently, which can include staying quiet instead of speaking up (Diefenbach and Sillince 2011; Dedahanov et al., 2021). As a result, employees who feel rejected by their supervisors might feel powerless, lose their motivation to follow the rules, and resort to defensive silence as a way to protect themselves. Based on recent research findings pertaining to exclusion and feelings of powerlessness, it is substantiated that employees experiencing exclusion at the workplace may engage in defensive silence (Vakola and Bouradas, 2005; Guo et al., 2018). This behavior has the potential to impede employees' capacity for creative thinking and innovation (Kim et al., 2013).

Prosocial silence (PS)

Prosocial silence, according to Van Dyne et al. (2003), is when employees choose not to share their work-related ideas, facts, or opinions in order to help others or benefit the organization. This silence is driven by their desire to be supportive and altruistic (Morrison, 2014; Rhee et al., 2014; Imam and Kim, 2023) Prosocial Silence, akin to organizational citizenship, entails a proactive and deliberate behavior directed towards others, as articulated by Korsgaard et al. (1997). Moreover, it is noteworthy that prosocial silence is an intentional act, unburdened by any organizational mandates. In this context, individuals may choose to withhold information from others, safeguarding a co-worker, employer, or the organization from complications, as elucidated by Knoll and Van Dick (2013). According to Van Dyne et al. (2003); Kızrak and Yeloğlu (2024), the act of prosocial silence is driven by a genuine care for others rather than a personal fear of facing negative repercussions. For instance, maintaining the confidentiality of organizational information for betterment of the company can be regarded as a cooperative behavior by an employee. Similarly, exercising discretion with regard to insider information, refraining from the misuse of personal information about others, and upholding confidentiality all necessitate employees to actively and purposefully withhold specific ideas out of concern for the organization and in pursuit of its welfare.

Organizational Citizenship Behavior (OCB)

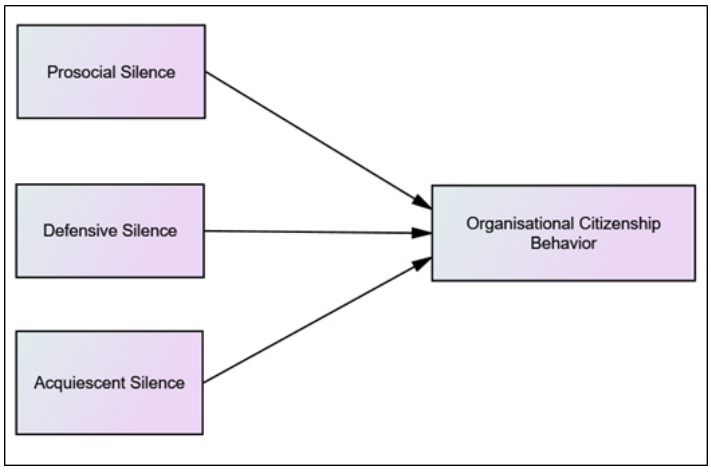
The term “organizational citizenship behavior” (OCB) is specifically attributed to Bateman and Organ (1983). Although the notion of extra-role behaviors at work has been previously discussed by Katz and Kahn (1966), it is important to further examine this issue. Organizational Citizenship Behavior (OCB) is defined as actions that employees choose to do voluntarily (Organ, 1988; de Geus 2020). These actions are not directly linked to getting rewards but are done to benefit the organization. Later in 1997, Organ refined this idea to include any extra work-related tasks that go beyond the assigned roles and make the workplace better for individuals in terms of their feelings and relationships (Zeinabadi and Salehi, 2011; Yadav and Punia 2013; Cem-Ersoy et al., 2015; Khaola and Rambe 2021; Halder and Chatterjee 2024). In an organizational setting, employees have the freedom to make choices about their actions at work. These choices are not something that can be forced upon by means of their job description and employment contract (Acaray et al., 2015; Yadav and Punia, 2021). These choices are personal decisions, and employees cannot be

punished for not following them. In recent decades, there has been substantial progress in the field of Organizational Citizenship Behavior (OCB) research. Since its inception in 1983, researchers have identified more than 30 distinct dimensions of OCB (Podsakoff et al., 2000; Rodrigues and Ferreira, 2015). Organ (1988) initially outlined five core forms of OCB, including Altruism, which involves spontaneous acts of assistance to others, such as helping absent co-workers and mentoring new employees among others (Pare and Tremblay, 2000; Azmi and Jayakrishnan, 2016; Pfattheicher et al.,2022). Additionally, Courtesy includes behaviors like politeness, respect, and civility that contribute to preventing workplace issues (Organ, 1997; Podsakoff and MacKenzie, 1997; Yoon et al., 2022). Conscientiousness means being ready to do more than what your job officially requires, like working extra hours or taking on tasks outside your regular duties (Organ, 1988; Spielmann et al., 2022; Bansal et al., 2025). Sportsmanship refers to how well employees can handle not-so-great work conditions without complaining or putting their own interests before the company's (Castro et al., 2004; Mohammad et al., 2011; Puspitasari et al., 2023). Civic Virtue means actively getting involved in the company's activities and helping with administrative tasks (Snow 2018; Sundary,2023). In 1989, Graham took Organ's research a step further by introducing four dimensions connected to Organizational Citizenship Behavior (OCB): Loyal Boosterism, Individual Initiative, Personal Industry, and Interpersonal Help. Van Dyne et al. (1994) identified three additional dimensions: Loyalty, Obedience, and Participation. Dewett and Denisi (2007) categorized OCB dimensions into two distinct types of citizenship behaviors: Maintenance Citizenship Behavior, encompassing Conscientiousness, Compliance, Courtesy, Cheerleading, Sportsmanship, Altruism, and Goodwill, all of which enhance the sustainability of support relationships; and Change-Related Citizenship Behavior, which includes Advocacy, Individual and self-Initiative, Participation, Leadership, Innovation, and other forward-looking behaviors (Dewett and Denisi, 2007). In summary, the multifaceted nature of organizational citizenship behavior has evolved over time, with various scholars contributing to its conceptualization. These dimensions encompass behaviors that go beyond formal job roles and play a crucial role in shaping the organizational culture and employee interactions (Somech, and Ohayon, 2020).

Organizational Silence (OS) and Organizational Citizenship Behavior (OCB)

Reviewing the literature, we found that limited research has been conducted exploring the relationship between OCB and OS. Existing scholarly research indicates a notable negative relationship between these two variables. (Corporanzo et al., 1997; Rhoades and Eisenberger, 2002; Saghih et al., 2023). When employees are discouraged from freely expressing their opinions about their work, it has a negative effect on their engagement in Organizational Citizenship Behavior (OCB), which is a pivotal aspect that should be promoted within all businesses. OCB plays a significant role in maintaining smooth operations and nurturing the overall functionality of the organization. Research has consistently indicated that civic behavior positively influences individual and organizational performance (Martina and Nagarajan, 2022) Organizational silence is influenced by a variety of internal factors within a company. When left unaddressed, this phenomenon can have profound and consequential implications. It tends to result in employees maintaining a reserved demeanour, thereby reducing their propensity to engage in behaviors associated with organizational support and advancement. Furthermore, it is imperative to discern and categorize the different forms of employee silence. Specifically, employees who exhibit acquiescent or defensive modes of silence are notably less inclined to demonstrate behaviors that contribute positively to the organization. Conversely, those practicing prosocial silence tend to exhibit more inclination towards engaging in corporate citizenship behavior.

Figure 1: Research Framework



Source: Author's Own

Hypothesis Development

On the basis of above discussion, we hypothesize that:

H1: Prosocial silence (PS) has a positive effect on organizational citizenship behavior (OCB).

H2: Defensive silence (DS) has a negative effect on organizational citizenship behavior (OCB).

H3: Acquiescent silence (AS) has a negative effect on organizational citizenship behavior (OCB).

Research Methodology

Measurement instrument development

For measurement of all the concepts and constructs, we developed a structured questionnaire to be used as a survey instrument based on the theoretical framework proposed in Section 2.3. We conducted a literature survey to identify existing scales and items that have been used to measure constructs under consideration in similar contexts. Our questionnaire included items such as defensive silence (DS), acquiescent silence (AS), and prosocial silence (PS) making up the organizational silence scale adopted from Dyne et al. (2003) and OCB scale adopted from Singh and Kolekar (2015). These items were modified and adapted to suit the needs of our study. The questionnaire consisted of two distinct sections. Part A encompassed a cover page that described the contextual background of our investigation to the participants. The purpose of the research was mentioned and confidentiality was ensured. Furthermore, it included questions relating to the demographic profile and career-related aspects of the respondents. Part-B contained fixed alternative questions related to the constructs under study. The measurement of each item was conducted using 5-point Likert scales, where a rating of 1 represented "strongly agree" and a rating of 5 represented "strongly disagree."

Data Collection & Analysis

Data was collected using convenience sampling targeting 600 full-time employees of an Indian companies (Private and public) operating within service sector. Out of the 600 survey distributions, 530 employees returned surveys, 14 of which were found invalid owing to missing information or inattentive fill-ups of the survey. Ultimately, were left with 516 valid responses that were analyzed further. In social science research, a return rate of 86% can be regarded as a satisfactory return rate as the expected rate of return in this case is generally 20-40%. Data was analyzed using SPSS AMOS 22.0.

Results and Findings

Sample profile

The sample profile of respondents (Table 1) represents the categories as per gender, age, industry type, and salary. The sample had 162 female (31.4%) and 354 male (68.6 %) employees. Age was grouped into 18–25 years, 26–35 years, 36–50 years, and 50 years and above; the frequency of participants is 143, 179, 56, and 33, respectively representing diverse range of career stages.

Table 1. Demographic Characteristics of the Study Sample

Demographics	Category	Frequency	Percentage %
Gender	Male	162	31.4
	Female	354	68.6
Age	18-25 years	143	34.8
	26-35 years	179	43.6
	36-50 years	56	13.6
	Above 50 years.	33	8
Industry Type	Banking	78	15.1
	Education	156	30.2
	Hospital	70	13.6
	IT & ITES	74	14.3
	Manufacturing units	76	14.7
	Tourism and Hospitality	62	12.0

Salary	Up to 200000	160	31.0
	200000-500000	198	38.4
	500000-1000000	94	18.2
	Above1000000	64	12.4
	Up to 200000	160	31.0
Sector	Private	338	65.5
	public	178	34.5

Source: Author's own

Industry type was grouped into six categories: Banking, Education, Hospitals, IT and ITES, Manufacturing units, Tourism, and Hospitality, with frequencies of 78, 156, 70, 74, 76, and 62, respectively. Salary was grouped into four categories: up to 2 lakhs, 2 lakhs to 5 lakhs, 5 lakhs to 10 lakhs, and above 10 lakhs, with a frequency of 160, 198, 94, and 64, respectively. The sector of the organization was grouped into two categories: private and public, with frequencies of 338 and 178, respectively.

Reliability and Validity Test

Confirmatory factor analysis was used to check the reliability and validity of the constructs. First, as shown in Table 2 and figure 2, all factors' loadings are higher than the suggested threshold of 0.6 (Chin et al., 1997). Furthermore, Cronbach's alpha (α) and composite reliability (CR) were used to check the internal consistency of the scale. Both the α and CR values, as shown in Table 2, are above the 0.7 benchmark (Hair et al., 2019). Further, for assessing the scale's convergent validity, average variance extracted (AVE) was used. All constructs (Table 2) have AVE values that exceed the benchmark of 0.5 (Hair and Alamer, 2022). Thus, the scale used in the study established the required reliability and convergent validity.

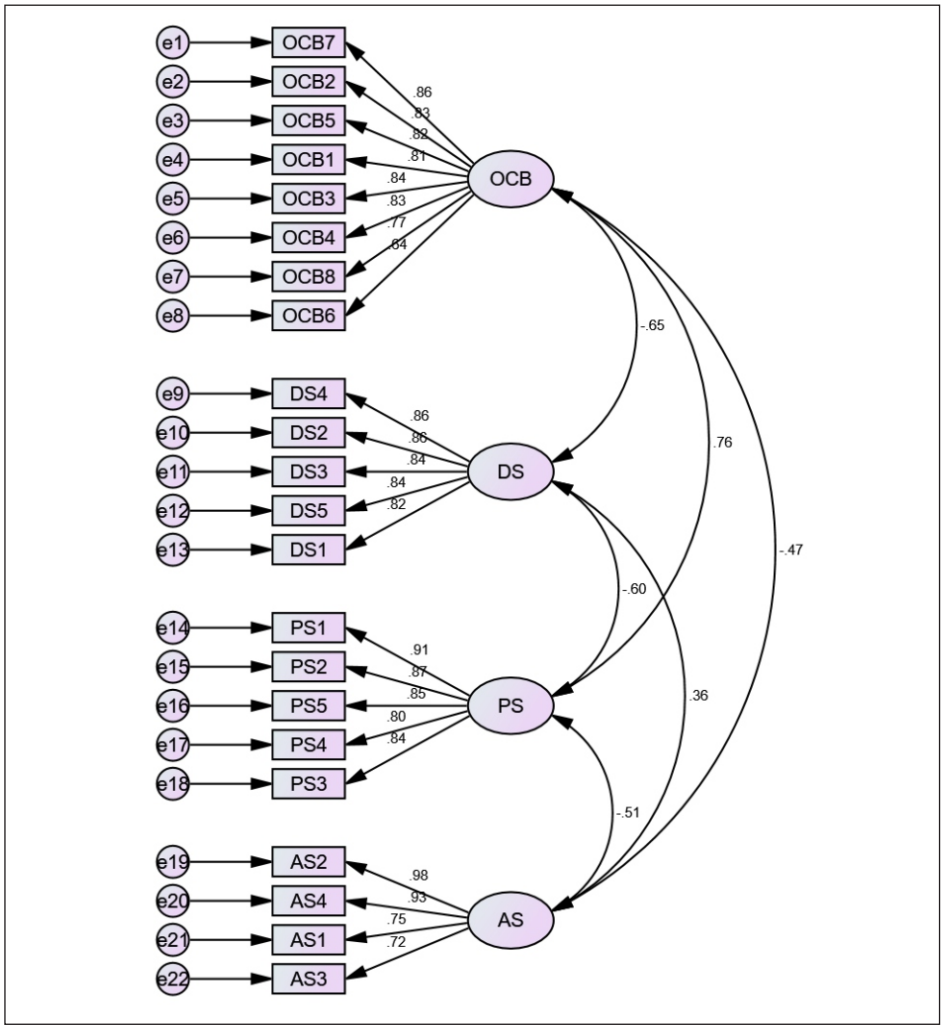
Table 2. Construct's Reliability and Validity

Constructs	Indicators	Loadings	CA	CR	AVE
Prosocial Silence			0.927	0.930	0.728
	PS1	0.906			
	PS2	0.870			
	PS3	0.840			
	PS4	0.800			
	PS5	0.847			
Defensive Silence			0.925	0.926	0.713
	DS1	0.821			
	DS2	0.859			
	DS3	0.842			
	DS4	0.862			
	DS5	0.837			
Acquiescent Silence			0.917	0.914	0.731
	AS1	0.752			
	AS2	0.981			
	AS3	0.723			
	AS4	0.935			

Organizational Citizenship Behavior			0.933	0.935	0.644
	OCB1	0.813			
	OCB2	0.830			
	OCB3	0.837			
	OCB4	0.832			
	OCB5	0.823			
	OCB6	0.637			
	OCB7	0.862			
	OCB8	0.766			

Note(s): PS = Prosocial silence, DS= Defensive silence, AS=Acquiescent silence, OCB=Organizational citizenship Behavior
Source: Author's own

Figure 2: Measurement model



Note(s): PS = Prosocial silence, DS= Defensive silence, AS=Acquiescent silence, OCB=Organizational citizenship Behavior
Source: Author's own

Table 3. Discriminant Validity

	OCB	DS	PS	AS
OCB	0.803			
DS	-0.651***	**0.845**		
PS	0.762***	-0.600***	**0.853**	
AS	-0.469***	0.360***	-0.508***	**0.855**

Note(s): PS = Prosocial silence, DS= Defensive silence, AS=Acquiescent silence, OCB=Organizational citizenship Behavior
Source: Author's own

For measuring the discriminant validity of the scale, Fornell and Larcker criteria (1981) was used. According to this method, scale is discriminately valid when the square root of AVE for given constructs exceeds its correlation with other constructs in the study. As shown in Table 3, results show adequate discriminant validity of the scale.

Model fit assessment

Table 4: Goodness-of-fit indices for variables under study

Fit index	CMIN/DF	CFI	TLI	NFI	RMSEA	SRMR	P Close
Acceptable value	Between 1and 3	>0.95	>0.95	>0.95	<0.06	<0.08	<0.05
Model fit score	2.398	0.970	.966	.950	0.052	0.052	0.272

Source: Author's own

The results as shown in Table 4, suggest that the model provides a good representation of the relationship between OS and OCB. The CMIN/DF value reveals that the model fits the data well, and the CFI, TLI, NFI, P Close, RMSEA, and SRMR values also suggest that the model is a good fit. In conclusion, there is no scope for improvement as all of the indices reach or surpass the specified thresholds. The model is reliable and valid for exploring the association between OS and OCB.

Hypothesis Evaluation

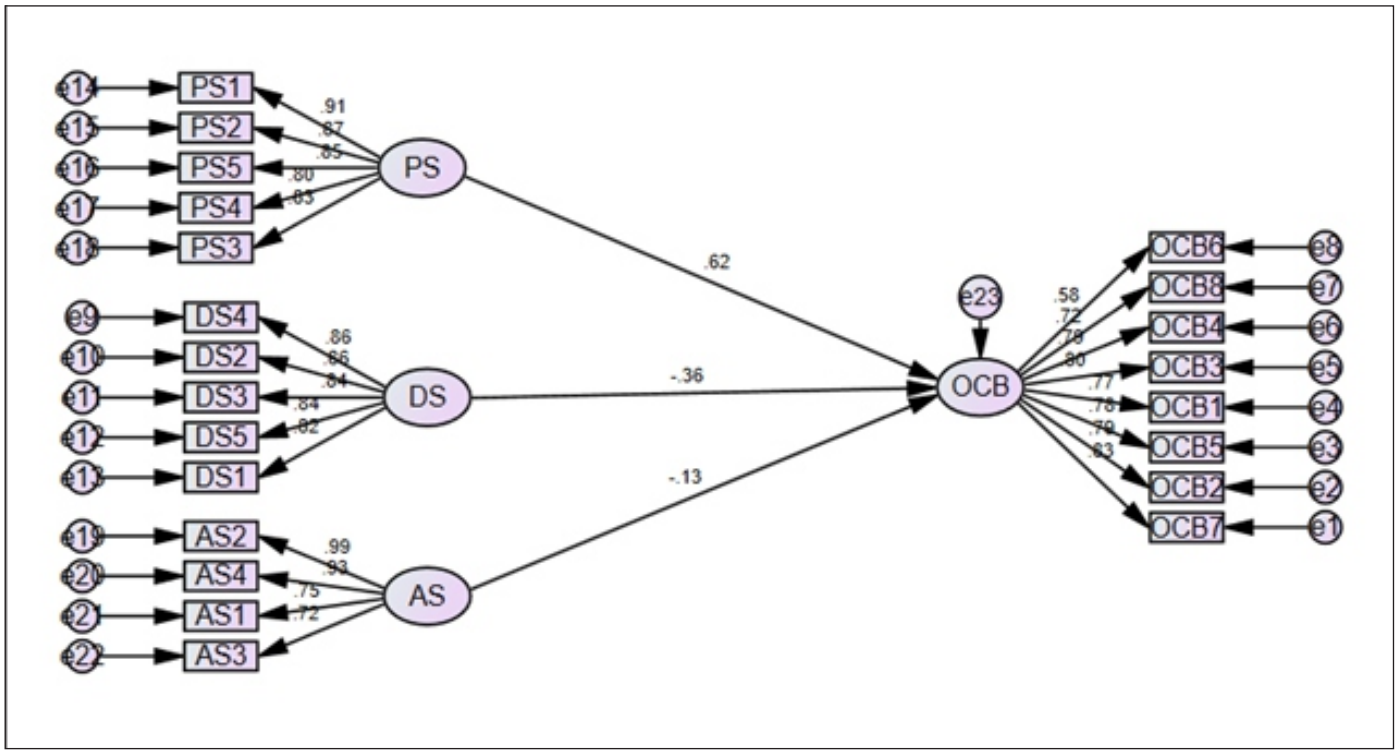
Table 5: Results of Structural Model

	Dependent Variable (DV)			
	OCB			
Independent Variable (IV)	**β**	**Lower Bound**	**Upper Bound**	**Sig**
PS	.615	4.005	.688	.001
DS	-.361	-9.132	-.276	.001
AS	-.129	-13.95	-.039	.001
R^2		0.645		

Note(s): PS = Prosocial silence, DS= Defensive silence, AS=Acquiescent silence, OCB=Organizational citizenship Behavior
Source: Author's own

Research used path analysis to conduct hypothesis testing. Results shown that Prosocial silence (PS) has a favorable impact on organizational citizenship behavior, as shown in Table 5 (β= .615, p<.001) where defensive silence (DS) has a negative impact on organizational citizenship behavior (OCB) (β= -.361, p<0.001) and according the result, acquiescent silence (AS) has also a detrimental impact on organizational citizenship behavior (OCB) (β = -.129, p< 0.001). The H1, H2, and H3 hypothesis are supported in this situation.

Figure 3: Path Model



Source: Author's own

The Path model as shown in Figure 3 represented the significant path coefficients among the study variables i.e., OS and OCB
Figure 3: Path Model

Discussion and Implications

This study aims to present a conceptual framework that elucidates the interplay between organizational citizenship behavior (OCB) and the construct of organizational silence. The proposed model offers a valuable tool for academics and managers to comprehend this interaction within an organizational context. In the contemporary landscape of business, it is imperative for organizations to cultivate and maintain a competitive advantage in order to endure and thrive. As a result, organizations must make efficient use of their human resources and make the most of the potential that their personnel possess. Employees who are self-assured, capable of responding to environmental challenges, and ready to divulge their knowledge are essential to the organization's ability to continue operating successfully and uninterruptedly. Employers can use voice as a powerful tool to gather valuable ideas and insights from employees, aiding the organization in achieving its goals. Furthermore, employees unofficially declared extra efforts can significantly contribute to achieving strategic goals and gaining competitive advantages. Based on our research findings, it has been determined that silence within an organization, particularly defensive silence and acquiescent silence, might have a negative effect on the behavior of individuals who possess organizational citizenship. Employees' organizational citizenship behavior suffers when they lack encouragement to express their thoughts. This leads to missed possibilities for fresh thoughts and creative solutions. Consequentially, it is vital for businesses to cultivate a culture that fosters and promotes the expression of employee opinions. On the contrary, prosocial silence may have a favourable effect on organizational citizenship behavior. This suggests that when employees choose not to express their opinions regarding their workplace and the people they work with for the benefit of the organization, their organizational citizenship behavior actually improves. In light of this, it is of the utmost importance for managers to foster and cultivate an environment in the workplace that values open communication and feedback systems. Consequently, this will contribute to the development of a wide variety of viewpoints and ideas, which can ultimately result in more efficient decision-making and organizational planning. They have the ability to further enhance their overall performance and their response to changes in the environment if they encourage individuals within their workforce to engage in organizational citizenship behavior.

The implications of the study's findings hold significant management relevance for organizations functioning within the service industry in India. Specifically, the results suggest that

reducing defensive and acquiescent silence among employees can improve their organizational citizenship behavior, which in turn can lead to positive outcomes for the organization, such as increased productivity, customer satisfaction, and employee retention. Managers can take several steps to reduce defensive and acquiescent silence in the workplace. For example, they can create a culture of open communication and encourage employees to share their concerns and ideas without fear of retaliation. They can also provide regular feedback and recognition to employees who demonstrate organizational citizenship behavior, which can serve as positive reinforcement for desired behaviors. Additionally, managers can provide training and development opportunities to employees to improve their communication skills and build their confidence in expressing their opinions and ideas. In general, the results of this study indicate that addressing organizational silence may have important implications for improving organizational citizenship behavior and enhancing organizational performance in the service sector in India.

Conclusion and Constraints

Defensive silence and acquiescent silence have detrimental consequences on organizational citizenship behavior (OCB), according to the present study, which sought to explore this relationship among Indian workers in the service industry. Conversely, prosocial quiet had a positive effect on corporate citizenship behavior. The above stated results suggest that it is critical for companies to have a supportive environment in which staff members may openly share their thoughts and views without fear of negative consequences. enhanced corporate citizenship behavior may result from this, and enhanced citizenship behavior may eventually boost organizational performance. Organizations also need to be aware of and responsive to the detrimental impacts that organizational silence has on worker job satisfaction, organizational learning, creativity, and innovation.

The current research possesses various constraints that present avenues for future investigation. First, the study primarily concentrated on the service industry in India, perhaps constraining the applicability of the results to different industries or cultural contexts. Further studies may endeavor to replicate the present research across several sectors or nations in order to assess the stability of the observed relationships. Furthermore, the study employed self-reported measurements, a method that may involve biased responses and may restrict the precision of the data obtained. Future studies could incorporate other methods, such as observational data or interviews with employees and managers, to triangulate findings and provide a more comprehensive understanding of the relationships between organizational silence and OCB. Finally, the study only examined the relationship between organizational silence and OCB, without exploring the potential mediating or moderating variables that may impact this relationship. Further studies could investigate other factors, such as organizational justice, organizational trust, or leadership styles that may influence the relationship between organizational silence and OCB.

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Mapping Blockchain's Impact: A Bibliometric Analysis of Decentralized Finance's Future

*Priya Yadav

Abstract

The internet is gradually moving towards decentralisation, and distributed networks and blockchain technology are essential to changing infrastructure and fostering innovation in a variety of industries. Blockchain's ability to ensure security, authentication, and transparency, combined with the decentralized nature of networks, has given rise to Decentralized Finance (DeFi) a transformative paradigm in the financial sector. Despite growing interest in blockchain and DeFi, there remains a significant gap in bibliometric studies that analyze the broader research landscape of blockchain technology. This study aims to address that gap by conducting a bibliometric analysis of blockchain-related research, with a particular focus on DeFi and its security implications. Drawing from over 493 articles published between 2017 and 2024 in the Scopus database, this study examines global trends in blockchain and DeFi research, identifying key research areas, geographic distributions, and collaborative networks. The findings show that China leads in blockchain research productivity, followed by India and the USA. Although the USA and New Zealand publish fewer articles, they receive notable citation attention. Outlining DeFi's contribution to the development of the internet in detail, this research offers valuable insights into the existing mechanisms, risks, and opportunities for secure participation in DeFi ecosystems.

Keywords: *bibliometric, blockchain technology, decentralized finance, digital economy*

Introduction

Blockchain technology has emerged as a result of internet development and can greatly enhance many facets of human life. In the world of digital media, blockchain technology has become an influential force with exciting potential (Alamsyah et al., 2024). Numerous benefits, such as increased credibility, transparency, cost-effectiveness, and accessibility, make blockchain technology an exciting opportunity to address the ongoing problem of financial inclusion that the unbanked population faces (Li et al., 2022). Blockchain technology is widely used in a variety of

industries, including finance, healthcare, and education, indicating its applicability and versatility (Pal et al., 2021). An additional degree of societal significance is added by the fact that blockchain technology, as a powerful facilitator, supports anti corruption initiatives (Trequattrini et al., 2024). The emergence of DeFi has been crucial to the financial industry, especially in the context of the crypto economy. Important roles are played by well-known DeFi systems like Ethereum, Binance Smart Chain, and Tron in this context. Interestingly, permissioned distributed ledger technologies (DLTs) or other systems with comparable features can be used to carry out DeFi implementations (Aquilina et al., 2024).

Peer-to-peer, trustless financial transactions without the need for centralised middlemen are made possible by DeFi platforms, which are digital financial apps installed on decentralised blockchain networks and take use of the security and dependability offered by DLT are collectively referred to as DeFi (Mohan, 2022). Financial services including stablecoin, security, insurance, borrowing, staking, yield farming, and payments are all offered through DeFi applications (Gudgeon et al., 2020). Unfettered blockchains were the main platform used in the early development of DeFi applications, real user transactions were

*Research Scholar, Department of Commerce, Maharshi Dayanand University, Rohtak, Haryana, India. Email: priya.rs.comm@mdurohtak.ac.in

made possible by this architecture, which eliminated the need for centralised control. Furthermore, a decentralised operational paradigm was reinforced by the users themselves acting as validators (Truchet, 2022). The integration of real-world assets (RWAs), which entails tokenising off-chain assets to enable their smooth and effective use within the blockchain ecosystem, is one of DeFi's unique features. In contrast to TradFi systems, integrating RWA into blockchain can open up new possibilities and improve market efficiency for asset holders (Naggar, 2023).

DeFi greatly enhances market efficiency across financial activities by facilitating asset tokenisation and fostering the creation of decentralised apps (DApps) (Aquilina et al., 2024). By combining blockchain technology, digitization, and securitization, tokenization makes it easier to convert traditional assets into digital native assets. By considering tokenization, market participants increase the versatility of portfolio management by gaining direct holding and settlement capabilities. Additionally, this procedure enhances the transparency, security, timeliness, tracking, and affordability of traditional assets. Furthermore, tokenization enables the development of a strong and expandable infrastructure for a coherent ecosystem of digital assets. As a result, the capital market becomes more accessible, encouraging active participation from players of all sizes and fostering inclusion in financial systems (Naggar, 2023). DeFi garnered recognition for its ability to upend and change TradFi by connecting conventional markets with cryptocurrency assets (Mnohoghitnei et al., 2022). The benefits of DeFi, which are not present in TradFi systems, include programmability, minimal fees, transparency, disintermediation, accessibility, and personalized rates (Steiner and Bhaumik, 2022). DeFi's ability to provide international lending and borrowing at lower prices than TradFi systems is one of its main advantages (Cowen and Tabarrok, 2022).

DeFi protocols should not be marketed as payment methods or currencies like Bitcoin or Ethereum, but rather as options to bankers and financial services (Metelski and Sobieraj, 2022). Notably, DeFi offers insurance that covers a range of DeFi goods and services to handle possible problems like asset loss. This insurance determines policy pricing and evaluates claims using an amalgamation of off-chain and on-chain data (Alamsyah and Syahrir, 2023). It is important to stress that although DeFi has some benefits, conventional financial services cannot be completely replaced by it and because TradFi has been in business for a long time and is governed by existing regulatory and legal bodies, DeFi cannot completely replace its services (Zetzsche et al., 2020). These investigations have demonstrated the urgent need for further research in this area. However, bibliometric analysis has been mainly ignored in these investigations. Although there is a sizable amount of work on the subject, its bibliometric aspects have not received as much attention as the implications and developments in blockchain research. A methodological technique with roots in data science and library and information science, bibliometrics is used to examine publication patterns, author productivity, and international research cooperation. Additionally, it is used to get insight into particular expertise as well as information about growth and advancement. This approach helps to improve the organization's data asset association (Dehdarirad et al., 2015). The use of bibliometrics offers several key benefits: (1) Researchers can demonstrate the significance of their work, investigations, and findings; (2) Institutions can evaluate publications and assess their quality and impact; (3) Scientists can identify future research directions and the potential impact of studies in specific fields; and (4) Analysts can track the expansion of knowledge over time.

With an emphasis on the growth and development of both fields, this study provides a thorough bibliometric analysis of blockchain and DeFi research that was published in the Scopus database between 2017 and 2024. The approach includes a review of research topics, publishing patterns, and real-world uses in the blockchain and DeFi space. The following research questions are addressed in order to direct the analysis and accomplish the goals of this study:

RQ1: What is the global trend in publishing research on blockchain and DeFi?

RQ2: What insights can be drawn from this trend, and how might blockchain and DeFi research evolve in the future?

The bibliometric analysis in this study covers the following areas:

(a) A total of 493 research papers, including ISI-indexed publications, were extracted from the Scopus database to evaluate blockchain and DeFi research; (b) The study examines blockchain research across various types of documents, including journal articles, conference papers, and other formats; (c) The study employs the Dominance Factor (DF) rankings to assess author influence in blockchain and DeFi research, analyzing both the citations received and the keywords used by authors in their publications; (d) The study investigates the overall number of articles, publications, and citations in each country, providing insights into the global landscape of blockchain and DeFi research; (e) Three key network relationships are explored: country collaboration networks, keyword co-occurrence networks, and affiliation collaboration networks. These networks are designed to investigate the connections between countries, research terms,

and institutional collaborations; (f) The study concludes by analyzing the current trends in blockchain and DeFi research and offers predictions on potential future developments in these Fields. One modern method for estimating, analyzing, and visualizing the development of scientific areas is bibliometrics (Koskinen et al., 2008). It is used to describe how the target field in a certain subject of expertise is expanding (Liu et al., 2018). The impact factor, citation count, publishing entities, and countries of origin are some of the indicators used in this technique to evaluate publications (Yi & Wei, 2019; Docampo & Cram, 2019; Iefremova et al., 2018). This approach has been used in several research to examine academic output. To further evaluate author influence and contribution, the current study also uses an alternative statistic called the DF. To improve our bibliometric analysis, this publication also employs sorts of network linkages that have been overlooked by earlier research, such as affiliation collaboration, keyword co-occurrences, and country collaboration.

Methodology

The four main stages of this study's approach are (1) search, (2) compilation of results, (3) findings, and (4) analysis. Figure 1, which offers a graphic depiction of the entire research process, shows these phases. The first step of this study begins by using "blockchain" and "decentralized AND finance" as the keywords in the Scopus database. The aim is to identify the key areas of focus within blockchain and DeFi research. This study utilizes the Scopus database due to its comprehensive coverage of ISI-indexed and high-ranking scholarly publications (Oakleaf, 2009). This was followed by the retrieval of 493 papers published between 2017 and 2024. Since the DeFi was released in 2017, we focused our investigation on that year and beyond. We concentrated on finding the information in the next stage of our investigation. We examined multiple dimensions of the research landscape, including document types, subject areas, contributing authors, and country affiliations. The bibliometric analysis and results were obtained in the last stage of this study. This study constructed the blockchain and DeFi bibliometric analysis using the open-source statistical program R. In particular, we installed and utilised the bibliometrix package (Aria and Cuccurullo, 2017), which is accessible through the R desktop application. This bibliometric technique has been utilised by numerous investigations for their own research domains (Cirillo et al., 2018; Aria and Cuccurullo, 2017). To the best of the author's knowledge, this research is the first to use this technology for bibliometric analysis in both DeFi and blockchain. In the section that follows, we created visualizations and conducted additional analysis based on the tool's numerous discoveries.

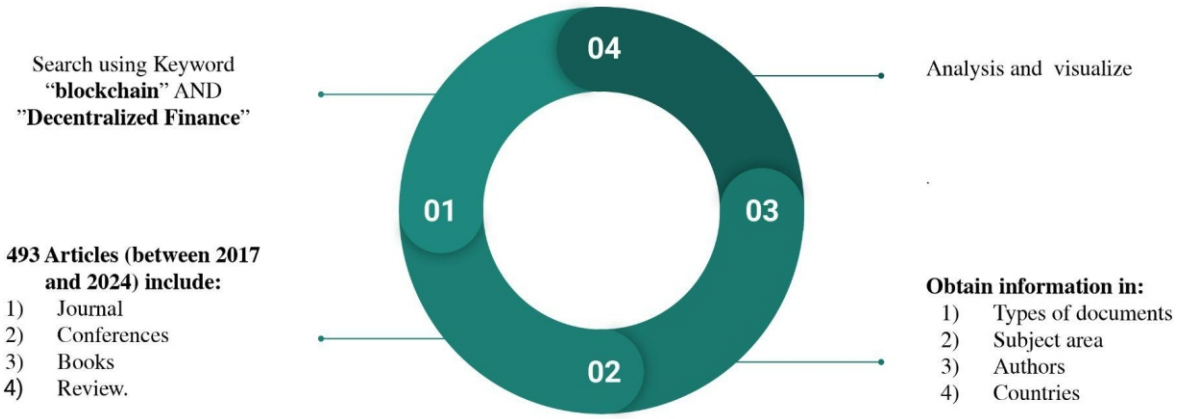

Figure 1: Methodology stages

Bibliometric Analysis

Our study's bibliometric analysis is classified in four sections, each containing several sub-categories. Four main sections comprise the organisation of the analysis: Types of Documents, Subject Areas, Authors, and Countries. Several subcategories are analysed within the Authors category, such as: (a) Author Dominance, (b) Author Keywords, (c) Total Citations, (d) Total Articles by Country, (e) Publication Output by Country, (f) Citation Count by Country, and (g) International Collaboration Networks. The results from these categories are valuable as they generate bibliometric data that can help identify high-impact studies contributing to the advancement of blockchain and DeFi research. Data taken from the Scopus database is summarised in Table 1, which includes 493 publications between 2017 and 2024. These articles were sourced from 306 different publications, including books, journals, conference

proceedings, and other sources. The total number of keywords cited in these articles was 1,313, which is more than double the number of articles. A total of 1,550 authors contributed to these publications, with 64 being single-authored papers and the remaining 1,436 being multi-authored. The data also shows a rapid increase in the number of publications from 2017 to 2024, and we anticipate this trend will continue, with the number of publications steadily rising through 2025.

Table 1: Key Details

Information	Description	No.
Articles	Total articles	493
Sources (Journals, Books, etc.)	The frequency distribution of sources (journals, books, etc.)	306
Author's Keywords	Total keywords	1313
Authors		
Author	The authors' frequency distribution	1648
Authors of single-authored articles	Single author per articles	64
Authors of multi-authored articles	Authors of multi authored articles	1584
Other		
Co-Authors per Article	Average number of co-authors in each article	3.63
Average citations per article	Average number of citation in each article	6.56
Collaboration Index		
Year	Number of articles in each year	
2017		3
2018		6
2019		7
2020		15
2021		43
2022		81
2023		92
2024		246

Source: Author's Contribution

Figure 1 illustrates that blockchain and DeFi researchers are more engaged in submitting conference papers in the form of proceedings, rather than contributing to collections of research papers published in books or on websites. The advantage of conference proceedings is that the papers are made available to attendees prior to the conference, allowing readers to familiarize themselves with the content. Participants can become acquainted with the ideas and, if feasible, provide input following the paper presentations thanks to this early access. Such feedback is invaluable, as it allows authors to revise and refine their research ideas based on the audience's insights.

Conference publications prior to the event are particularly beneficial because they give readers the opportunity to review the material multiple times, ensuring a deeper understanding of the research. This early access also facilitates more meaningful interaction between authors and attendees, enabling authors to gather constructive input and further develop their work.

Result And Discussion

Type of Documents

Table 2 illustrates that blockchain researchers tend to submit their conference papers to Lecture Notes in Computer Science. Many authors have chosen this source for their conference publications, as evidenced by the table and figure 2, which shows that conference papers outnumber journal articles in this case. Numerous creative concepts and contributions related to blockchain and DeFi technology are included in these proceedings.

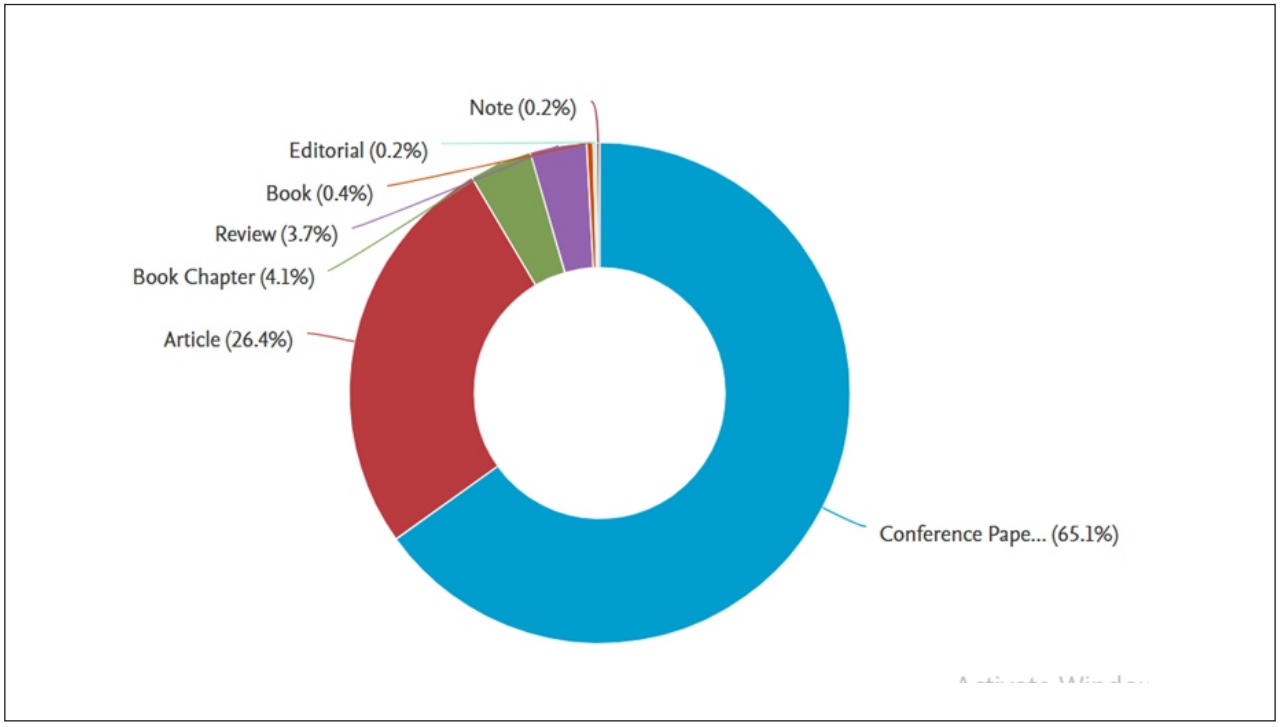

Figure 2: Type of documents (Source: Scopus)

In addition to lecture notes, other sources such as ACM and Lecture Notes in Networks and Systems show consistent occurrences, with the exception of IEEE Access. According to Figure 3, IEEE Access is expected to see an increase in publications about blockchain and DeFi in the future. The next section will focus on the subject areas that have drawn researchers to adopt blockchain and DeFi technologies.

Table 1: Statistical Validation Techniques Applied

Sources (top 10)	**No.**
Lecture notes in computer science including subseries lecture notes in artificial intelligence and lecture notes in bioinformatics	30
ACM international conference proceeding series	22
Lecture Notes In Networks And Systems	19
Proceedings 2024 IEEE International Conference On Blockchain Blockchain 2024	15
2024 IEEE International Conference On Blockchain And Cryptocurrency Icbc 2024	13
IEEE Access	12
Tqcebt 2024 2nd IEEE International Conference On Trends In Quantum Computing And Emerging Business Technologies 2024	7
Communications In Computer And Information Science	7
Ceur Workshop Proceedings	6
Proceedings IEEE Symposium On Security And Privacy	5

Source: Author's Contribution

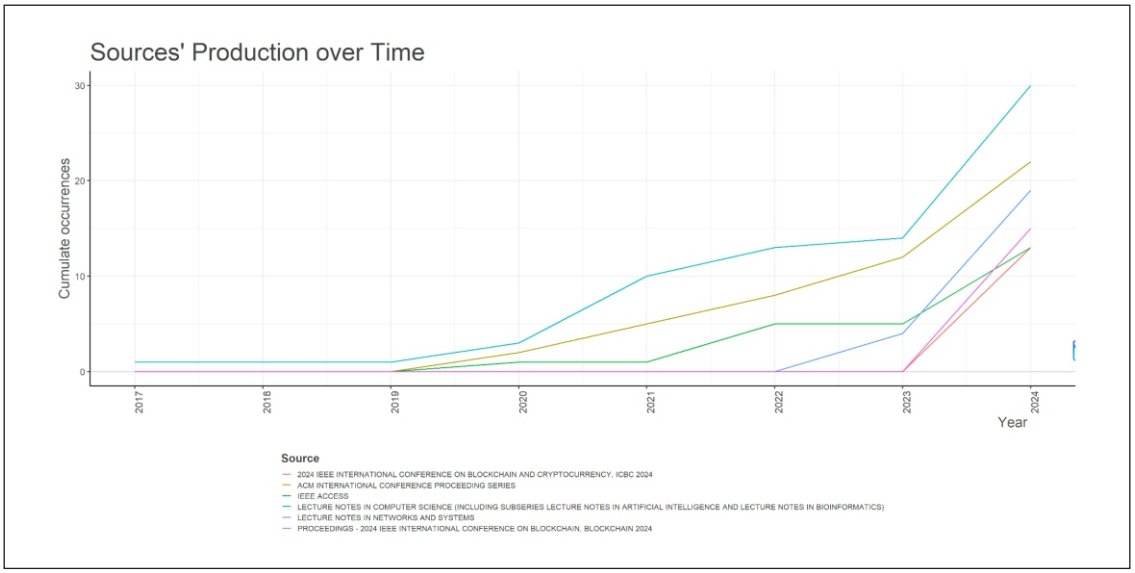

Figure 3: Source growth (*Source:* VOS viewer)

Subject Area

The topics covered by both blockchain and DeFi research are depicted in figure 4. As expected, the field of Computer Science has received the most attention, with 32.8% of blockchain and DeFi-related research focused in this domain. The integration of two fundamental Computer Science disciplines—Distributed Computing and Cryptography has been crucial in driving blockchain innovation. Distributed computing, a core component of blockchain technology, offers significant advantages. Before blockchain emerged, decentralized systems like torrent networks had already applied this concept with notable success. However, a major limitation of these platforms was the unethical behavior of some participants, who uploaded irrelevant or malicious content without being detected or penalized.

Furthermore, participants who volunteered their computers in the torrent network, acting as peers, received no incentives for their contributions. To address this issue, Bitcoin's creator, Satoshi Nakamoto, developed a solution that not only limited the network's participants' power, but also incentivized them by rewarding them for validating Bitcoin transactions. This innovation led to the inclusion of Cryptography as a key element in the blockchain framework. Cryptography is a technique used to secure private communications, ensuring that only the intended sender and receiver can access the content. It involves two main processes: (1) Encryption, which converts a message into an unreadable format, and (2) Decryption, which reverses the process to restore the original message.

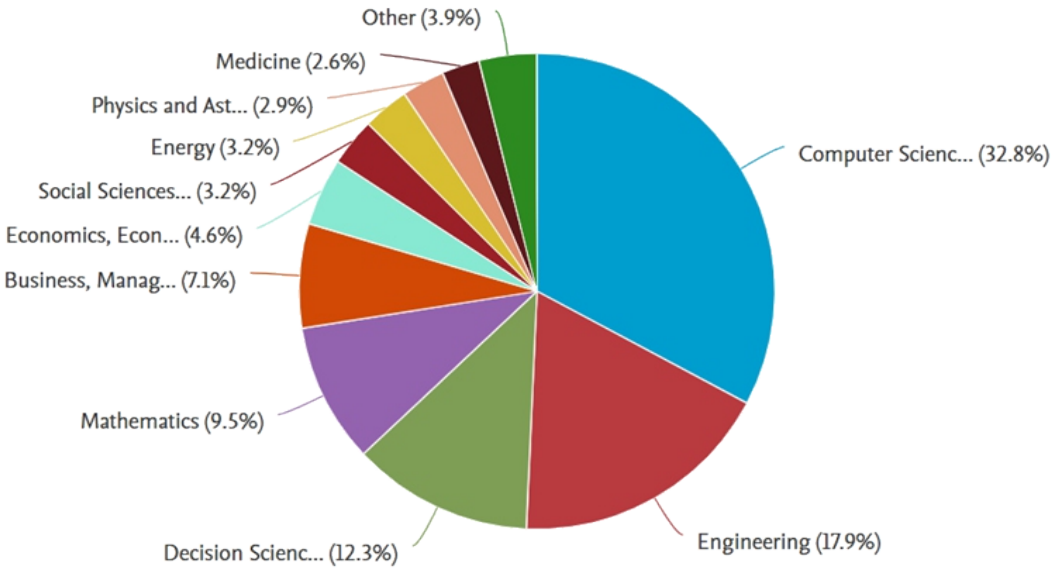

Figure 4: Subject areas that involve blockchain and DeFi research (Source: Scopus)

These processes rely on distinct algorithms and encryption keys, preventing unauthorized access. Modern cryptography has evolved into various subfields, including data integrity, user authentication, and applications in areas such as e-commerce and banking continue to be the key areas of attention (Kshetri, 2017), while business, engineering, and mathematics are becoming important areas of interest. Management and accounting are next in line.. Given that DeFi and blockchain are closely intertwined with economic systems, it is no surprise that disciplines like engineering, mathematics, and business play a pivotal role. Engineering and mathematics are foundational to computer science, while business, management, and accounting focus more on economic applications. Monetary policy, taxation, voting, fiscal policy, and national security are some of the tools that traditional economies use to operate. Through features like transaction fees (taxation), network voting for protocol updates, block size changes (fiscal policy), inflation control (monetary policy), and strong network security acting as a kind of collective defence, Bitcoin similarly reflects these economic ideas. Through decentralization, Bitcoin offers a level of transparency and financial freedom that contrasts with the centralized models used by traditional banking systems. Blockchain's distributed ledger ensures transparency by making all transactions publicly verifiable, which helps build trust among users. Security is strengthened through cryptographic techniques, while immutability ensures that once data is recorded, it cannot be altered or tampered with. Smart contracts self-executing agreements encoded in software automate transactions and enforce terms without the need for intermediaries, reducing costs and enhancing efficiency. Blockchain also promotes financial inclusion by granting global access to DeFi services, overcoming the geographic limitations and barriers of traditional banking. Additionally, blockchain enables interoperability across different platforms, allowing assets to be transferred seamlessly between various blockchains. Through tokenization, real-world assets can be represented digitally, simplifying both trading and asset management. Decentralized governance, via decentralized autonomous organizations (DAOs), gives users the power to influence the protocols they engage with. In summary, blockchain supports DeFi by providing decentralization, automation, security, transparency, and programmability empowering users to control their financial activities without relying on central authorities

Authors

This section looks at author keywords, dominance ranking variables, and overall citation counts to identify the most important writers in blockchain and DeFi research. The top 20 authors are listed in Table 3, arranged by the quantity of publications they have written in this field. Among them, Watterhofer R. leads with the highest number of publications, followed closely by Kumar A., Wang H., and Wang Y. each contributing eight articles. The remaining authors have published either six or five articles. Table 5 further outlines the authors' roles in these publications, indicating whether they contributed as main or corresponding authors. While some authors consistently appeared as lead authors, others contributed as co-authors. To better understand the influence and contribution of each researcher, the next section explores the DF using a set of relevant metrics.

Table 3: Authors with a number of articles

Authors (top 20)	No.
WATTENHOFER R	9
KUMAR A	8
WANG H	8
WANG Y	8
CHEN J	6
GERVAIS A	6
HEIMBACH L	6
WANG Z	6
LIU J	5
LIU Y	5
MILIONIS J	5
MOALLEMI CC	5
QIN K	5
WANG X	5
YANOVICH Y	5
ZHENG Z	5
ZHOU L	5
CHEN Y	4
CUFFE P	4
FENG Y	4

Source: Author's Contribution

Authors' dominance ranking

The percentage of multi-authored publications where an author serves as the first author is measured by a ratio called the DF (Kumar and Kumar, 2008). The DF factor was used in a number of bibliometric research (Wu et al., 2015, Elango and Rajendran, 2012). In Figure 5, the DF is displayed.

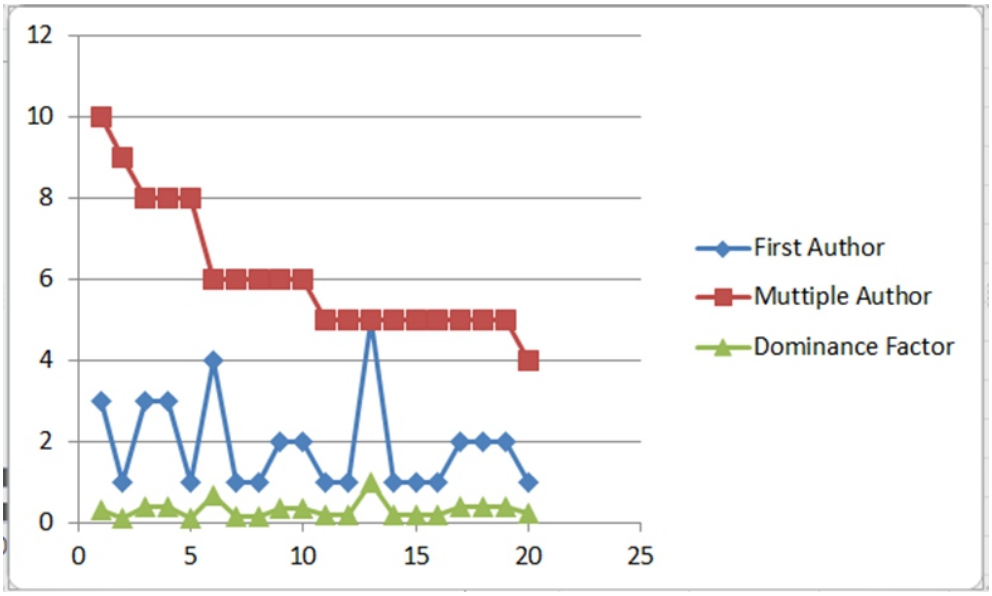

Figure 5: Dominance factor in figure form (*Source:* Biblioshiny)

DF is determined by dividing the total number of multi-authored papers written by a particular author (Nmt) by the number of multi-authored articles in which that author appears as the first author (Nmf). Since the DF value in single-authored publications is always equal to one, this statistic is not used in these instances. The following is the mathematical expression for the DF:

$$DF = \frac{N_{mf}}{N_{mt}}$$

The list of writers in the top 20 DF rankings is shown in Table 4, with Milionis, J. leading the list. Milionis is first author in five articles and appears as a co-author in five multi-authored

Table 4: Author's dominance

Rank by DF	Author	Multi authored	First Author	Dominance factor
1	Milionis, J.	5	5	1.000
2	Alamsyah, A.	6	4	0.667
3	Qin, K.	5	2	0.400
4	Chen, Y.	5	2	0.400
5	Liu, J.	5	3	0.400
6	Chen, J.	8	3	0.375
7	Wang, Y.	8	2	0.375
8	Heimbach, L.	6	2	0.333
9	Wang, Z.	6	3	0.333
10	Kumar, A.	10	1	0.300
11	Singh, J.	4	1	0.250
12	Wu, J.	5	1	0.200
13	Yanovich, Y.	5	1	0.200
14	Moallemi, C.C.	5	1	0.200
15	Zhou, L.	5	1	0.200
16	Liu, Y.	5	1	0.200
17	Zheng, Z.	6	1	0.167
18	Gervais, A.	6	1	0.167
19	Wang, H.	8	1	0.125
20	Wattenhofer, R.	9	1	0.111

Source: Author's Contribution

papers. Following Milionis are Alamsyah, A. and Qin, K. The findings suggest that Milionis, Alamsyah, and Qin have a dominant presence within their research teams, as they are the first authors on all of their respective papers (five for Milionis, six for Alamsyah, and five for Qin).

Author's keywords

This section presents an analysis of the keywords associated with blockchain and DeFi. Researchers often include multiple keywords in their articles, linking them to blockchain and DeFi topics. This is a crucial aspect of understanding current research trends, identifying gaps in the blockchain and DeFi fields, and recognizing the areas of research where blockchain and DeFi are being integrated. The top ten author keywords in blockchain and DeFi research are shown in Table 5. "Blockchain," "decentralised," "decentralised finance," and "smart contracts" are at the top of the list. A smart contract is a self-executing digital agreement that is saved and enforced on the blockchain, yet it works similarly to a traditional contract in the real world. Specifically, a smart contract is a software-based agreement that encodes the terms of a transaction, ensuring that both parties fulfill their obligations before execution.

Table 5: Author's keywords in the blockchain and DeFi

Top Ten Author Keywords	Articles
block-chain	368
blockchain	310
decentralised	299
ecentralized finance	280
finance	146
smart contract	109
distributed ledger	64
decentralisation	50
ethereum	47
blockchain technology	42

Source: Author's Contribution

The key concept behind smart contracts is to eliminate the need for a third party in establishing business relationships, allowing the involved parties to create and enforce agreements directly with each other. On the other hand, Figure 6 presents a TreeMap visualization of the keywords that have garnered significant interest from researchers in the fields of blockchain and DeFi. The TreeMap highlights common blockchain related keywords such as “finance,” “decentralized finance,” and “smart contracts.” In addition, other notable keywords include “security,” “bitcoins,” “cryptography,” and “electronic money.” This indicates that researchers are increasingly focused on integrating blockchain and DeFi with these fields, demonstrating how these technologies are transforming sectors like security, cryptography, Bitcoin, and electronic money by providing decentralized, secure, and transparent solutions. Through the use of cryptographic methods, decentralized governance, and smart contracts, blockchain and DeFi eliminate the need for intermediaries, reduce costs, and enhance security, paving the way for a more efficient and secure financial ecosystem. Whether it is Bitcoin's trustless transactions, the protection of data via cryptography, or DeFi's innovative financial products, these technologies are reshaping the future of finance.

From a data perspective, the visualization also reveals that researchers are placing increasing trust in data-related areas, adopting blockchain to enhance data security. Other prominent buzzwords that highlight important technological problems and research goals within the blockchain and DeFi environment are data privacy, digital storage, data security, big data, and distributed databases. This demonstrates that the researchers are exploring the vast potential of blockchain to secure critical data, ensuring both privacy and cost efficiency. In addition to the TreeMap, which illustrates the combination of multiple keywords, the following figures provide a more in-depth visualization of keyword relationships in blockchain and DeFi research. A subject dendrogram created using hierarchical clustering is shown in Figure 7, which illustrates the hierarchical linkages between important terms in the blockchain and DeFi research landscape. This dendrogram helps group related keywords by measuring the height at which different objects (keywords) are merged into clusters. In the dendrogram, the term “privacy” is represented as a central node, indicating its prominence among the research topics. All other objects in the diagram correspond to the various keywords found in blockchain articles.

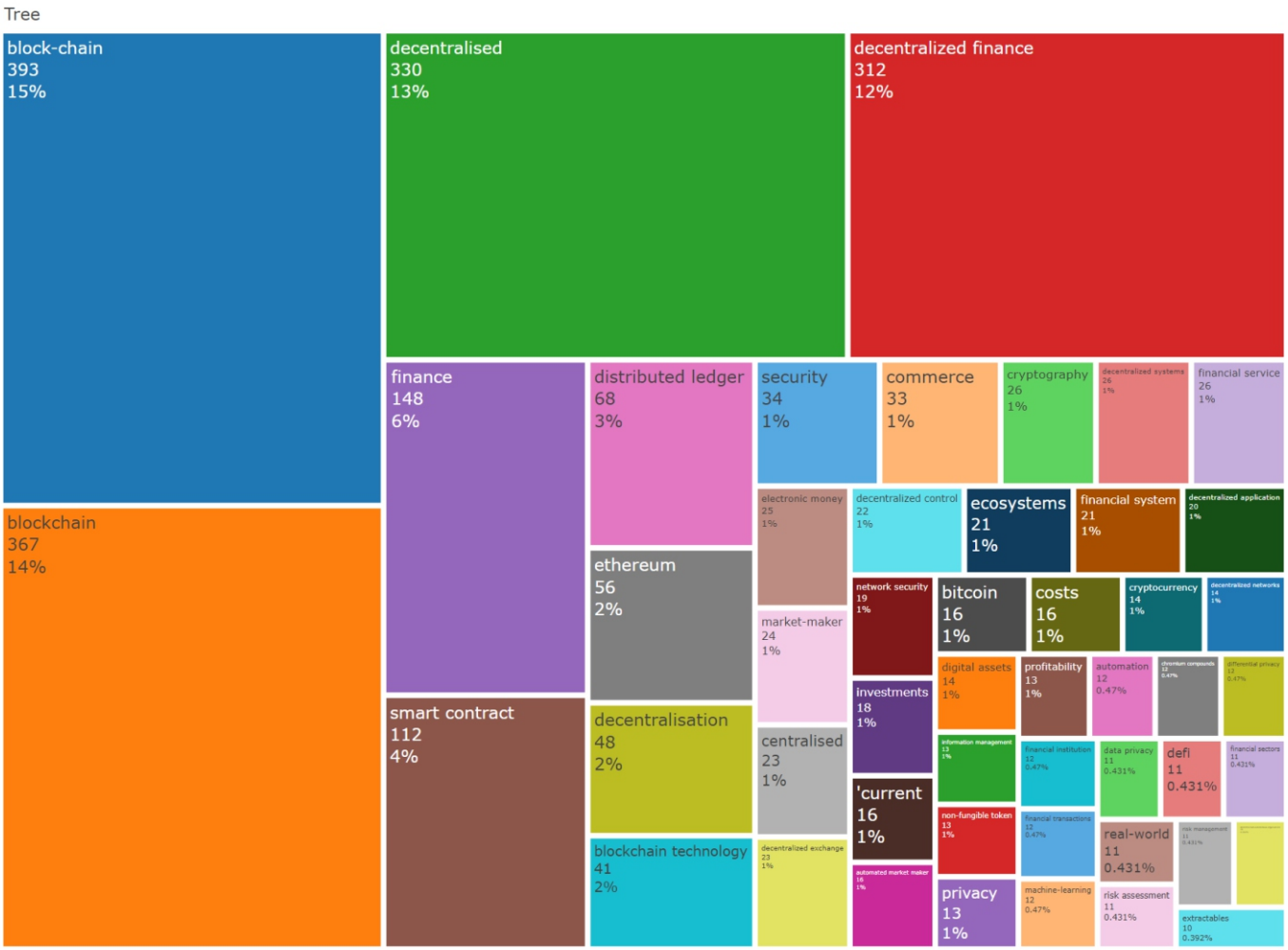

Figure 6: Word TreeMap (*Source:* Biblioshiny)

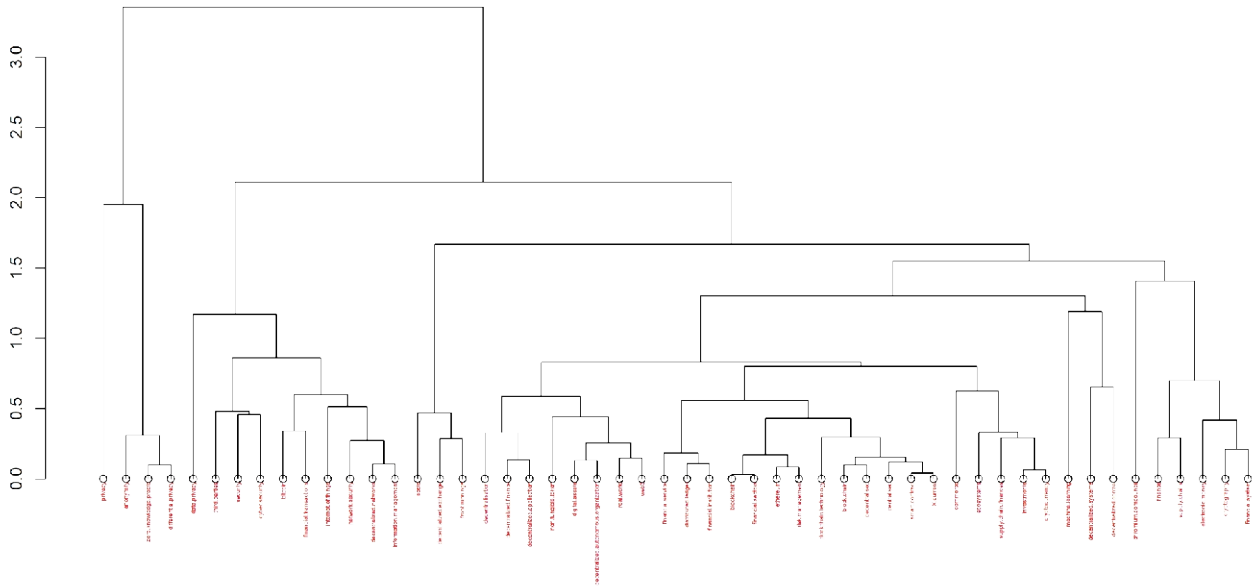

Figure 7: Topic dendrogram (*Source:* Biblioshiny)

The diagram illustrates that DeFi spans various branches, including privacy areas such as data privacy, security, financial transactions, and network security. It shows that researchers tend to treat these areas separately in their studies, often excluding decentralization from privacy research. Instead, they tend to combine privacy with other aspects like decentralization, trusted third parties, and security. Security-related branches include the Internet of Things (IoT), financial transactions, and decentralized networks. This indicates that researchers rely on blockchain technology to safeguard IoT data, protect individuals' identities, and secure supply chain information from potential cyberattacks. To summarize the key trends, the following figure presents a word cloud that identifies the most prominent keywords attracting global attention in blockchain and DeFi research. Figure 8 visualizes the most common keywords found in blockchain and DeFi-related articles. Among the general terms highlighted are “finance,” “smart contracts,” and “distributed ledger.” However, more specific and notable keywords include “security,” “blockchain technology,” and “cryptography.” The word cloud indicates that blockchain and DeFi are burgeoning fields with significant research potential, suggesting an increase in publications in the near future.

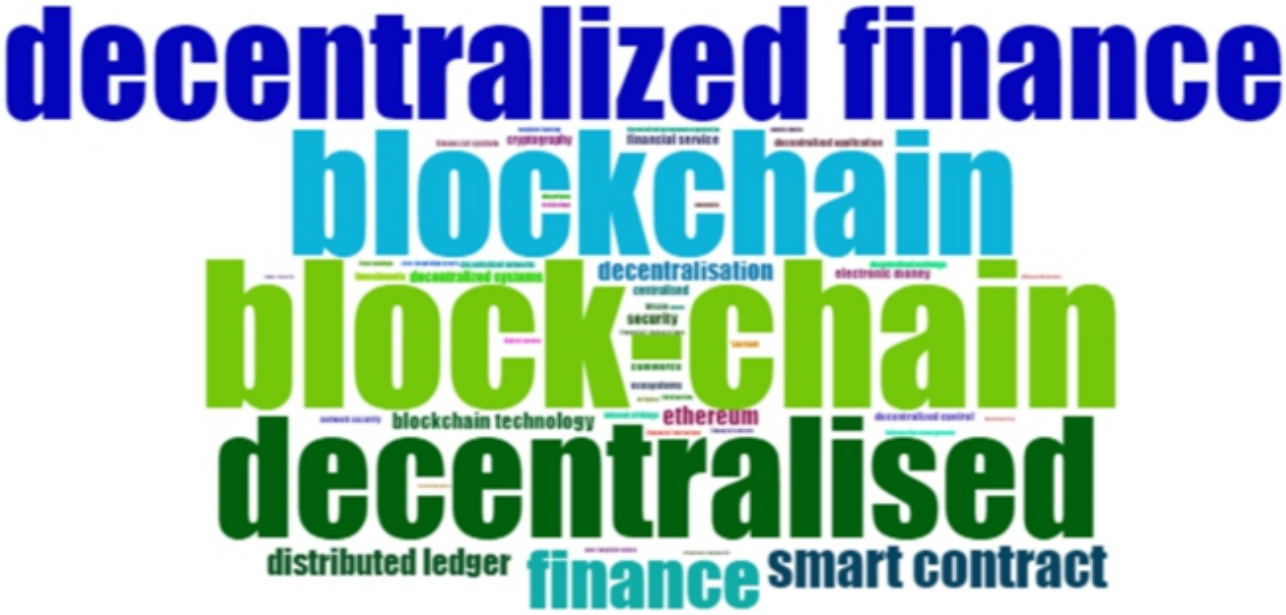

Figure 8: Word cloud of blockchain keywords (*Source:* Biblioshiny)

Blockchain's inherent security features make it an attractive solution for safeguarding sensitive data from breaches and unauthorized access by hackers. Beyond the word cloud, the next section explores which countries are most engaged with these keywords. This is visualized through a multi-field plot, which shows the relationship between research affiliations and keywords in the top 20 rankings. As a reflection of their individual fields of competence, Figure 9 shows how different universities focus their blockchain research on particular areas. For example, Guangzhou University specializes in decentralized systems and transparency. Other universities, such as the Southern University of Science and Technology, Vishwakarma Institute of Technology, the School of Computer Science, and Telkom University, have shown a strong interest in blockchain technology. In contrast, universities conducting research at the intersection of blockchain and DeFi include Saint Petersburg State University, Fordham University, and Peking University. Additionally, the following section discusses blockchain and DeFi articles that have gained significant attention and have been frequently cited by other researchers.

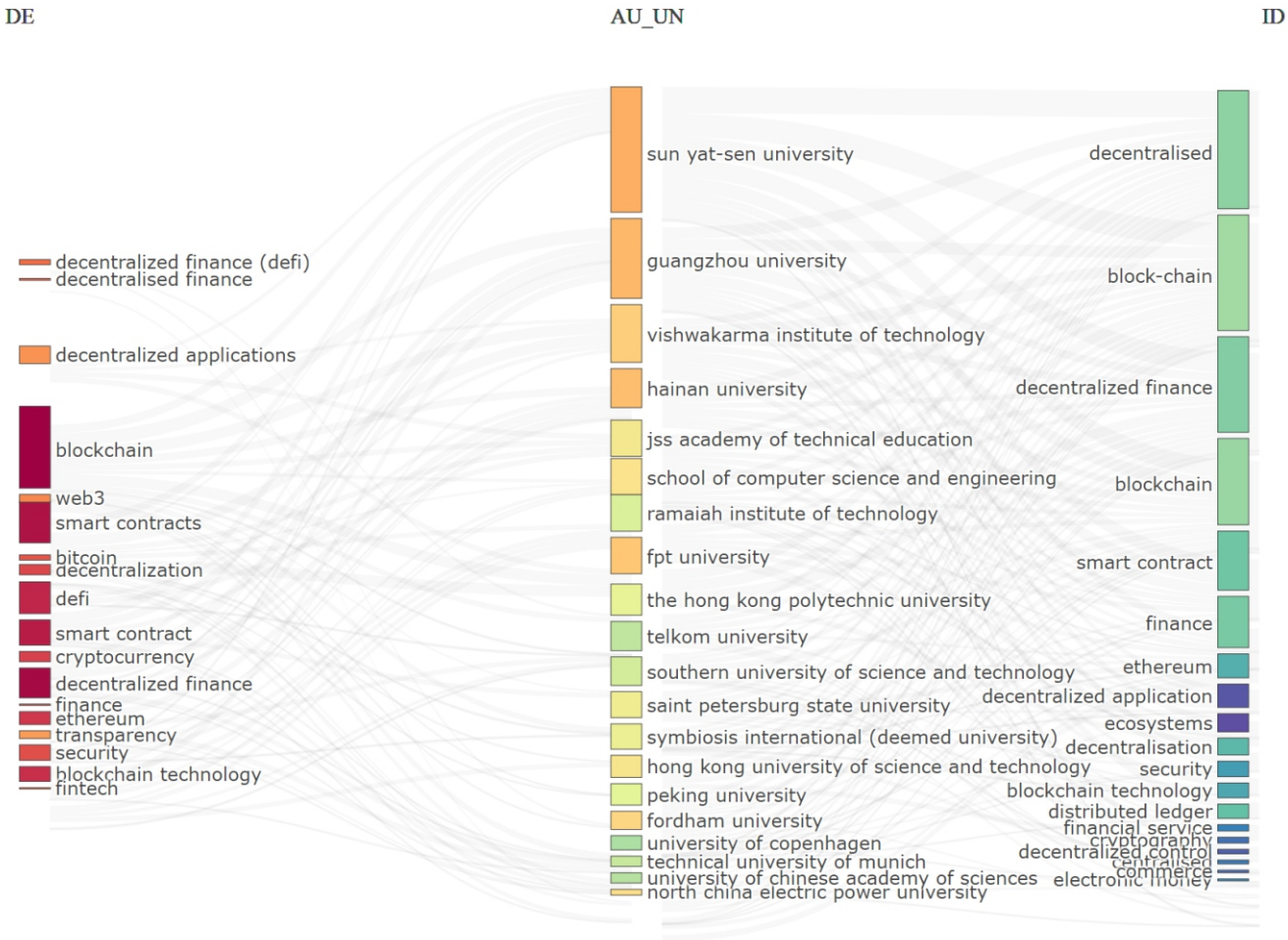

Figure 9: Multi-fields plot between affiliation and keywords (*Source:* Biblioshiny)

Total citations

The most prominent publication venues in the subject are highlighted in Table 6, which includes the top 20 sources (or journals) that have earned the most citations from other papers. This table reveals that some papers garnered significant citations in particulars years, suggesting that some articles were highly relevant only during those particular periods. Numerous authors cited studies that were closely relevant to their own research areas, combining blockchain technology with other disciplines like decentralisation. From another perspective, some blockchain and DeFi papers are consistently cited year after year. This steady citation pattern indicates that these papers are considered authoritative in the field, covering essential information on blockchain and remaining valuable for future research. Among the highest-ranking sources in the table, Lecture Notes in Computer Science (LNCS) and Technological Innovation Management Review stand out, each contributing multiple highly cited papers. This suggests that these sources provide substantial content on blockchain and DeFi, making them frequent references for many authors. In addition to LNCS, several other conference sources appear in the top 20 rankings, including Sensors, Computers, and the IEEE Symposium on Security and Privacy. These conferences typically have a quicker review process and fewer page requirements, which explains why many authors choose to present their initial research at conferences. By doing so, they can showcase their novel ideas early, reducing the risk of having their concepts duplicated before they publish the full paper in a journal.

In contrast, journal articles tend to undergo a more extensive review process, which takes more time. This is one reason why authors may first present their research at conferences and later submit updated versions to journals. Aside from conferences, journals like Technology Innovation Management Review and IEEE Access are also important for blockchain and DeFi studies, particularly because they are open-access journals, making the research more widely available to the global academic community.

Table 6: Articles that receive citations

Rank No.	Authors with the source (top 20)	TC	TCpy
1	CHEN Y, 2020, J BUS VENTUR INSIGHTS	357	71.40
2	MCCORRY P, 2017, LECT NOTES COMPUT SCI	298	37.25
3	EYAL I, 2017, COMPUTER	253	31.63
4	BECK R, 2018, COMPUTER	160	22.86
5	ZHOU L, 2021, PROC IEEE SYMP SECUR PRIVACY	98	24.50
6	KRICHEN M, 2022, SENSORS	87	29.00
7	CALDARELLI G, 2021, APPL SCI	68	17.00
8	WANG H, 2019, FUTURE GENER COMPUT SYST	60	10.00
9	GUDGEON L, 2020, PROC - CRYPTO VALLEY CONF BLOCKCHAIN TECHNOL, CVCBT	57	11.40
10	XU J, 2023, ACM COMPUT SURV	56	28.00
11	JENSEN JR, 2021, COMPLEX SYST INFORM MODEL Q	52	13.00
12	BIRYUKOV A, 2017, LECT NOTES COMPUT SCI	51	6.38
13	GRASSI L, 2022, QUAL RES ACCOUNT MANAGE	50	16.67
14	ZHAO X, 2022, J OPER MANAGE	48	16.00
15	DAS D, 2022, PROC ACM CONF COMPUTER COMMUN SECUR	48	16.00
16	CHOD J, 2022, MANAGE SCI	47	15.67
17	KUMAR A, 2022, SENSORS	41	13.67
18	KUMARI A, 2022, TECHNOLOG INNOV MANAG REV	41	13.67
19	WU J, 2023, IEEE OPEN J COMPUT SOC	38	19.00
20	PINEIRO-CHOUSA J, 2022, TECHNOL FORECAST SOC CHANGE	38	12.67

Source: Author's Contribution

Country

With an emphasis on the affiliations of writers as stated in the published literature, this section looks at the nations that are making contributions to blockchain research. It includes details such as the total number of articles, publications, citations, and collaboration networks for each country. The following subsection begins with an analysis of the total number of articles published by each country.

Country total of articles and publications

Table 7 presents the countries actively engaged in blockchain research, based on the institutional affiliations of contributing authors. With 63 items, China tops the list, followed by India with 59 and the US with 21. Interestingly, these top contributions come from opposite continents: the United States represents the Americas, while China leads Asia. This distribution implies that a dominant nation is spearheading blockchain and DeFi research in each of the major regions. Europe exhibits a high level of involvement in this area, in addition to Asia. This section examines the international collaboration networks influencing global blockchain research and further analyses blockchain publications by differentiating between single-country and multi-country contributions.

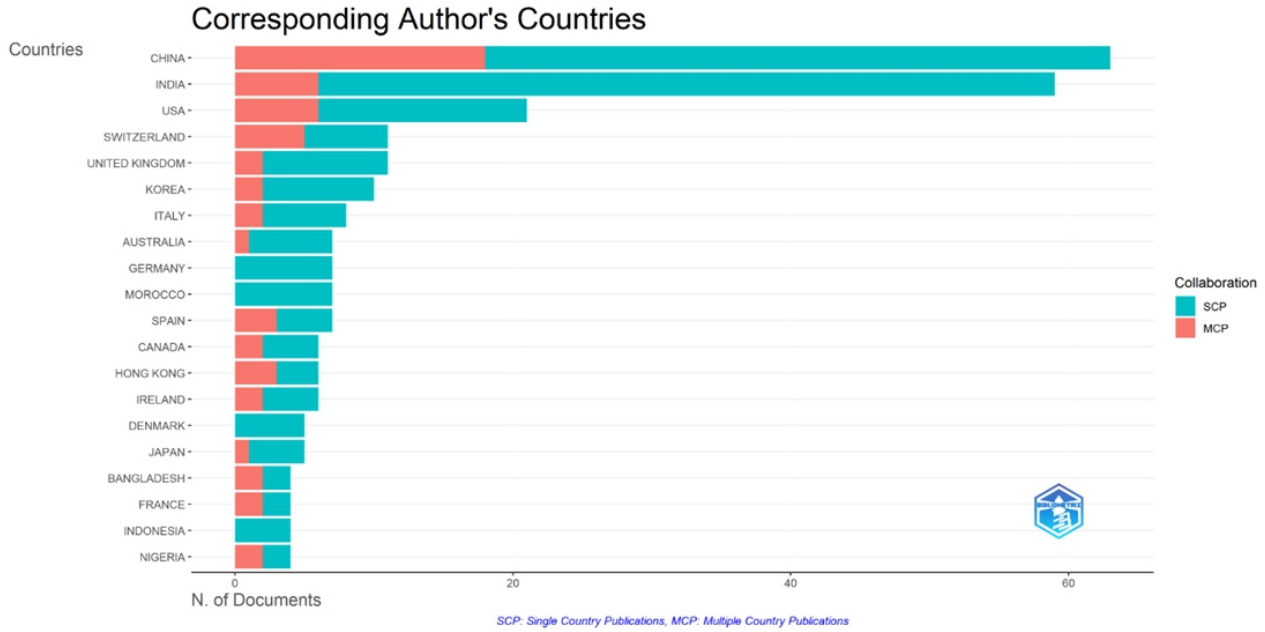

Figure 10: Country with publications in figure form (*Source:* Biblioshiny)

Table 7: Country with blockchain and DeFi publications

Top Ten Country	Articles	SCP	MCP
CHINA	63	45	18
INDIA	59	53	6
USA	21	15	6
SWITZERLAND	11	6	5
UNITED KINGDOM	11	9	2
KOREA	10	8	2
ITALY	8	6	2
AUSTRALIA	7	6	1
GERMANY	7	7	0
MOROCCO	7	7	0
SPAIN	7	4	3
CANADA	6	4	2
HONG KONG	6	3	3
IRELAND	6	4	2
DENMARK	5	5	0
JAPAN	5	4	1
BANGLADESH	4	2	2
FRANCE	4	2	2
INDONESIA	4	4	0
NIGERIA	4	2	2

Source: Author's Contribution

Table 7 shows that only a few countries, such as China, India, and the USA, have published articles solely within their own borders without international collaboration. On the other hand, most other nations primarily publish articles written in their own countries, with just a small number of publications coming from international partnerships. The table highlights China, India, and the USA as the top three leading countries in this area. For a clearer overview, Figure 10 provides a graphical representation of both single-country publications and multi-country publications, making it easier to observe the trends and collaboration patterns. From the perspectives of MCP and SCP, China has a leadership role in both single-country and multi-country publications, as seen in Figure 10, with the USA and India coming in second and third, respectively. But from the standpoint of multi-country publications, the data also shows that some nations, like Morocco and Germany, have zero MCP values, indicating that they participate in international partnerships very little. However, these countries appear to be more involved in single-country publications, with publication values greater than one. Interestingly, the highest values in MCP (18) are lower than those in SCP (45), suggesting that most countries prefer to publish blockchain and DeFi research within a single country rather than through international collaborations.

However, there are three countries that have chosen to collaborate with others. Notably, Nigeria, with the lowest SCP value, published only two papers. Despite this, Nigeria demonstrated a clear interest in international collaboration, as both of its publications were in the MCP category. This indicates that Nigeria is more inclined to collaborate with other countries in the field of blockchain and DeFi research.

Country collaboration map

Global country cooperation in blockchain research are depicted in Figure 11, where collaborative activities are indicated by blue shading. Higher frequencies of foreign relationships are shown by darker blue zones. The most active partners are the United States, the United Kingdom, Australia, France, China, and India. Notably, the US is the leader in cooperation, interacting with almost every nation actively engaged in blockchain research, with China and India coming in second and third, respectively. When compared to single-country efforts, this pattern highlights the benefits of international collaboration in terms of increasing publishing output.

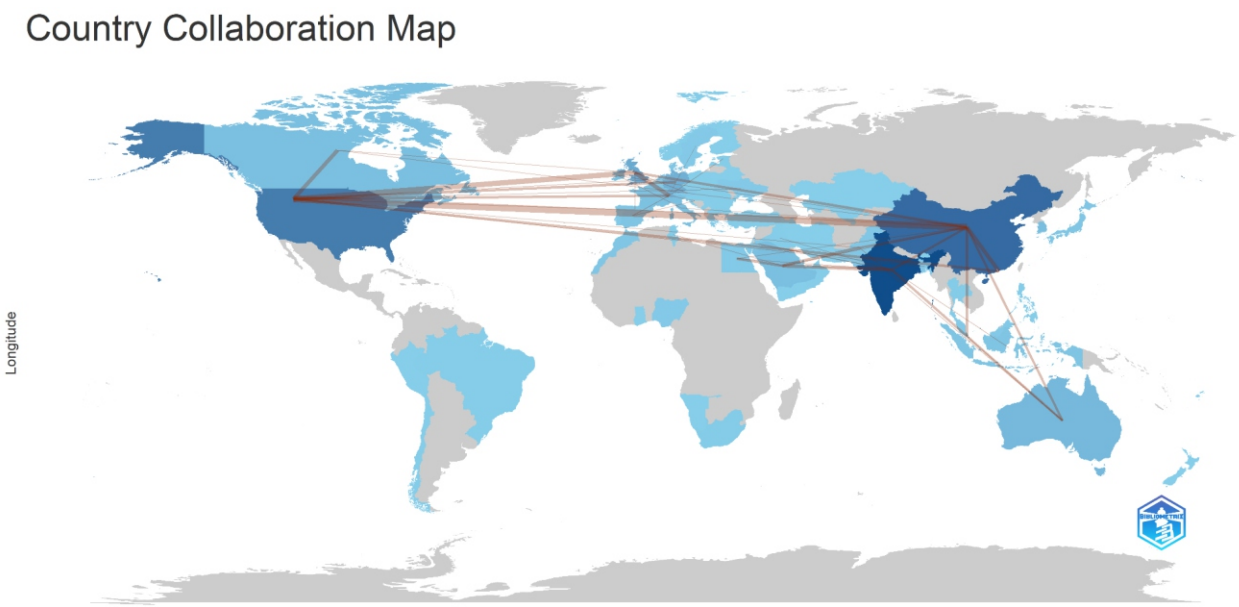

Figure 11: Country collaboration map (*Source:* VOS viewer)

Country total citations

This section highlights the blockchain and DeFi publications that have received the highest citations worldwide, ranking in the top 20. Table 7 presents the total and average citation values for these articles. The United States is ranked first in the rankings, followed by the United Kingdom and New Zealand. Additionally, Table 8 demonstrates that certain nations, such as Norway (60 total citations, 6 average) and Denmark (231 total citations, 46 average), have relatively low total citation counts, but high average citations per article. This suggests that while these countries may have published fewer articles, each received substantial international recognition, indicating that their blockchain and DeFi research is of high quality.

Table 8: Country with a total of citations

Country	Total citations	Average article citations
USA	413	19.70
NEW ZEALAND	357	35.70
UNITED KINGDOM	316	28.70
CHINA	279	4.40
DENMARK	231	46.20
ITALY	124	15.50
SAUDI ARABIA	88	22.00
SWITZERLAND	75	6.80
INDIA	72	1.20
SPAIN	71	10.10
NORWAY	60	6.00
LUXEMBOURG	57	28.50
IRELAND	40	6.70
KOREA	38	3.80
IRAN	34	3.40
ESTONIA	32	16.00
CANADA	30	5.00
SINGAPORE	29	14.50
INDONESIA	19	4.80
LATVIA	17	17.00

Source: Author's Contribution

Network

Using network visualisations, this section provides a bibliometric analysis of blockchain and DeFi research, including both country collaboration networks and term co-occurrence networks. The structure and interconnectedness of the research landscape are highlighted by these visualisations, which make it easier to examine the connections and interactions between different nodes.

Country collaboration network

Figure 11 depicts a network of collaboration, highlighting the countries that actively engage in bilateral and multilateral research partnerships. This network illustrates how authors are connected through their coauthorships, highlighting the collaborative relationships between countries (Gl¨anzel and Schubert, 2004).

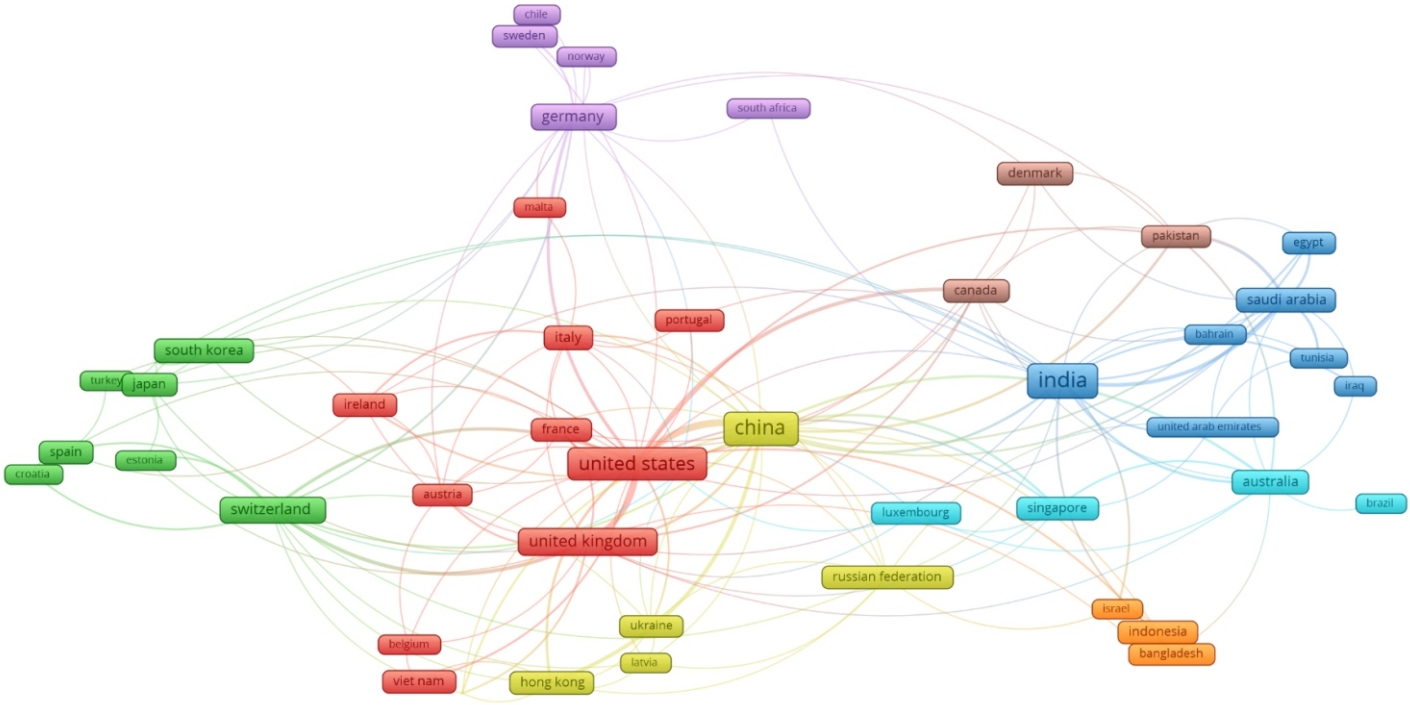

Figure 12: Country collaboration layout network (*Source:* VOS viewer)

Figure 12 depicts the total number of articles published. The figure shows that India leads the collaborative publishing of blockchain and DeFi articles, followed by China, the United States, the United Kingdom, Germany, and Switzerland. It also highlights that the upper part of the collaboration network contains numerous connections, indicating that countries on the left side of the network are more actively engaged in collaboration compared to those on the right. Many of the countries on the left side are from the Asian region, including Singapore, China, Indonesia, New Zealand, India, Hong Kong, Japan, and Korea. This suggests that countries in Asia are more inclined to collaborate internationally in blockchain and DeFi research, rather than publishing research independently.

Keyword co-occurrences network

It is standard practice for published articles to include keywords immediately following the abstract, which serve to represent the primary research areas addressed within the paper. Figure 13 illustrates the connections between blockchain and DeFi research fields, showcasing the keyword co-occurrence network. As the figure demonstrates, 'blockchain' is used more frequently than 'blockchain' or 'decentralized finance'. This discrepancy arises because, in earlier years, “blockchain” was a relatively new term and was not yet included in global dictionaries. Although the terminology varies, both terms fundamentally denote the same concept: blockchain. The figure also highlights the extensive array of keywords linked to blockchain, underscoring its broad interdisciplinary applications. Common research areas related to blockchain and DeFi include security, bitcoin, cryptography, and supply chain finance.

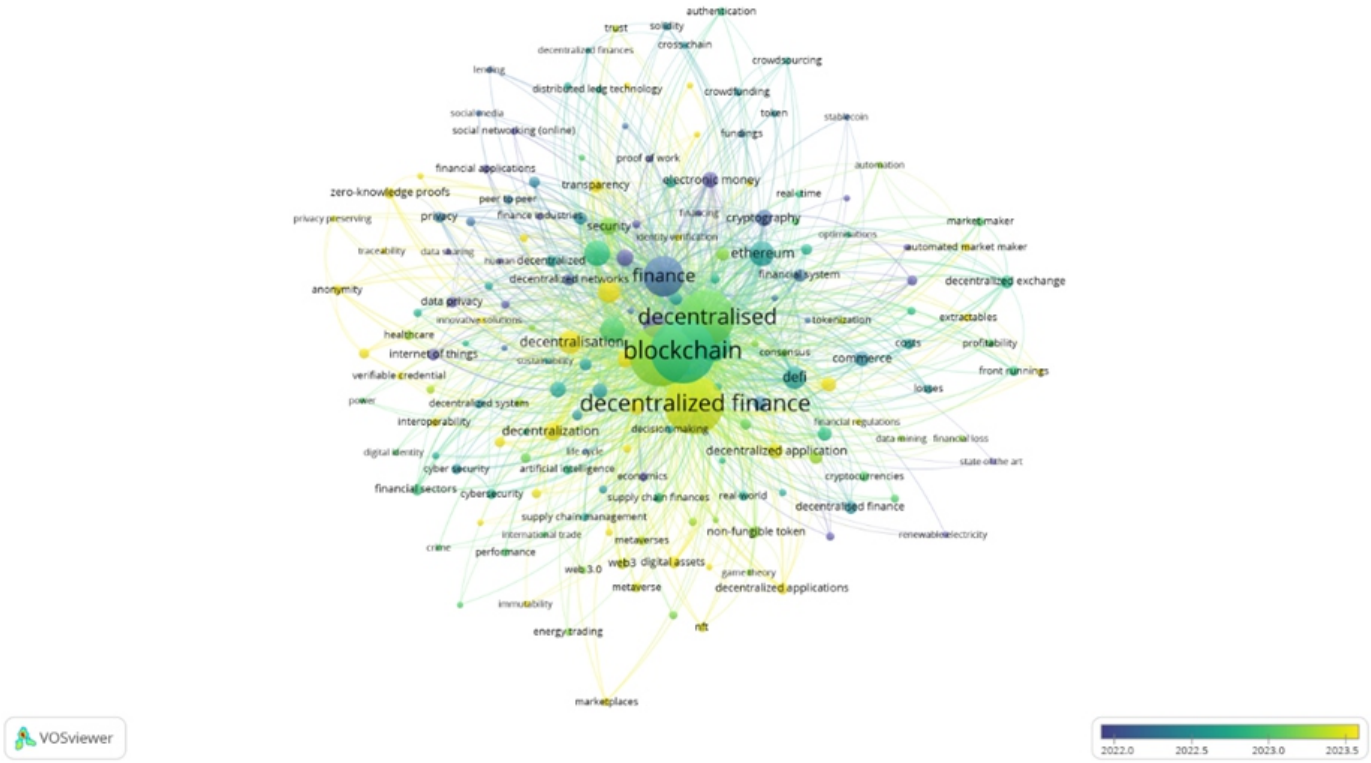

Figure 13: Keyword co-occurrences network (*Source:* VOS viewer)

In addition, keywords such as transparency, privacy, data sharing, and cryptocurrencies are prominently mentioned. This pattern suggests that researchers initially explored blockchain and DeFi with a focus on transparency, followed by exploring its integration with fields like cryptography, data science, and data mining (Husain, 2020, Cherian and Chatterjee, 2019, Liu and Shang, 2022, Jennath et al., 2019).

Affiliation collaboration network

The colored nodes in the network depicted in Figure 14 represent collaborative relationships between universities and researchers from various countries, highlighting the global interconnectedness of blockchain and DeFi research. For instance, Sun Yat-sen University in China has partnered with five institutions: Imperial College London, Cyberspace Institute of Advanced Studies, Storox Labs in Copenhagen, ETH Zurich in Switzerland, and the University of Manitoba. Additionally, ETH Zurich has collaborated with Aarhus University in Denmark.

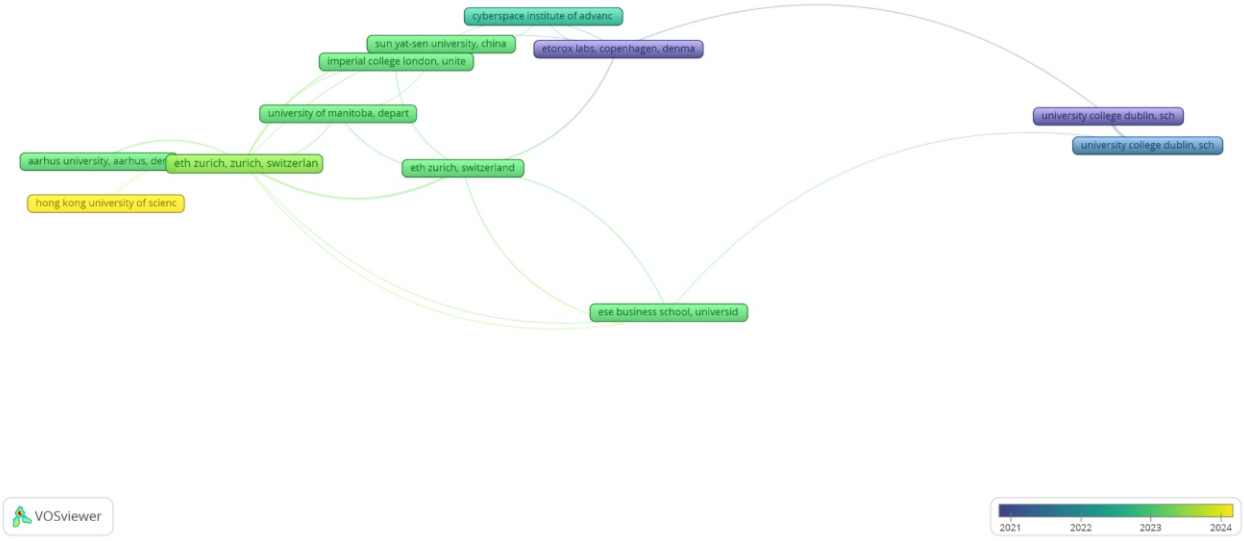

Figure 14: Affiliation collaboration network (*Source:* VOS viewer)

Conclusion

Blockchain, initially developed as the foundation of Bitcoin, has garnered significant global attention from researchers, who have expanded its application across various fields. While blockchain technology has made considerable strides, there is still a lack of comprehensive bibliometric reports exploring its evolving research patterns. This study fills this gap by performing a bibliometric analysis of 493 blockchain and DeFi articles published from 2017 to 2024.

The analysis highlights prominent researchers in the field, with Wattenhofer R leading with nine publications, followed by Kumar A with eight. Both authors are particularly focused on integrating blockchain and DeFi, often collaborating with multiple co-authors. Furthermore the list of authors in the DF ranking, with Milionis, J. leading the list. Milionis is the first author in five articles and appears as a co-author in five multi-authored papers, following Milionis are Alamsyah, A. and Qin, K. The study also reveals key research themes, including blockchain's role in enhancing security and DeFi's application in promoting transparency. Notably, before blockchain's rise, securing data in IoT networks was a significant challenge, with issues surrounding data protection among sensors. Key terms such as “security,” “smart contracts,” “cryptography,” and “electronic money” reflect researchers' growing interest in these areas, demonstrating a clear focus on advancing blockchain and DeFi integration to tackle critical issues.

From a global perspective, the leading countries in blockchain and DeFi research are China, India, and the United States, with a notable increase in research activity in Europe. Many European countries are actively contributing to blockchain research, and further publications are expected from this region in the near future. Asian countries, particularly China, are also expected to maintain a prominent role in this research, with a strong focus on using blockchain and DeFi for securing data.

Additionally, the study reveals a trend where blockchain and DeFi researchers prefer publishing their work in conferences rather than journals or books. The primary reasons for this include the desire to share innovative ideas involving blockchain and DeFi with the research community quickly and to receive immediate feedback for further development.

Overall, this bibliometric analysis shows that blockchain and DeFi are rapidly evolving fields with growing interest from researchers worldwide. With ongoing advancements, we can expect even more contributions and breakthroughs in the future, particularly in the areas of security, transparency, and financial inclusion.

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Building Trust for Green Consumerism: Examining the Influence of Green Marketing Strategies on Online Purchase Intention in India's FMCG Sector

*Renukaprasad
**Mala K.

Abstract

In the era of environmental sustainability in Fast-Moving Consumer Goods (FMCG) sector, companies have to accept and implement green marketing strategies. Although previous studies have talked about the direct impact of such strategies on consumer behavior, the mediating process that converts eco initiatives into purchase intentions has been ignored especially in digitally influenced, price-sensitive emerging economies. Drawing on signaling theory and trust theory, this study investigates the mediating effect of green brand trust (GBT) on the relationships among three fundamental marketing dimensions (i.e., green product strategy [GPS], green price strategy [GPS], and green communication strategy [GCS]) and online green purchase intention (GPI). Standardized and validated measurement instruments were used in the cross-sectional study with 332 urban Indian consumers in Bangalore, India. SmartPLS was used to conduct the analysis testing the theoretical models, using structural equation modelling (SEM). The results verify that all green marketing strategies have significantly positive impacts on GPI directly and indirectly via GBT. The mediating role of GBT emphasizes its role as a trust-facilitator which could help to reduce consumer scepticism and can be used to substantiate the persuasive value of green marketing initiatives. Contributions while contributing an empirical confirmation of a trust-based approach in the FMCG sector, there are both managerial implications for the development of a green market and theoretical contributions to the literature on green marketing.

Keywords: *Green marketing, Green brand trust, Green communication strategy and Green purchase intention*

1. Introduction

The Fast-Moving Consumer Goods (FMCG) industry, which was worth USD 4.94 trillion in 2024 and is anticipated to cross USD 7.56 trillion by 2033 (Bothare, 2025), is witnessing one of the most substantial shifts driven by increasing environmental consciousness—coupled with escalating demand from consumers for sustainable living. More than 80% of consumers worldwide report they are more likely to pay extra for eco-friendly packaging, and for consumers in Gen Z age groups, it's well into the 90% (Trivium Packaging, 2023). In this context, green marketing has transformed from an alternative branding option to a strategic necessity forcing companies to redesign, rethink their products, take sustainable prices, and transparently promote strategies (Chen & Chang, 2012; Sharma & Trivedi, 2016b).

Prior work has examined the effects of green marketing tools, including green product design, environmentally oriented pricing and sustainable communication, on consumer preferences (Cai et al., 2025). Additionally, green product and biodegradable packaging increase the perception of safety and social responsibility of the product (Sangeetha, 2017; Nedumaran & Manida, 2018), ecological value-based pricing policies result in controversial results according to consumer segment and price sensitivity (Karunarathna et al., 2020; Fuiyeng & Yazdanifard, 2015). At the same time, the transparent communication, such as eco-labels and digital marketing, is positively related to brand credibility and purchase intention (Correia et al., 2022; Ashoush & Kortam, 22-24).

The existing literature on green marketing reveals significant limitations that warrant further investigation. Prior research has predominantly examined individual dimensions of green marketing in isolation, failing to provide comprehensive models that assess their synergistic effects on online purchase intention. This gap is particularly salient in digital retail contexts, where the inability to physically evaluate products heightens

*Research Scholar, Department of Commerce, BON SECOURS COLLEGE FOR WOMEN, Affiliated to Bharathidasan University, Thanjavur, Tamilnadu, INDIA. Email: rprasad3005@gmail.com
**Assistant Professor of Commerce and Research Supervisor, BON SECOURS COLLEGE FOR WOMEN, Affiliated to Bharathidasan University, Thanjavur, Tamilnadu, INDIA.
Email: dr.kmala1971@gmail.com

consumer reliance on brand signals (Kuria, 2023; Chagwesha et al., 2023). The current body of evidence disproportionately reflects developed economies, offering limited insights into emerging markets such as India. In these contexts, consumers exhibit greater price sensitivity and skepticism toward unsubstantiated environmental claims (Agyeman, 2014; Bake, 2014; Nekmahmud & Fekete-Farkas, 2020). Compounding this challenge is the pervasive issue of greenwashing, which undermines consumer trust and distorts market perceptions (Ashoush & Kortam, 2022; de Sio et al., 2022; Shabbir et al., 2020).

Although green brand trust (GBT)—the consumer's confidence in a brand's genuine environmental stewardship—has received conceptual attention (Chen, 2010; Nguyen-Viet & Tran, 2024), its function as a mediator between green marketing strategies and online purchase intentions remains inadequately examined (Majeed et al., 2022; Walia et al., 2021). Existing frameworks predominantly position GBT as an endpoint rather than a transformative mechanism, overlooking its theorized role in Trust Theory and Signaling Theory (Spence, 1973; Chen, 2010). This oversight obscures trust's dynamic influence in digital green consumption, especially for low-involvement FMCG products where rapid decision-making hinges on heuristic cues.

The literature further neglects emerging urban markets like Bangalore, where environmentally conscious yet pragmatic consumers increasingly dominate digital commerce, (Goyal & Bansal, 2018; Kumar & Kushwaha, 2022). A unified framework integrating green marketing strategies, trust formation, and online purchase intention is thus urgently needed to address this contextual gap.

Research Objective

- To examine the impact of green product, price, and communication strategies on online green purchase intention in the FMCG sector.
- To investigate the mediating role of green brand trust (GBT) in these relationships.
- To provide empirical insights specific to Bangalore, an emerging urban green consumer market in India.

2. Review of literature for hypothesis development

2.1 GPS and GPI relationship

Green product strategy (GPS)—encompassing eco-design, sustainable packaging, and non-toxic ingredients—serves as a critical signal of environmental responsibility, directly influencing online purchase intentions (Chen & Chang, 2012; Rahman et al., 2015). In the FMCG sector, GPS mitigates consumers' evaluation barriers by offering tangible eco-attributes (e.g., biodegradable packaging, organic certifications), which function as heuristic cues for quality (Nedumaran & Manida, 2018; Sangeetha, 2017). This has been supported by studies: Astuti et al. (2021) found Indonesian consumers had 32% higher purchase intent for FMCG products with biodegradable packaging, and Sharma and Trivedi (2016b) found that GPS lowered product performance risk perception by 41% for online shopping.

Signaling Theory (Chen, 2010) explains this relationship: GPS acts as a credible market signal, reducing information asymmetry and fostering trust. When brands communicate lifecycle effects in a transparent way (e.g., carbon footprint labels), consumers believe less in greenwashing risks (Majeed et al., 2022). Based on this study proposed:

H1: Green product strategy positively influences online green purchase intention.

2.2 GPrS and GPI relationship

Green price strategy (GPrS) reflects the internalization of environmental costs, often manifesting as premium pricing or competitive parity. Whereas Agyeman (2014) find that price sensitivity constrains adoption in developing nations, GPrS could further increase perceived value for developing consumers motivated by consumer ethics. For example, Karunarathna et al. (2020) found that 68% of Sri Lankan shoppers for FMCG in supermarkets linked a green FMCG product with superior quality based on its higher price, while Fuiyeng and Yazdanifard (2015) discovered that a competitive pricing strategy enhanced the market penetration for FMCG for price-sensitive customers in India.

The duality of GPrS underscores its context-dependency. Arief and Kurriwati (2017) identified that premium pricing reinforces authenticity for eco-conscious segments, whereas Bake (2014) emphasized that affordability drives mass adoption. Perceived value theory (Majeed et al., 2022) suggests that consumers weigh environmental benefits against monetary costs, with trust moderating this trade-off. The study formulated follow hypothesis:

H2: Green pricing strategy positively influences online green purchase intention.

2.3 GCS and GPI relationship

The green communication strategy (GCS)—consisting of eco-labels, certifications and AI generated campaigning—closes the green gap among corporate and consumers as well (Rahman et al., 2015). Ashoush and Kortam (2022) found that when FMCG brand used third-party certification (e.g., USDA Organic), online

purchase intent increased by 27% and Vijayakumar and Geetha (2023) demonstrated that machine learning-optimized green ads increased click-through rates by 19%. However, GCS's effectiveness depends on authenticity. De Sio et al. (2022) found that 62% of consumers distrust brands with vague claims (e.g., "eco-friendly" without evidence), aligning with Trust Theory's emphasis on consistency (Chen, 2010). Correia et al. (2022) and Kumar and Kushwaha (2022) further highlight that multi-channel transparency (e.g., QR codes linking to sustainability reports) bolsters credibility in online settings. The study formulated below mentioned hypothesis:

H3: Green communication strategy positively influences online green purchase intention.

2.4 Green Marketing Strategies and GBT

Green Brand Trust (GBT) is defined as the extent to which consumers trust that the environmental claims of a brand are trustworthy, credible, and consistent with sustainable values (Mohammed et al., 2025). In FMCGs market, where product involvement is low and tactile evaluation is restricted, consumers tend to depend more on reliable and creditworthy information, therefore trust become pivotal player in green marketing (Walia et al., 2021).

The synchrony in a brand's green product, feature, price and message enhances consumers' perceptions of companies and ultimately enhances trust. Conversely, vague and insincere claims undermine trust and weaken the effects of green messages (Shabbir et al., 2020; Mohammed et al., 2025). According to Signal Theory (Spence, 1973), green marketing strategies provide market signals which help to reduce the information asymmetry between consumers and companies. But these signals must also be clear and credible to form trust. Such as, high environmental price of the product, or a third-party partner certification being adopted in the promotional communications, to ensure the trust degree of the consumer, (Wu & Liu, 2022). The researchers also proved that GBT is a critical antecedent for the long-term brand loyalty and positive word-of-mouth among the environmentally concerned market (Tan et al., 2022).

If a company is believed by consumers with respect to its claims of environmental claims, consumers are more likely to engage in green consumption behaviour (Cai, et al., 2025; Walia, et al., 2021). Trust reduces cognitive dissonance and perceived risk and causes consumers to become committed to their intentions to engage in sustainable purchasing, even in online scenarios with no physical inspection of products (Joshi & Rahman, 2015). Multiple studies demonstrate that GBT functions as a critical conduit that amplifies the impact of environmental marketing stimuli on purchase decisions (Tan et al., 2022; Mohammed et al., 2025). Based on these theoretical and empirical reasoning, the following hypotheses are suggested:

H4: Green product strategy exerts a positive influence on green brand trust in FMCG.

H5: Green price strategy exerts a positive influence on green brand trust in FMCG.

H6: Green communication strategy exerts a positive influence on green brand trust in FMCG.

H7: Green brand trust positively impacts green purchase intention in FMCG.

2.5 GBT as mediating variable

GBT serves as an essential bridge between green marketing strategies and consumers' purchase decisions. Consumers demand GBT to assess the credibility of environmental claims, since the sustainability of products is not always tangible (Nguyen-Viet & Tran, 2024). Trust Theory and Signaling Theory validate how repeated brand activities, and transparent signals of sustainability help build up this trust.

Studies show that GBT strengthens the effect of green product features on purchase intention by reducing doubts about greenwashing (Chen & Chang, 2012; Astuti et al., 2021). For green pricing, consumers accept higher costs only when they trust the brand's commitment to sustainability; otherwise, premium prices deter purchases (Karunarathna et al., 2020; Bake, 2014). In the context of green communication, verified claims and the presence of certification generate trust, which increasing purchase likelihood, while unsubstantiated messages harm trust (Ashoush & Kortam, 2022; de Sio et al., 2022). This trust mechanism operates dually - first as a relational construct that reduces consumer uncertainty, and second as a behavioral catalyst that converts environmental awareness into concrete purchasing actions. Based on this discussion current study formulated following hypotheses:

H8a: The association of green product strategy with purchase intention mediated via green brand trust.

H8b: The association of green price strategy with purchase intention mediated via green brand trust.

H8c: The association of green communication strategy with purchase intention mediated via green brand trust.

Research Methodology

3.1 Research Design

This study adopts a quantitative, cross-sectional design to assess the impact of green marketing strategies on purchase intention, with green brand trust as a mediator. The research is grounded in positivist epistemology, focusing on empirical testing of theoretical links derived from Signaling Theory and Trust Theory (Creswell & Creswell, 2022; Saunders et al., 2023).

3.2 Sampling and Data Collection

The study targeted urban consumers in Bangalore, India—an emerging hub for eco-conscious and digitally active shoppers, particularly within the sustainable FMCG sector. A combination of purposive and snowball sampling was employed to identify regular buyers of green products. Data were collected over a three-month period using both online channels (consumer forums, social media, WhatsApp groups) and in-person surveys at outlets specializing in eco-friendly FMCGs. Participants were pre-screened for familiarity with green-labeled products and provided informed digital consent. This dual-mode collection strategy ensured sample diversity and yielded 332 valid responses, maintaining methodological rigor while capturing a broad spectrum of consumer insights.

Table 1: Respondents' details

Variable	Category	N	(%)
Gender	Male	182	54.8%
	Female	146	44.0%
	Prefer not to say	4	1.2%
Age Group	21–25 years	74	22.3%
	26–30 years	114	34.3%
	31–35 years	96	28.9%
	36–40 years	48	14.5%
Education	Undergraduate	102	30.7%
	Postgraduate	190	57.2%
	Professional/Doctorate	40	12.1%
Occupation	Private sector employee	158	47.6%
	Self-employed / Entrepreneur	68	20.5%
	Student	56	16.9%
	Homemaker / Others	50	15.1%
Monthly Household Income	Below ₹30,000	58	17.5%
	₹30,000–₹60,000	106	31.9%
	₹60,001–₹1,00,000	112	33.7%
	Above ₹1,00,000	56	16.9%

3.3 Measurement and Instrumentation

The questionnaire had an organized structure consisting of two sections i.e. demographics and constructs measured with multi-item scales. The respondents were requested to give their poinion on Likert scale, where 1 (strongly disagree) to 5 (strongly agree). GPS was measured with the items adapted from Chen and Chang (2012), supplemented by references from Sangeetha (2017) and Astuti et al. (2021), adapted to suit FMCG dimensions. GPrS measurement was guided by Fuiyeng and Yazdanifard (2015) and Karunarathna et al. (2020). Adapted items of the GCS were taken from Ashoush and Kortam (2022) and Sohaib et al. (2024), based on environmental messages in advertising. GBT was adapted from the scale developed by Chen (2010) and was adapted to the FMCG industry, as proposed by De Sio et al. (2022). GPI, the outcome variable, was measured by using the refined items from Majeed et al. (2022) and Nekmahmud & Fekete-Farkas (2020). The instrument reliability and validity tested through:

- Expert review by three marketing scholars and two FMCG sustainability professionals for face and content validity,
- Pilot testing with 30 Bangalore consumers, yielding Cronbach's alpha values above 0.80 for all constructs,
- Item refinement to clarify ambiguous terms and standardize response anchors based on pilot feedback.

3.4 Data Analysis

The study has applied PL_SEM using SmartPLS 4.0 for the measurement model (validity and reliability) and structural model (path relationships). The mediation effect of green brand trust was tested using the bootstrapping method with 5,000 resamples to establish significance.

4. Results

4.1 Measurement Model Evaluation

Confirmatory factor analysis (CFA) was performed to test the reliability and validity of the measurement model. The outer loadings of all items are all higher than the recommended threshold of 0.70 (Hair et al., 2022) (Table 2), which implies good indicator reliability.

Table 2. Measurement Items and Outer Loadings

Construct	Item Code	Measurement Item	Loading
GPS	GPS1	This product uses environmentally friendly raw materials.	0.924
	GPS2	The packaging is biodegradable or recyclable.	0.919
	GPS3	The product is safer for health compared to non-green alternatives.	0.918
	GPS4	The brand uses sustainable sourcing practices.	0.900
GPrS	GPrS1	The price is justified by its environmental benefits.	0.878
	GPrS2	I am willing to pay more for eco-friendly products.	0.881
	GPrS3	Green products offer value for money.	0.906
	GPrS4	The premium pricing reflects green value.	0.889
GCS	GCS1	The company provides transparent environmental information.	0.903
	GCS2	I notice green labels or certifications.	0.900
	GCS3	Green ads influence my perception of the brand.	0.891
GBT	GBT1	I trust the brand's environmental claims.	0.922
	GBT2	I believe the brand is committed to sustainability.	0.899
	GBT3	I rely on the green image when shopping.	0.923
	GBT4	This brand would not mislead with false eco claims.	0.880
GPI	GPI1	I intend to buy green products online soon.	0.773
	GPI2	I prefer green brands when shopping online.	0.859
	GPI3	I would recommend green products to others.	0.874
	GPI4	I consider environmental impact before buying.	0.870

All constructs demonstrated excellent internal consistency, with Cronbach's Alpha values and composite reliability values above threshold of 0.7. Average Variance Extracted (AVE) for all constructs exceeded the 0.50 benchmark, ensuring convergent validity (Fornell & Larcker, 1981).

Table 3. Construct reliability

Construct	Cronbach's α	Composite Reliability	AVE
GPS	0.890	0.920	0.740
GPrS	0.870	0.905	0.710
GCS	0.860	0.899	0.720
GBT	0.875	0.910	0.750
GPI	0.845	0.880	0.670

4.2 Discriminant Validity

Discriminant validity was tested by Fornell–Larcker criterion. It was found from Table 3 that the square root of AVE for each construct (on the diagonal) was greater than the absolute value of the corresponding off-diagonal correlations among the constructs, implying acceptable degree of discriminant validity (Hair et al.

Table 4. Fornell-Larcker Discriminant Validity

	GBT	GCS	GPS	GPrS	GPI
GBT	0.866				
GCS	0.610	0.848			
GPS	0.580	0.560	0.840		
GPrS	0.595	0.570	0.585	0.860	
GPI	0.630	0.600	0.610	0.620	0.820

4.3 Structural Model Results

4.3.1 Results of Direct Effects

All hypothesized direct paths from green marketing strategies (GPS, GPrS, GCS) to GPI and GBT were found to be statistically significant. Table 5 presents the standardized regression coefficients, t-values, and p-values.

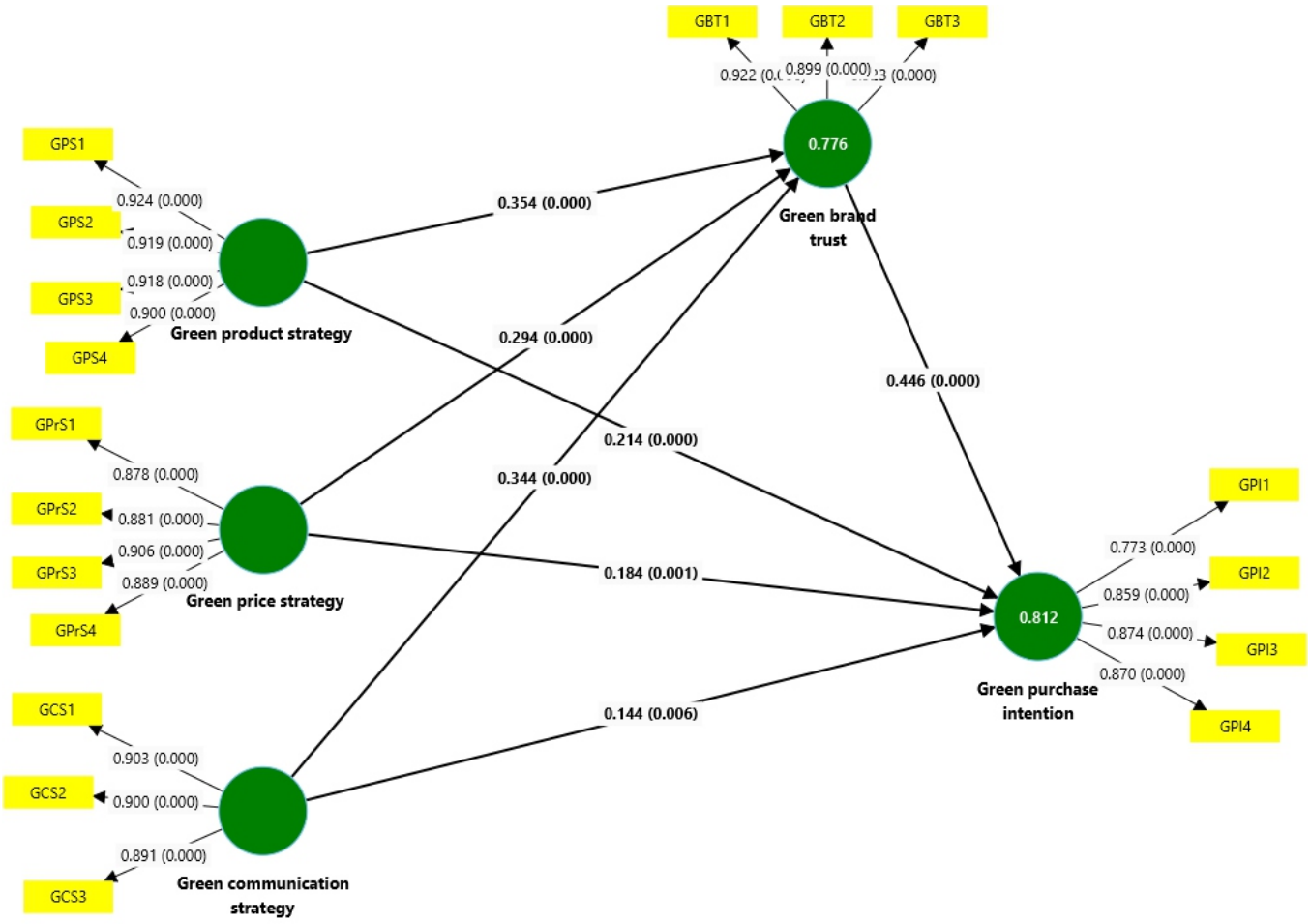

Figure 1: Structure model for green purchase intention

Table 5. Direct Path Coefficients

	Relationship	β	t-value	p-value	Decision
H1	GPS → GPI	0.214	4.181	0.000	Significant
H2	GPrS → GPI	0.184	3.262	0.001	Significant
H3	GCS → GPI	0.144	2.769	0.006	Significant
H4	GPS → GBT	0.354	5.439	0.000	Significant
H5	GPrS → GBT	0.294	4.976	0.000	Significant
H6	GCS → GBT	0.344	5.977	0.000	Significant
H7	GBT → GPI	0.446	8.765	0.000	Significant

The structural model results (Table 5) confirm that all three green marketing strategies—GPS, GPrS, and GCS—positively and significantly impact both green brand trust and green purchase intention. Among these, the path from green brand trust to green purchase intention ($\beta = 0.446$, $p < 0.001$) exhibited the strongest effect size, underscoring trust as a central mechanism through which marketing strategies translate into consumer behavior. Since the entire path, p values are below than 0.05 and T value above 1.96, therefore research hypothesis were supported.

4.4 Mediation Analysis

Mediation was tested using bootstrapping (5000 resamples). The mediation analysis further reinforces this conclusion (Table 6). Green brand trust significantly mediates the relationships between each marketing strategy and purchase intention, with the indirect effects ranging from $\beta = 0.131$ to $\beta = 0.158$, all statistically significant ($p < 0.001$).

Table 6. Mediation Effects via GBT

Hypotheses	Path	Indirect Effect (β)	t-value	p-value	95% CI
H8a	GPS → GBT → GPI	0.158	4.949	0.000	[0.103, 0.231]
H8b	GPrS → GBT → GPI	0.131	4.016	0.000	[0.075, 0.206]
H8c	GCS → GBT → GPI	0.153	5.112	0.000	[0.101, 0.219]

These findings indicate that while the strategies independently influence consumer intentions, their effectiveness is amplified when consumers perceive the brand as trustworthy. As the direct path from all the green marketing strategies and the indirect path is also significant, therefore it is confirmed that GBT playing role or partial mediator.

4.5 Coefficient of Determination (R^2)

The R^2 values indicate the proportion of variance in the endogenous constructs explained by the model. The model demonstrates strong explanatory power, particularly for GPI (81.2%), indicating the effectiveness of the integrated framework.

Table 7. R^2 Values

Endogenous Variable	R^2	Adjusted R^2
Green Brand Trust	0.776	0.774
Online Green Purchase Intention	0.812	0.810

5. Discussion

The empirical findings of this study substantiate the significant role of green marketing strategies on green brand trust and purchase intention.

5.1 Influence of Green Marketing Strategies on Online Green Purchase Intention

According to the SEM analysis, GPS was revealed to be the most significant predictor for GBT and GPI. This ensured that the

purchase decisions of the consumers are influenced by product-driven attributes such as eco-friendly design, sustainable sourcing or biodegradable packaging. This is consistent with prior research that has shown physical product attribute in the environment serve as credible quality signals in lowering perceived risk (Chen & Chang, 2012). The powerful effect of GPS is particularly relevant in the FMCG sphere, where research has consistently demonstrated that measurable sustainability attributes such as non-toxic components and recyclable packaging strongly raise product value (Sangeetha, 2017; Astuti et al., 2021).

The findings also firmed the positive significant effect of GPrS on influencing green behavior, although the impact of GPrS was just slightly less intense than that of GPS. This is consistent with the idea that consumers are willing to pay a higher price premium when they recognise real environmental value in products (Agyeman, 2014). But, as indicated by prior research, the relationship is moderated by individuals' perception of price fairness and strength of commitment to the brand in terms of their environmental commitment (Karunarathna et al., 2020).

As the results highlighted GCS has the lowest direct effect of the three strategies ($\beta = 0.144$, $p < 0.01$), but its significance should not be underestimated. The findings indicate that effective communication with transparency and credible certifications influence purchase intentions positively (Correia et al., 2022). This is in line with current discussion reflecting on the increasing relevance of digital platforms for spreading green messages (Vijayakumar & Geetha, 2023).

5.2 The Mediating Role of Green Brand Trust

The most theoretical contribution of our study is to provide evidence for GBT in mediation role through which green market strategy impacts purchase intension. Consistent with the above results, the indirect effects through GBT were significant for all three strategies tested (GPS: $\beta = 0.158$; GPrS: $\beta = 0.131$; GCS: $\beta = 0.153$; all $p < 0.05$), indicating that trust serves as the psychological construct through which environmental marketing intervention operates in altering consumers' behavior. This evidence helps reinforce both Trust Theory (Chen, 2010) and the Signaling Theory (Spence, 1973) claim of the significance of credibility in market communications.

Notably, GPS demonstrated both the strongest direct and the most substantial indirect effect via GBT, indicating that even concrete product-level sustainability features depend on consumer trust to influence purchase decisions effectively. This insight expands on Walia et al. (2021), highlighting that trust not only supports but enhances the impact of sustainable product attributes.

In the case of GPrS, the mediating role of trust is reinforced between justification of price premiums. The results are in line with previous research (Karunarathna et al., 2020) indicating that consumers are willing to pay more only if they believe that a brand is sincere about its environmental commitment.

In the case of GCS, the results emphasize that communication strategies are most effective when they cultivate trust. Retaining credibility is crucial, so overstated or ambiguous claims can undermine (de Sio et al., 2022). This is of particular significance in online environments because consumers cannot rely on physical markers to verify product claims (Nguyen-Viet & Tran, 2024). Therefore, the findings contribute to the argument on the strategic importance of trust-oriented communication for enhancing green brands.

5.3 Theoretical Contributions

This study contributes to the green marketing literature in three ways. First, it develops an overarching theoretical framework incorporating Trust Theory and Signaling Theory with reference to the combined value and explanatory power of those theoretical perspective in explaining digital FMCG consumption. The empirical testing of these theories in an online shopping environment fills an important gap in the literature.

In addition, the research delivers definitive evidence of the mediating role of GBT and how it translates corporate sustainability actions into consumer purchase intentions. These results surpass prior conceptual models (Shabbir et al., 2020; Cai et al, 2025) in the form of mediation effects in an emerging market environment.

And, critically, it provides new insights into digital environmental consumerism, where lack of physical examination of the product increases the importance of trust. The findings illustrate how the virtual shopping-space changes ordinary green shopping calculus at its core, via trust mechanisms in lieu of physical, in person examination of goods. This digital dimension is an important progression in sustainable consumption theory.

6. Managerial implications

6.1 Embedding Sustainability into Product Development

FMCG manufacturers must transition from token environmental labeling to comprehensive sustainability integration throughout product lifecycles. This transformation requires adopting plant-

based packaging alternatives, eliminating hazardous substances from formulations, and implementing blockchain-enabled supply chain tracking. Independent eco-certifications and cradle-to-grave environmental impact assessments should become standard practice, transforming sustainability from a promotional tactic into an intrinsic product characteristic that drives consumer confidence.

6.2 Strategic Pricing Aligned with Trust-Building

While cost consciousness persists across emerging markets, research demonstrates consumers' willingness to pay premiums when pricing structures visibly support ecological initiatives. Marketing teams should develop transparent accounting frameworks that itemize how price differentials fund renewable energy transitions, regenerative agriculture programs, or fair wage practices. This approach converts price objections into value propositions by demonstrating measurable environmental returns on consumer investment.

6.3 Strengthening Communication Through Verifiable Claims

Marketing messages should be backed by specific, measurable data to build consumer trust. Vague claims like “eco-friendly” must be replaced with concrete evidence—such as reduced plastic usage or lower carbon emissions. Brands can also use digital tools and interactive platforms to showcase proof of their sustainability claims, fostering deeper engagement and transparency.

6.4 Adopting Metrics to Track Trust and Impact

Conventional campaign analysis isn't sufficient to prove the subtle bond between sustainability claims and consumer trust. Other specialist monitoring technologies must be deployed tracking the rate of recognition of a certification mark, the trends of sentiment in independent media coverage with respect to environmental performance, and changes over time in brand credibility indices. These leading indicators can help marketers spot nascent trust gaps and adjust their communication strategy before credibility begins to slide.

7. Limitations and Future research direction

While this study offers valuable insights, it is subject to several limitations that should be acknowledged.

7.1 Geographic and Sectoral Limitation

The research focuses exclusively on consumers in Bangalore and within the FMCG sector. While this setting provides an ideal urban consumer base with active green awareness, the findings may not generalize to rural markets or other industries like automobiles or electronics. Future studies could explore the same model across different geographies or sectors to enhance external validity.

7.2 Cross-Sectional Design Constraints

The study employed a cross-sectional survey, which restricts causal inferences. Longitudinal research would allow for the examination of how trust and purchase intentions evolve over time, particularly in response to brand actions or environmental events (e.g., policy changes, green scandals).

7.3 Consumer-Centric Model Only

The study focuses solely on consumer perceptions, excluding organizational-level variables such as marketing resource allocation, supply chain greenness, or corporate sustainability strategy. Future research could adopt a multi-level perspective that links firm-side practices with consumer-side responses.

7.4 Role of Psychographics and Cultural Moderators

Variables like consumer environmental attitude, values, or cultural orientation (e.g., collectivism vs. individualism) were not considered in this model. These could potentially moderate the effect of green marketing strategies on GBT and GPI. Future research may explore these nuances to derive more segmented insights.

8. Conclusion

This study provides empirically evidence on strategic significance of green marketing mix factors—GPS, GPrS and GCS—in forming consumers' green purchase intention in FMCG industry. It contributes to the literature by showing that green brand trust is a key mediating variable that shapes environmental appeals into overt behavioral responses. Influenced by Trust Theory and Signaling Theory, the study emphasizes the need for trustworthiness to be demonstrated through consistency, transparency and value congruence.

The lesson for marketers is very well explaied: environmental appeals aren't enough all by themselves. Only when they are seen as credible and believable, then they converted into trust – and ultimately, purchase intentions. As consumer consciousness grows and sustainable options become more mainstream than niche, brand trust will continue as a lever for the green marketing's effectiveness as similar to the past. Firms that grasp this point will be better equipped to drive the green revolution not just in India, but also in other developing countries.

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Rising Above the AI Line: Charting a Collaborative Future

*Deepanshi Singharia
**Shekhar Upadhyay
***Vibhooti Narayan

Abstract

As artificial intelligence (AI) continues to evolve, its integration into various domains is shifting from a disruptive force to a collaborative partner in human endeavors. This paper explores the maturation of AI, particularly generative AI, and its profound impact on industries such as entertainment, healthcare, education, and enterprise solutions. The study highlights the paradigm shift toward human-centric AI, where AI complements human creativity, decision-making, and problem-solving rather than replacing human expertise. Ethical considerations, transparency, and regulatory measures are crucial to ensuring responsible AI deployment while mitigating biases, misinformation, and economic disruption. Additionally, the paper discusses the need for localized AI models to align with India's linguistic, economic, and cultural diversity, fostering technological independence. By embracing AI as a co-creator and integrating it responsibly, societies can unlock its full potential while preserving human values and ingenuity.

Keywords: *Artificial Intelligence, Human-Centric AI, Generative AI, Ethical AI, AI Regulation, AI in India*

Rising Above the AI Line: Charting a Collaborative Future

As the first quarter of 21st century is about to get over, the discourse surrounding artificial intelligence (herein after AI) is undergoing a transformation. No longer solely characterized by unbridled excitement and boundless potential, the conversation is shifting toward a more measured and nuanced integration of AI into human lives and endeavours. The past years have been a landmark for AI, a period that has witnessed unprecedented advancements in generative AI systems that have touched and reshaped industries as diverse as entertainment, education, healthcare, and enterprise software. Generative AI, in particular, has proven to be a groundbreaking force, capable of producing realistic images, lifelike videos, compelling narratives, and even sophisticated software code. These innovations have opened up new avenues for creativity and efficiency, empowering artists, educators, and developers to push the boundaries of what is possible. Entertainment companies have used AI to streamline production pipelines and create immersive experiences, while educators have embraced AI-powered tools to personalize learning for students across the globe. In the enterprise world, AI has optimized workflows, accelerated product development, and redefined how businesses interact with customers. Yet, amid the fervour of these developments, a new narrative is emerging—one that reframes AI not as a replacement for human ingenuity but as a collaborative partner in creativity and problem-solving. This shift is critical as both corporations and individuals recalibrate their understanding of AI's potential and limitations. While AI excels in processing vast amounts of data and performing repetitive tasks with precision, it lacks the depth of human judgment, emotional intelligence, and moral reasoning that are essential for navigating complex, real-world challenges.

The notion of AI as a co-pilot rather than an autonomous driver has gained traction across industries. In creative fields, for instance, AI tools are being used to assist rather than replace artist, enabling them to experiment with new styles, techniques, and formats. Writers are leveraging AI- generated suggestions to overcome creative blocks, while filmmakers are using AI-driven simulations to visualize scenes before they are shot. Similarly, in business, AI systems are supporting decision-

*Junior Research Fellow, Department of Public Administration, Babasaheb Bhimrao Ambedkar University, Email- dipanshisingharia@gmail.com
**Junior Research Fellow, Department of Public Administration, University of Luknow, Email- pshekhar3339@gmail.com
***Assistant Professor, Department of Public Administration, Babasaheb Bhimrao Ambedkar University, Email- vnarayanbhu@gmail.com

makers by analysing trends and providing actionable insights, but the ultimate responsibility for strategic direction remains firmly in human hands. As we step into this collaborative future, the integration of AI must be guided by principles that prioritize ethical considerations, inclusivity, and accountability. Policymakers, technologists, and educators have a shared responsibility to ensure that AI is developed and deployed in ways that enhance human well-being rather than exacerbate inequalities or erode trust. Public discourse around AI ethics has intensified, with calls for greater transparency in algorithmic decision-making and robust safeguards against biases.

The dawn of next quater of the 21st Century offers a moment of reflection and recalibration. By embracing AI as a co-creator and collaborator, humanity has the opportunity to rise above the AI line—leveraging the technology's strengths while staying anchored in the uniquely human qualities that define our existence. This balanced approach promises not only to unlock the full potential of AI but also to chart a future where innovation and humanity thrive side by side.

A Pivotal Decade for AI Adoption

The year 2020-30 is going to prove to be a transformative decade in development and deployment of artificial intelligence (AI), marking the maturation of tools that were once confined to the realm of science fiction. Today, AI systems have become integral to millions of users worldwide, with their capabilities ranging from generating photo- realistic images and writing coherent essays to creating music and crafting complex code snippets. The impact of AI tools like ChatGPT, MidJourney, and GitHub Copilot has been profound, revolutionizing workflows and transforming industries. These tools have empowered professionals in various sectors, enabling them to work more efficiently and creatively. In fields like design and media, AI helps artists and creators bring concepts to life in record time. Developers leverage tools such as GitHub Copilot to enhance productivity, reduce errors, and streamline software development processes. Even in education, AI-powered platforms are personalizing learning experiences for students, making education more accessible and engaging. However, alongside these transformative benefits, the rapid adoption of AI has significant challenges that must be addressed prior to its mass adoption and usage. The challenges can be multifaceted it can be behavioural i.e. over-depedence on AI tools

AI Systems: Increasing reliance on AI for critical decision-making is raising concerns, particularly in sensitive domains such as healthcare and law, where human judgment and accountability are irreplaceable. It can give rise to ethical dilemmas in research and academic domain which are essential to human progress and development, generative AI has been criticized for perpetuating biases in its training data, spreading misinformation, and raising questions about intellectual property rights when using creators' work without consent. It poses a great threat to social stability as it poses an economic implication i.e. the adoption of AI tools has sparked fears of job displacement, especially in roles susceptible to automation. This highlights the urgent need for workforce retraining to equip workers with skills relevant to an AI-driven economy. As AI driven system are regularized in usage, these challenges are coming into sharper focus. AI is no longer an experimental curiosity but a strategic necessity, and addressing these issues will be critical to ensuring AI's continued role as a tool for progress rather than a source of division or disruption.

Human-Centric AI: A Paradigm Shift

Despite widespread concerns about automation replacing jobs, many experts believe that the future of artificial intelligence (AI) lies in augmenting human capabilities rather than replacing them. This "human-in-the-loop" approach positions AI as a collaborator and assistant, ensuring that technology enhances human potential rather than undermines it. AI driven system can be useful to human society in multiple ways one which is collaboration AI systems are increasingly designed to complement human creativity and expertise. For instance, in fields like journalism, co-writing tools draft articles and reports, while human editors refine, contextualize, and inject personal insights. This collaboration allows professionals to focus on higher-order thinking and storytelling. Similarly, in design and art, AI assists creators by generating ideas or automating repetitive tasks, leaving humans to make the critical creative decisions. In higher education, generative AI tools like ChatGPT are used by students to expand knowledge, summarize concepts, and generate research ideas, enhancing productivity and learning experiences(Razmerita, 2024).AI also plays a role in scientific collaboration by improving efficiency, enhancing work quality, and generating new ideas, although challenges such as technical difficulties and AI dependence remain(Gawlik-Kobylińska, 2024). Collaboration is key to adapt and accommodate the technology in active and responsive use.

When there is adoption and interaction with AI based technology there is generation of huge amount of data this can relate to information sharing, generation new ideas, store house of knowledge etc, when culminated and converged to a system to interact in intelligent manner this can aid and act as a decision-making support system. AI-driven decision-making systems utilize deep learning to analyze historical data, improving decision accuracy and reducing human errors (Sadeghi et al., 2024). The decision making is also being used in private sector to uptake decisive decisions in an open an competitive market. Machine learning algorithms help

organizations uncover patterns in large datasets, aiding in strategic business decisions and enhancing market competitiveness (Wang, 2024). AI automates data-driven decisions, providing real-time insights that allow businesses to quickly adapt to market changes (Badmus et al., 2024). Algorithms are now being deployed to assist with complex decision-making processes. In industries like banking, AI helps assess risks, detect fraud, and analyze trends. Similarly, in logistics, predictive analytics driven by AI enhances supply chain efficiency. However, the final decisions, especially those involving nuanced judgment or ethical considerations, typically rest with humans, ensuring accountability and oversight.

Once the collaboration of parties/actors and the technology happens and there is established symbiosis in decision making the outcome is measured as what efficiency gains does these systems provide. AI is revolutionizing efficiency in numerous industries. For example, customer service teams increasingly rely on AI chatbots to manage routine queries, reducing response times and improving operational efficiency. This frees human agents to focus on complex or emotionally sensitive cases that require empathy and problem-solving skills, striking a balance between automation and personalized service. By embracing a human-centric approach, AI systems are not only addressing concerns about job displacement but also creating opportunities for innovation and growth. This paradigm shift underscores the potential of AI as a tool for empowering humanity, fostering a future where technology and people thrive together.

Projected usage of AI in various sectors

As artificial intelligence (AI) continues to evolve, one of the most promising trends is the shift toward "below-the-line" AI—applications that operate behind the scenes yet have a profound impact on efficiency, productivity, and innovation. These often-unseen uses of AI are transforming industries in remarkable ways.

Revolutionising business and supply chain management

In the financial sector, AI is proving indispensable for predictive analytics and decision-making. Financial institutions are using sophisticated algorithms to forecast market trends, identify emerging opportunities, and mitigate risks. These insights enable more informed investment decisions, ensuring better returns and resilience in volatile markets. By focusing on these critical but often unseen applications, AI in 2025 is set to enhance industries in ways that not only boost efficiency but also improve the quality of services delivered. AI is revolutionizing the logistics industry by optimizing complex operations. Algorithms are now capable of designing highly efficient delivery routes, taking into account variables like traffic, weather, and fuel consumption. Predictive analytics powered by AI helps businesses anticipate demand fluctuations, reducing overstocking or understocking issues. Additionally, AI systems are being deployed to manage warehouse inventory more effectively, cutting down on waste and improving overall operational efficiency

Healthcare, Drug Discovery and Mental Well Being

The healthcare sector is seeing transformative applications of AI, particularly in diagnostics and treatment personalization. Diagnostic tools and AI-powered systems analyse medical imaging, such as X-rays and MRIs, with accuracy levels comparable to that of experienced radiologists, enabling earlier and more reliable diagnoses. It also broadens the avenue of personalized medicine, AI helps tailor treatments to patients' unique genetic profiles, improving outcomes while minimizing side effects. This precision medicine approach is also driving down healthcare costs by avoiding ineffective treatments. Quantum computing could significantly accelerate the development of new medical treatments by simulating molecular interactions with unparalleled precision. This capability allows researchers to identify promising compounds, predict their behaviour, and optimize drug designs in ways that traditional computing cannot achieve. The result could be faster, more efficient drug discovery processes, ultimately leading to improved healthcare outcomes. AI-powered algorithms could be developed to detect signs of emotional distress or harmful behaviour patterns among users. For instance, these systems might analyse language in posts or engagement patterns to identify individuals who may be struggling. Social media platforms could then provide these users with resources, such as helpline information, mental health support networks, or coping strategies, fostering a safer and more supportive online environment. By addressing these challenges and exploring innovative solutions, AI has the potential to reshape the social media landscape in ways that prioritize user well-being, trust, and meaningful connections.

AI and the Social Media Landscape

Social media platforms have been among the earliest adopters of artificial intelligence (AI), leveraging algorithms to curate personalized content feeds, moderate posts, AI algorithms in personalising content for social media users, emphasizing their effectiveness in enhancing user engagement and analyze user behavior. These AI- driven tools play a critical role in shaping how users interact with platforms, from recommending relevant posts to detecting harmful content. However, this reliance on AI has not been without controversy, as it has exposed significant challenges and unintended consequences.

An Advance, Intelligent, Responsive and Interactive Computing
As advancements in hardware technology continue to push the boundaries of computing, the potential of artificial intelligence

(AI) is reaching unprecedented levels. Quantum computing, in particular, represents a revolutionary leap forward. Unlike traditional computers, which process information in binary, quantum systems harness the principles of quantum mechanics to perform calculations of immense complexity and scale. This breakthrough technology has the potential to transform a range of industries by solving problems that were previously deemed intractable. There are several transformative applications of AI one such is Climate Modelling, AI powered by quantum computing has the potential to generate more detailed and accurate climate models. By analysing vast datasets and accounting for intricate variables, these systems can provide insights into weather patterns, global warming trajectories, and the impacts of human activity. Such advancements could inform policy decisions, improve disaster preparedness, and drive more effective responses to the climate crisis, enhancing agriculture productivity. Despite the incredible promise of such computing power, it comes with a significant environmental cost. The energy demands of quantum computers and large-scale AI deployments can be substantial, contributing to carbon emissions and environmental strain. To address this, researchers and tech companies are increasingly prioritizing energy-efficient AI development. Initiatives focus on designing algorithms and hardware systems that minimize energy consumption while maintaining high performance, ensuring that the benefits of advanced computing are achieved without compromising sustainability. Unmatched computing power opens new frontiers for AI, but balancing innovation with environmental responsibility will be essential as these technologies evolve.

Understanding AI: Do machines and humans learn the same way?

differences between human and machine learning highlights that while AI models process vast amounts of data rapidly, they struggle with abstraction and generalization, which come naturally to humans. Humans learn through experience, adaptation, and feedback loops in constantly changing environments. Unlike machines, human learning is flexible, adapting to new and unforeseen situations.The brain integrates past experiences with new information to build knowledge. AI models rely on pattern recognition and data-driven learning but lack common sense. They excel at repetitive tasks, calculations, and pattern detection but struggle with creativity and contextual understanding. Unlike humans, AI models do not truly "understand" information but process it statistically. Humans are superior in reasoning, adapting to new environments, and applying knowledge contextually. AI excels in efficiency, processing speed, and reliability for structured tasks like chess and data analysis. Current AI models need vast amounts of data to learn, while humans can generalize knowledge from minimal input.Scientists are exploring how neuroscience insights can improve AI learning methods. While AI continues to advance, human cognition remains unparalleled in flexibility, creativity, and contextual intelligence. AI may complement human intelligence but does not replicate it (Padma,2025).

Key Challenges in AI Adoption

Amplification of Divisive Content and Misinformation

AI algorithms designed to maximize user engagement often prioritize sensationalist or polarizing material. This is because emotionally charged content tends to generate more likes, shares, and comments. Unfortunately, this dynamic can lead to the amplification of divisive or harmful narratives, contributing to societal fragmentation and eroding constructive discourse online. The growing sophistication of AI has made it easier to create "deepfakes" and fabricate realistic yet false news stories. AI-generated content on social media influences public sentiment and trust, altering how users perceive and interact with information (Liao, 2024). These AI-generated materials are increasingly difficult for users to discern as fake, undermining public trust in information shared on social media platforms. The rapid spread of misinformation has significant implications for democracy, public health, and global stability. AI is used in political propaganda for microtargeting and spreading disinformation, but it also helps detect and remove content that violates democratic principles(Azgın & Kıralp, 2024).Legislative measures in various countries mandate the use of AI to counteract propaganda, though this raises concerns about freedom of expression. As these challenges continue to grow, social media companies are likely to pivot toward leveraging AI to create healthier and more trustworthy online ecosystems. AI systems can both enhance and undermine public information campaigns. While they can support public health and democracy, they also have the potential to generate convincing disinformation, complicating the information landscape (Germani et al., 2024) Advanced AI systems could play a vital role in combating misinformation by identifying false claims, verifying facts, and providing users with credible sources. By integrating real-time fact- checking features, platforms can help users make informed decisions while curbing the spread of false narratives.

Ethical Considerations and Challenges

The rapid proliferation of artificial intelligence (AI) technologies has brought immense opportunities, but it has also raised pressing ethical concerns that demand immediate attention. Public views on AI ethics highlight concerns about human agency, privacy, and data governance. However, issues like diversity, fairness, and societal well-being receive less attention (Machado et al., 2023). As AI systems become more integrated into daily life, questions of fairness, accountability, and societal impact are at the forefront of discussions. The ethical use of AI in

public spaces requires careful consideration of privacy and data governance. Transparency and accountability are crucial in addressing these concerns and maintaining public trust (Deng, 2024) One of the most significant challenges in AI is addressing bias embedded in algorithms. Since AI systems are trained on vast datasets derived from real-world information, they often inherit societal prejudices and inequalities. This can result in biased outcomes, disproportionately affecting marginalized groups. For instance, facial recognition software has faced widespread criticism for exhibiting higher error rates when identifying individuals from minority groups compared to others. Such biases can perpetuate discrimination and undermine trust in AI systems, particularly in critical applications like hiring or law enforcement.

As AI increasingly influences critical decision-making processes, there is growing demand for transparency in how these systems operate. Users want to understand the logic behind AI-driven decisions, particularly in areas like credit scoring, policing, and healthcare. The lack of clarity, often referred to as the "black box" problem, can erode trust and raise concerns about accountability, especially when decisions have significant consequences for individuals or communities. While AI is driving innovation and creating new roles in fields like data science and AI engineering, it also poses a risk to jobs in traditional sectors such as manufacturing, customer service, and data entry. Automation threatens roles that involve repetitive or routine tasks, leaving many workers vulnerable to displacement. To address this, governments, corporations, and educational institutions must collaborate to design and implement upskilling and reskilling programs, ensuring that workers are equipped with the skills needed to thrive in an AI-driven economy.

As AI continues to evolve, addressing these ethical challenges will be critical to ensuring its responsible and equitable deployment. Striking a balance between innovation and ethical Considerations will help pave the way for a future where AI serves as a force for societal good.

Test, Implement, Regulate

As artificial intelligence (AI) becomes more deeply integrated into society, several trends are expected to shape its trajectory of the future human development. These developments will impact industries, economies, and individuals in significant ways. A robust testing environment is essential to ensure proper know how of the technology and its immediate impact on its user and his surroundings. A systematic framework for testing and evaluating AI models is necessary to ensure their suitability for specific applications. This includes defining performance metrics, conducting model training and testing, and analyzing results to guide model selection (Li et al., 2023). Testing AI before implementation is crucial to ensure its reliability, safety, and effectiveness in real-world applications. This process involves a comprehensive evaluation of AI models to address potential risks and optimize their performance. The following sections outline key aspects of AI testing prior to deployment. Policymakers will play a more active role in developing such testing infrastructure and regulating AI development, ensuring it aligns with societal values, ethical standards, and legal frameworks. As AI becomes more influential, regulations will address concerns such as data privacy, transparency, and fairness, ensuring the responsible deployment of these technologies while preventing potential misuse or discrimination.

Schools and universities are increasingly incorporating AI literacy into their curriculums, preparing the next generation for an AI-driven world. Students will not only learn technical skills but also understand the ethical and social implications of AI, equipping them for careers where AI will be an essential tool across various industries.AI will continue to enhance the resilience of critical infrastructure, including power grids, water supplies, and transportation networks. By using machine learning and real-time data analytics, AI will help detect vulnerabilities, predict failures, and respond to crises more effectively, ensuring essential systems are better protected against cyber threats and natural disasters. Hence, regulation should establish clear guidelines for AI use, promoting technological advancement while safeguarding fundamental rights and fair competition(Mendes et al., 2024).

Why Local Foundational AI Models Needed?

AI development is currently dominated by Western firms, which may not align with India's cultural, economic, and linguistic diversity.A domestic AI model can ensure data sovereignty, security, and independence from global tech giants.Indian-specific AI can better serve local governance, industries, and citizens. Developing AI requires high computational power, data infrastructure, and investment, areas where India lags behind global leaders.The cost of training a foundational model is massive, demanding both private and public sector collaboration.Ethical and regulatory concerns must be addressed to ensure fairness, transparency, and privacy. The U.S. and China have invested heavily in AI, fostering innovation and economic growth. India can follow a public-private partnership (PPP) model to develop AI infrastructure while ensuring government oversight. India must invest in AI research, build data centers, and promote AI education.Encouraging startups and industries to participate in AI development is crucial (Deep,2025). AI policies should focus on inclusivity, language diversity, and ethical AI governance. Building a

sovereign AI model can enhance India's digital independence, economic growth, and technological leadership. However, it requires strategic investment, policy support, and collaboration between the government and private sector.

Recent AI based Investment and Development in India

OpenAI has initiated discussions to establish a data center in India to accommodate the increasing demand for AI tools like ChatGPT in the country. The center will likely store data of Indian users and possibly some neighboring countries. OpenAI is in the early stages of talks with data center operators.The location and capacity details are yet to be finalized.India is OpenAI's second-largest market, with a 3x rise in users expected by 2024.Most of OpenAI's servers are currently in Texas, USA, and it relies on Microsoft Azure Cloud for operations.Other tech giants like Google, AWS (Mumbai), and Microsoft (Hyderabad) are also expanding data centers in India.Reliance is investing in Nvidia's AI semiconductors and setting up a data center in Jamnagar, Gujarat.OpenAI is reportedly keen to complete the process within this year, though no official timeline has been set.This move aligns with the growing AI infrastructure demand in India, ensuring better performance and data localization. Seeing what people are building in India with Al at all the levels of stack, chips, models...you know all of the Incredible applications, I think India should be doing everything. It is really quite amazing to see what the country has done and embraced the technology." Altman had said during his India visit.Sebastian Thrun, a pioneer in artifi cial intelligence (AD, robotics, and self-driving cars), sees an exciting and huge opportunity for India in Al. he explained that India has huge potential in Al because it is a software-driven field and recommended that India focus on investing in technol ogy, bringing it to the people, and engaging in a broad dialogue about what Al truly means for society.

Conclusion: Rising Above the AI Line

The journey of artificial intelligence (AI) in 2025 is set to be one of recalibration. After years of rapid development and ambitious projections, corporations are beginning to scale back overly lofty expectations and focus on more tangible, impactful use cases. This shift is guiding a clearer understanding of AI's role in society and its potential to reshape the future. While AI has often been portrayed as a disruptive force capable of replacing human labour, the reality is far different. Instead of displacing humans, AI is emerging as a tool designed to amplify human potential, enhancing existing capabilities, transforming industries, and ultimately improving quality of life. AI's integration into various sectors is yielding profound changes. In healthcare, AI-powered diagnostics are accelerating early detection of diseases, leading to more personalized and effective treatments. In agriculture, AI is helping farmers optimize crop yields and manage resources more sustainably. In education, AI is assisting teachers in delivering personalized learning experiences that cater to individual student needs, making education more inclusive and effective. These examples demonstrate how AI is not a replacement for human expertise but a powerful companion, enabling individuals and organizations to achieve new levels of efficiency, precision, and creativity. However, the true potential of AI lies not in its ability to operate in isolation, but in its capacity to collaborate with humanity. AI systems, when used in partnership with human intelligence, have the ability to solve some of the world's most pressing challenges. From addressing climate change to advancing scientific research and improving public health, AI holds the promise of driving positive change on a global scale.

As we move forward into this new era, one thing is abundantly clear: the future of AI is not about autonomous machines acting independently, but about a harmonious collaboration between human ingenuity and machine learning. This partnership will allow us to tackle complex problems more efficiently, while still preserving the human values that make our societies vibrant and diverse. Together, we can rise above the so-called "AI line," moving past fears of obsolescence and toward a future where technology serves as a force for good. By focusing on ethical considerations, prioritizing human well-being, and leveraging AI's capabilities for social good, we have the opportunity to build a brighter, more equitable future for all.

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Exploring the Interplay of Emotional Intelligence and Teacher Performance: Is Self-Efficacy the Mechanism Linking Them?

*Aastha Chauhan
**Nisha Khanna

Abstract

Teaching performance plays a vital role in determining the quality of education, directly influencing student outcomes and the overall success of educational institutions. This study explores the interrelated roles of Emotional Intelligence, Self-Efficacy, and Teaching Performance among college educators. Data were gathered from a sample of 397 college teachers in Haryana through a validated questionnaire. The measurement model was rigorously assessed for reliability and validity, and structural equation modeling was employed to examine the proposed relationships. The results indicate that emotional intelligence significantly impacts teaching performance, both directly and indirectly through self-efficacy. The model's predictive power demonstrates a substantial proportion of variance explained in both self-efficacy and teaching performance. These findings highlight the importance of emotional intelligence and self-efficacy to enhance job performance in higher education. The study offers practical implications for designing teacher development programs aimed at strengthening psychological attributes, ultimately leading to improved instructional practices and student engagement.

Keywords: *Emotional intelligence, self-efficacy, teaching performance, higher education, teacher development, structural equation modeling.*

Introduction

In today's dynamic and continuously evolving educational landscape, psychological constructs such as *Emotional Intelligence (EI)* and *Self-Efficacy* have attracted considerable scholarly interest due to their significant influence on teaching effectiveness and student outcomes (Threesje Yolanda et al., 2021). Emotional intelligence—commonly defined as the ability to recognize, understand, and regulate one's own emotions while effectively managing interpersonal interactions—is vital for creating empathetic and supportive classroom environments (Krishnan & Awang, 2020; Valente et al., 2022). This emotional competence enables teachers to handle stress constructively, engage in effective communication, and cultivate meaningful relationships with students and colleagues (Khassawneh et al., 2022). Complementing this, self-efficacy—the belief in one's ability to accomplish specific goals—acts as a motivational driver that fosters perseverance, adaptability, and professional performance in complex educational contexts (Barni et al., 2019; Hussain & Khan, 2022).

The synergy between "*Emotional Intelligence (EI)* and *Self-Efficacy"* is especially vital in the teaching profession, where emotional resilience and professional confidence are critical to success. Educators with high emotional intelligence are more adept at regulating their emotions, demonstrating empathy toward students, and adapting to the varied and often unpredictable dynamics of the classroom. These competencies, in turn, strengthen their self-efficacy by reinforcing their belief in their ability to manage instructional challenges effectively (Aparisi et al., 2020; Rastegar & Memarpour, 2009). This relationship illustrates how EI not only shapes interpersonal behavior but also directly influences an educator's confidence in achieving teaching goals. Wang (2022) further supports this view, noting that emotionally intelligent teachers experience greater job satisfaction and resilience, which contributes to a heightened sense of efficacy when dealing with complex classroom situations. These findings underscore the reciprocal and mutually reinforcing connection between emotional

*Assistant Professor, Govt. College for Women, Karnal, Haryana, India. E-mail: Aastha.usm@kuk.ac.in
**Assistant Professor, Govt. College for Women, Karnal, Haryana, India. E-mail: nishakhannacommerce@gmail.com

intelligence and self-efficacy, reinforcing the importance of exploring their combined role in enhancing teacher effectiveness.

Moreover, the influence of these psychological constructs extends well beyond individual teacher performance, shaping broader educational outcomes. *Emotional Intelligence (EI)* contributes to the development of inclusive, supportive, and engaging learning environments where students feel understood and motivated to participate (Cocca et al., 2018; Priyono & Widarko, 2024). Simultaneously, *Self-Efficacy* empowers teachers to embrace innovation, persist through obstacles, and consistently deliver high-quality instruction (Fabio & Palazzeschi, 2008; Ye et al., 2024). When cultivated together, these attributes not only refine teaching practices but also elevate the overall educational experience. Their integration into professional development and teacher training initiatives is therefore essential. Embedding EI and self-efficacy into such programs provides educators with the emotional and psychological competencies needed to excel in increasingly complex and demanding teaching environments (Fabio & Palazzeschi, 2008). The significance of this study lies in its contribution to bridging crucial gaps in understanding the psychological foundations of teacher effectiveness. To this end, the study seeks to achieve the following objectives:

(i) "*To examine the relationship between emotional intelligence and self-efficacy in the teaching profession.*"

(ii) "To analyze the impact of emotional intelligence and self-efficacy on teachers' job performance."

(iii) "To investigate the mediating role of self-efficacy in the relationship between emotional intelligence and job performance."

Through the achievement of these objectives, this research advances the comprehensive understanding of the synergistic role of Emotional Intelligence and Self-Efficacy in enhancing instructional effectiveness and promoting favorable student outcomes. The expected outcomes of this research are intended to support educators, decision-makers, and institutional administrators by informing the design of professional training programs tailored to build emotional and psychological resilience among teachers. In doing so, the study contributes to the formulation of evidence-based educational strategies that improve teaching quality and responsiveness to emerging classroom challenges.

This study is divided into five sections: the first introduces the research problem, objectives, and significance; the second reviews relevant literature and presents the theoretical framework and hypotheses; the third outlines the research methodology; the fourth presents and interprets the findings; and the final section concludes with key insights, implications, and future research directions.

Theoretical Background and Hypotheses Development

Understanding the complex relationship between emotional intelligence (EI), self-efficacy, and job performance is crucial in the educational sector. This section delves into the theoretical underpinnings that form the basis of these interconnections, providing a solid foundation for this study. Emotional intelligence is increasingly recognized as a vital trait for educators. It enables teachers to adeptly manage the multifaceted demands of their profession while creating a positive and engaging learning environment. Educators with high EI demonstrate enhanced adaptability, effective problem-solving skills, and proficient management of interpersonal relationships. These competencies are essential for addressing diverse classroom challenges, including catering to varied student needs and upholding discipline. Moreover, emotionally intelligent teachers can regulate their emotions, maintaining composure during stressful situations and exemplifying emotional stability and professionalism. This emotional regulation fosters stronger connections with students, building trust and engagement that positively impact academic outcomes. Additionally, EI equips teachers to manage stress effectively, make informed decisions, and sustain consistent performance under pressure. Collectively, these attributes significantly contribute to the overall effectiveness and job performance of educators. The transformative impact of EI on teaching practices underscores its importance in the educational landscape. Therefore from the above review, the following hypothesis is proposed:

H_1: "Emotional Intelligence positively influences teachers' job performance."

The relationship between "*Emotional Intelligence (EI) and Self-Efficacy*" has attracted considerable attention in educational research. A growing body of literature highlights the significant influence of EI on teachers' confidence and professional competence. As noted by Harun (2017) and Rastegar & Memarpour (2009), individuals in the teaching field who display emotional maturity are adept at recognizing, interpreting, and guiding their emotional processes. This emotional awareness and regulation strengthens their belief in their ability to succeed in their teaching roles. Effective emotional regulation allows teachers to set achievable goals, handle classroom interactions skillfully, and respond positively to challenges—factors that are key to building self-efficacy (Mouton et al., 2013; Salami, 2007).

According to Aparisi et al. (2020), emotionally intelligent teachers are more resilient, show heightened devotion to their teaching responsibilities, and experience a significant boost in self-confidence. Moreover, studies by Amirian & Behshad (2016) and Wang (2022) indicate that emotional intelligence fosters a sense of control and mastery over teaching tasks, helping educators feel more capable and ready to meet their instructional goals. Voulgaraki et al. (2023) also affirm that EI enhances teachers' interpersonal skills, making it easier for them to navigate social and professional challenges. Finally, Ali et al. (2023) and Colomeischi & Colomeischi (2014) emphasize that the dynamic interplay between EI and self-efficacy contributes to increased motivation, job satisfaction, and sustained professional growth among teachers. Grounded in the aforementioned insights, the following hypothesis is formulated:

H2: "Emotional Intelligence positively influences teachers' self-efficacy."

Self-efficacy is widely acknowledged as a foundational element of effective teaching. It directly influences a teacher's ability to set meaningful goals, overcome challenges, and implement creative instructional strategies. Hussain and Khan (2022) synthesized a range of studies showing that teachers with strong self-efficacy tend to display higher levels of enthusiasm, resilience, and adaptability—all of which contribute significantly to improved job performance. Educators who believe in their own capabilities are more likely to take on challenges and persist through difficulties, ultimately enhancing the quality of education they provide. According to Priyono and Widarko (2024), self-efficacy also plays a pivotal role in promoting collaboration and teamwork among educators, positioning it as a key factor in successful teaching practices. Jamil et al. (2017) found that pre-service teachers with high self-efficacy are more open to adopting innovative teaching methods and maintaining a positive outlook—traits that are beneficial to their long-term career development. Similarly, Cocca et al. (2018) and Ye et al. (2024) underscore the importance of self-efficacy in managing classroom complexities, addressing diverse student needs, and meeting academic standards. Barni et al. (2019) and Rezaull Karim et al. (2021) emphasize that a strong sense of self-efficacy enhances not only teaching proficiency but also promotes greater job contentment and a well-defined professional identity. These outcomes help ensure consistent and high-quality performance over time. In light of the preceding review, the following hypothesis is formulated:

H_3: "Teachers' self-efficacy positively influences their job performance."

Self-efficacy plays a pivotal role in linking emotional intelligence (EI) to job performance in the teaching profession. It serves as the mechanism through which emotional competencies are translated into effective teaching practices. According to Hameli and Ordun (2022), self-efficacy functions as a bridge, strengthening the influence of EI on job performance by boosting teachers' confidence, problem-solving abilities, and classroom management skills. Teachers with high emotional intelligence tend to develop a stronger sense of self-efficacy, which in turn enhances their motivation and overall effectiveness, as demonstrated by Anwar et al. (2021). This dynamic relationship involves using emotional awareness and regulation to build professional resilience, adaptability, and a proactive approach to teaching. Research by Lu and Ishak (2022) and Wu et al. (2019) supports this view, noting that EI contributes to a more positive self-perception of capability, allowing teachers to tackle their responsibilities with greater confidence and efficiency. Empirical findings from Pirrone et al. (2022) further affirm that self-efficacy bridges emotional intelligence and job performance by enhancing positive cognition, motivational energy, and dedication to professional responsibilities. These findings highlight the critical function of self-efficacy in helping emotionally intelligent teachers achieve instructional goals, manage challenges effectively, and perform at a high level. Based on this understanding, the following hypothesis is proposed:

H_4: "Self-efficacy mediates the relationship between Emotional Intelligence and teachers' job performance."

Despite growing evidence linking emotional intelligence and job performance, limited studies have examined the mediating role of self-efficacy within this relationship, particularly in the teaching profession. Existing research often overlooks contextual factors such as professional identity and intrinsic motivation. Moreover, most prior studies are confined to Western settings, leaving a gap in understanding within diverse cultural contexts. This study seeks to address these limitations by exploring these dynamics in an underrepresented demographic.

Research Methodology

The section outlines the systematic methodology adopted to investigate the relationships among the selected variables. It details the research framework, criteria for participant selection, data collection methods, and the analytical techniques employed to ensure a rigorous and comprehensive examination of the study variables.

(a) *Research Design:* A quantitative research design has been employed in this study relying on a survey-based method

to gather data from teachers working in diverse educational settings. The primary goal is to explore and analyze the relationships among the core variables: emotional intelligence, self-efficacy, and job performance. A cross-sectional design was selected to collect data at a single point in time, allowing for the assessment of correlations and preliminary insights into possible causal links between the constructs.

(b) *Population and Sample:* The study targets college teachers from various institutions across Haryana as its population. A purposive sampling method was employed to select participants with substantial teaching experience and familiarity with classroom dynamics. To ensure a representative sample and enhance the generalizability of the results, a sample size of 385 was calculated using the formula proposed by Hasan and Kumar (2024). Of the 425 questionnaires collected, 397 were deemed suitable for analysis after thorough data cleaning and validation procedures.

(c) *Variable Description:* The study investigates Emotional Intelligence (EI) as the independent variable, which is hypothesized to impact teachers' job performance—the dependent variable—both directly and indirectly. Self-Efficacy is positioned as the mediating variable, playing a key role between EI and job performance.

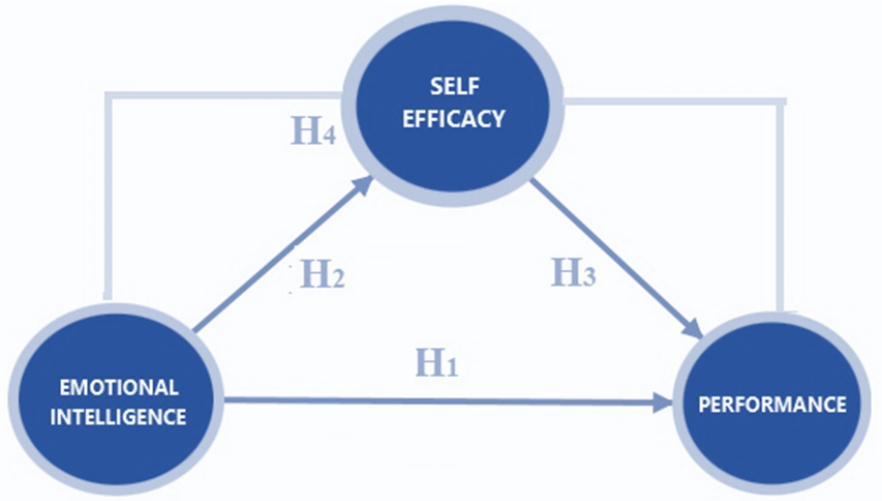

Figure 1 : Model of the Study

Figure 1 illustrates the hypothetical relationships among the study variables. This model highlights the proposed pathways and interactions underlying the study.

(d) Data Collection Tools: The questionnaire consists of three scales: The primary method of data collection involved the use of a "*structured questionnaire*" which incorporated three measurement scales:

- **Emotional Intelligence:** The *"Assessing Emotions Scale"* (AES), created by Schutte et al. (1998), is a 33-item self-report questionnaire designed to evaluate emotional intelligence traits using a five-point Likert scale. It is divided into four subscales: *"Perception of Emotions"* (10 items), *"Management of Personal Emotions"* (9 items), *"Management of Others' Emotions"* (8 items), and *"Utilization of Emotions"* (6 items). Renowned for its high internal consistency, this scale is frequently utilized in emotional intelligence studies.
- **Self-Efficacy:** In this study, the *"General Self-Efficacy Scale"* (GSES), developed by Schwarzer and Jerusalem (1995), was utilized to assess respondents' self-efficacy. This unidimensional scale comprises 10 items that evaluate an individual's confidence in managing challenges & difficulties. The five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree" was used.
- **Teaching Job Performance:** Teachers' teaching performance was assessed using the *"Middle School Teachers' Classroom Teaching Strategy Scale* (MSTCTSC)", a 23-item instrument developed by Corcoran & Tormey (2013) and Darling-Hammond (2010). This scale measures the extent to which educators implement various teaching strategies, serving as an indicator of their teaching effectiveness. The MSTCTSC comprises four key dimensions: *"Managing Strategy"* (4 items), *"Motivational Strategy"* (5 items), *"Teaching Methods"* (11 items), and *"Instructional Strategy"* (3 items). For this study, the scale

was adapted for application to college educators, with reliability and validity analyses conducted to confirm its appropriateness for this academic context

(e) Data Collection Procedure: The questionnaire was distributed through both online and offline channels to enhance accessibility and encourage broad participation. Ethical standards were strictly upheld during collecting the responses process. Respondents were provided with clear instructions and reassurances regarding the voluntary nature of their involvement, promoting transparency and adherence to ethical research practices.

(f) Analytical Techniques: Descriptive analysis was conducted to summarize the data. Correlation and Structural Equation Modeling (SEM) were used to explore relationships among the variables and to test the proposed hypotheses.

Data Analysis and Discussion

This section presents the results of the data analysis in a structured manner, encompassing both the measurement model and the structural model. The results are interpreted within the context of relevant theoretical frameworks and prior research, offering meaningful insights into the interplay between selected variables of the study. An in-depth explanation of the analysis is presented in the following sections:

(a) Measurement Model Assessment

To ensure the robustness of the constructs, the measurement model is assessed for reliability and validity. Ensuring these criteria are met is critical to verifying that the constructs are both conceptually sound and statistically robust, thereby supporting their use in subsequent structural analysis.

(i) Reliability Statistics

Reliability analysis assesses whether the items grouped under a specific construct reliably measure the same underlying concept. In this study, the reliability was evaluated using two indicators: "*Cronbach's alpha and Composite Reliability (CR).*" According to Hair et al. (2019), a Cronbach's alpha value more than 0.70 reflects an acceptable level of internal consistency, while a CR value exceeding 0.70 confirms the reliability of the construct. The outcomes of the reliability assessment are presented in Table 1.

Table 1: Reliability Statistics

	"Cronbach's alpha"	**"Composite reliability (rho_a)"**	**"Composite reliability** (rho_c)"
EMOTIONAL_INTELLIGENCE	0.913	0.915	0.939
PERFORMANCE	0.855	0.863	0.901
SELF_EFFICACY	0.929	0.932	0.940

As per the results of the reliability statistics, "Cronbach's Alpha (α)" evaluates the degree to which items within a construct consistently reflect the same latent concept, with values exceeding 0.70 generally indicating acceptable reliability. "Composite Reliability (ρc)", often deemed a more refined measure, considers the individual contribution of each indicator, and also adheres to the same threshold for acceptability. Meanwhile, "rho_A (ρa)" provides a reliability estimate based on construct-specific assumptions, contributing to a more nuanced evaluation of internal consistency. The results indicate excellent reliability across all constructs. Emotional Intelligence demonstrated high internal consistency, with values 0.913 (α), 0.915 (ρa), and 0.939 (ρc) exceeding the recommended threshold. Similarly, the Performance construct showed strong reliability, with values of 0.855 (α), 0.863 (ρa), and 0.901 (ρc). The Self-Efficacy construct also exhibited outstanding reliability, with $\alpha = 0.929$, $\rho_a = 0.932$, and $\rho c = 0.940$. These results confirm that all three constructs possess strong internal consistency, validating the reliability of the measurement model and supporting its readiness for further structural analysis.

(ii) Convergent Validity

Convergent validity assesses the extent to which the indicators of a latent construct accurately reflect the same underlying concept. As per the guidelines established by Fornell and Larcker (1981), an Average Variance Extracted (AVE) value exceeding 0.50 indicates adequate convergent validity. The results for each construct are summarized in Table 2.

Table 2: Convergent Validity Statistics

	AVE
EMOTIONAL_INTELLIGENCE	0.795
PERFORMANCE	0.695
SELF_EFFICACY	0.609

The findings demonstrate that all constructs meet the recommended threshold for convergent validity. *Emotional Intelligence* recorded an AVE of 0.795, indicating that 79.5% of the variance in its indicators is explained by the construct. *Performance* achieved an AVE of 0.695, meaning it accounts for 69.5% of the variance in its indicators. Likewise, *Self-Efficacy* showed an AVE of 0.609, signifying that 60.9% of the variance is captured by the construct. These results confirm that each construct reliably explains a substantial portion of the variance in its items, providing strong evidence of convergent validity and reinforcing the measurement model's suitability for further structural analysis.

(iii) Discriminant Validity

The Heterotrait-Monotrait Ratio (HTMT) was utilized to establish discriminant validity, given its reliability and acceptance in SEM literature. All HTMT values were below 0.85, supporting discriminant validity; 0.90 was considered as the upper limit where applicable. The results affirm that each construct measures a distinct concept within the model. Table 3 illustrates the comprehensive findings of this analysis.

Table 3: Discriminant Validity Statistics (HTMT Criterion)

	EMOTIONAL_INTELLIGENCE	PERFORMANCE	SELF_EFFICACY
EMOTIONAL_INTELLIGENCE			
PERFORMANCE	0.630		
SELF_EFFICACY	0.634	0.704	

The results indicate that all HTMT values fall well within the acceptable range, confirming strong discriminant validity among the constructs. Specifically, the HTMT value between *EI* and *Performance* was 0.630, between *EI* and *Self-Efficacy* was 0.634, and between *Performance* and *Self-Efficacy* was 0.704. These values are all below the standard threshold of 0.85 shows the discriminant validity of the measurement model and affirms its adequacy for further structural analysis.

(iv) Model Fit Indices

The estimated model demonstrates an acceptable level of fit based on the model indices. "*Standardized Root Mean Square Residual* (SRMR)" evaluates the average difference between observed and predicted correlations. A lower SRMR value reflects a better model fit, with values below 0.08 generally considered acceptable. As shown in Table 4, the SRMR for the estimated model is 0.066, which meets the acceptable threshold and indicates a good fit. For comparison, the saturated model—being unconstrained—yields a slightly lower SRMR of 0.061. This is typical, as saturated models allow for maximum flexibility. The Chi-square value for the estimated model is 3245.340, slightly higher than that of the saturated model (3065.152), which is expected given the constraints introduced in the specified model. These results collectively confirm that the estimated model fits the observed data well and is suitable for further interpretation.

Table 4 Model Fit Indices

	"Saturated model"	"Estimated model"
SRMR	0.061	0.066
Chi-square	3065.152	3245.340
NFI	0.841	0.843

The *Normed Fit Index* (NFI) values range from 0 to 1, with values of 0.90 or higher generally indicating a strong model fit. As a widely used metric in structural equation modeling, it provides insight into how well the proposed model performs relative to a baseline. In this study, the estimated model yielded an NFI of 0.843, representing a slight improvement over the saturated model's NFI of 0.841. Hence, the model meets the required fit criteria and ready for further analytical procedures based on the observed results.

(v) Correlation Statistics:

To assess the strength and direction of relationships among the latent variables, correlation statistics were computed and are presented in Table 5. The observed patterns not only support the conceptual framework but also reinforce the validity of the structural model, indicating that the variables are aligned in accordance with the study's hypotheses.

Table 5: Correlation Statistics

	EMOTIONAL INTELLIGENCE	PERFORMANCE	SELF_EFFICACY
EMOTIONAL_INTELLIGENCE	1.000		
PERFORMANCE	0.574	1.000	
SELF_EFFICACY	0.601	0.637	1.000

The correlation matrix offers detailed insights into the relationships among selected independent and dependent variables for the study. *Emotional Intelligence* shows a moderate positive correlation with *Performance* (r = 0.574), highlighting that emotionally intelligent individuals are more likely to excel in their professional roles. Moreover, a stronger positive correlation is observed between *Emotional Intelligence* and *Self-Efficacy* (r = 0.601), suggesting that emotionally intelligent individuals tend to have greater confidence in their abilities—highlighting EI's role in reinforcing self-belief. Additionally, *Self-Efficacy* correlates moderately with *Performance* (r = 0.637), emphasizing its strong influence on job outcomes. This supports that self-efficacy acts as a bridge linking emotional intelligence to performance. In essence, confidence in one's capabilities can significantly enhance professional effectiveness. These statistically significant, positive correlations align well with the theoretical framework and provide a robust basis for further testing of direct, indirect, and total effects within the structural model.

(b) Structural Model Assessment:

The structural model assessment focuses on evaluating the hypothesized relationships among the latent variables by analyzing their direct, indirect, and total effects. By confirming the expected linkages between constructs, the structural model assessment validates the study's theoretical framework and highlights the interconnected roles of selected independent and dependent variables for the study.

(I) Direct Effects (path coefficients and hypothesis testing)

The direct effects represent the immediate relationships between independent and dependent variables in the structural model, as captured by the path coefficients. The results have been shown in table 6 and figure 2. These coefficients indicate the strength and direction of influence each predictor variable exerts on the outcome variable.

Table 6: Path Analysis (Direct Effects)

	Path Coeff.	S.D.	t stat	p value	Decision
"EMOTIONAL_INTELLIGENCE -> PERFORMANCE"	0.300	0.046	6.515	0.000	H1 Supported
"EMOTIONAL_INTELLIGENCE -> SELF_EFFICACY"	0.601	0.034	17.607	0.000	H2 Supported
"SELF_EFFICACY -> PERFORMANCE"	0.457	0.042	10.912	0.000	H3 Supported

The statistical analysis of the hypothesized relationships reveals significant findings, as detailed below:

• *"Emotional Intelligence and Performance*

The path coefficient for the relationship between *Emotional Intelligence (EI)* and *Performance* is 0.300, with a P-value of 0.000 indicate a highly significant and positive relationship. These findings suggest that higher levels of emotional intelligence among teachers are associated with better job performance. This underscores the critical role of emotional regulation, self-awareness, and interpersonal competencies in promoting teaching effectiveness. The results provide strong support for **Hypothesis 1 (H1)**, which posits that emotional intelligence has a positive influence on teachers' job performance. The significance of this relationship highlights the value of emotional intelligence in enhancing educators' ability to manage classroom challenges, build meaningful relationships, and create a supportive learning environment. Overall, the findings reaffirm that emotionally intelligent teachers are more likely to excel in their roles and positively impact student outcomes.

• *"Emotional Intelligence and Self-Efficacy*

The relationship between *Emotional Intelligence* and *Self-Efficacy* is indicated by a path coefficient of 0.601 and a P-value of 0.000 reveal a strong and statistically significant positive relationship. This suggests that teachers with higher emotional intelligence are more likely to exhibit greater confidence in their ability to navigate classroom demands and

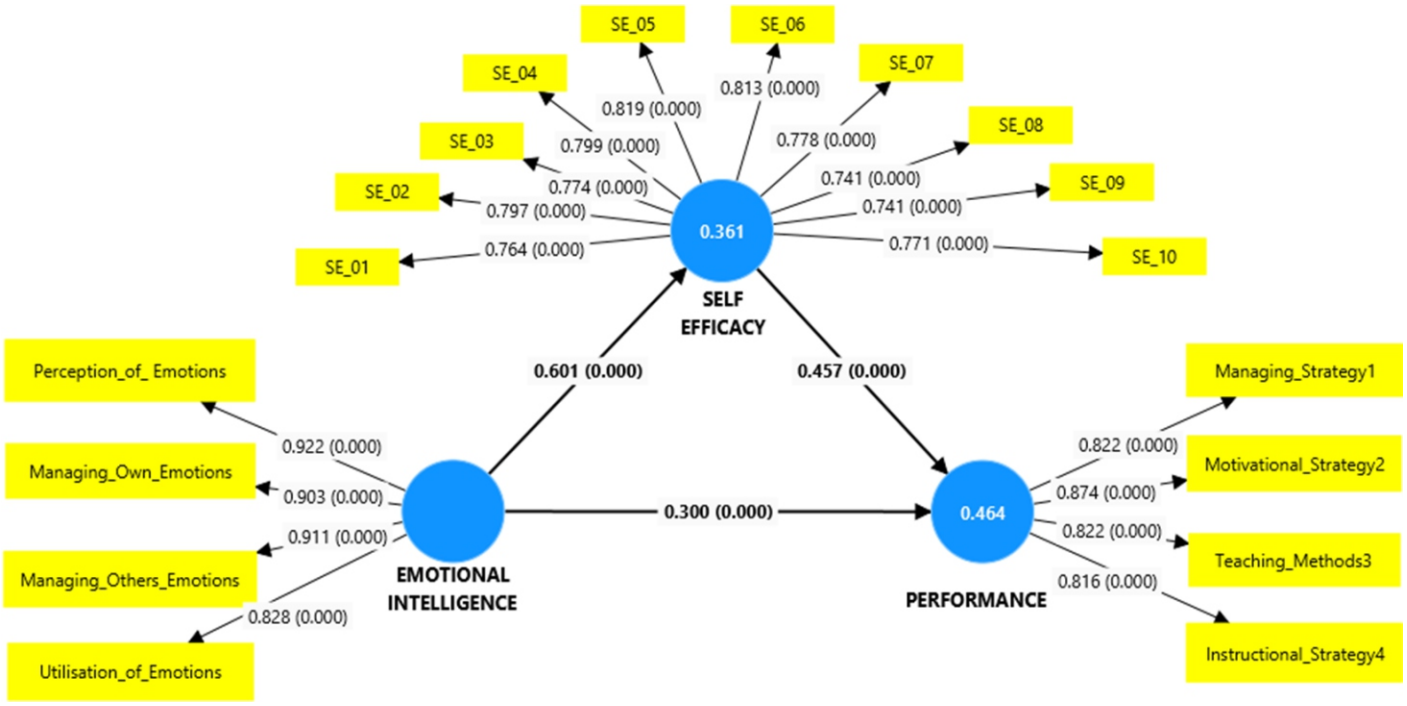

Figure 2 : "Structural Equation Model of Emotional Intelligence, Self- Efficacy and Teachers Job Performance"

Source: *Smart PLS 4 output (Author)*

achieve their instructional objectives. These findings provide robust support for **Hypothesis 2 (H2)**, which posits that emotional intelligence positively influences self-efficacy. The results demonstrate that emotionally intelligent educators are better equipped to regulate their emotions, remain resilient under pressure, and sustain belief in their teaching capabilities. This enhanced self-efficacy, in turn, contributes to improved instructional planning, classroom management, and student engagement—further reinforcing the integral role of emotional intelligence in the professional competence of teachers.

• *"Self-Efficacy and Performance*

The analysis reveals a significant positive relationship between *Self-Efficacy* and *Performance*, evidenced by a path coefficient of 0.457 and a P-value of 0.000 confirm the robustness and statistical significance of this relationship. These results suggest that self-efficacy plays a crucial role in enhancing teachers' job performance. Teachers who have strong confidence in their capabilities are more likely to approach challenges proactively, stay motivated, and maintain consistent effectiveness in their professional responsibilities. This finding lends strong support to **Hypothesis 3 (H3)**, which posits that self-efficacy significantly influences teachers' job performance. It highlights the importance of fostering confidence and self-belief among educators, as these qualities empower them to overcome difficulties and perform at higher levels.

Moreover, the results underscore the interconnected nature of "*Emotional Intelligence*, *Self-Efficacy*, and *Performance"* in shaping teaching effectiveness. These insights provide a solid empirical basis for developing targeted professional development programs aimed at strengthening these psychological attributes, ultimately leading to improved educational outcomes.

(ii) "Indirect Effects (mediation analysis)

Indirect effects assess the influence of one variable on another through a mediating variable, offering a more nuanced understanding of how relationships unfold within the model. This analysis helps determine whether the association between the independent and dependent variables is fully or partially mediated by the intervening construct. In structural equation modeling, the significance of indirect effects is commonly evaluated through bootstrapping techniques, which enhance the accuracy of inference. In this study, *Table 7* presents the mediation analysis results, highlighting the indirect effects of *Emotional Intelligence* on *Teaching Performance* via *Self-Efficacy*. The indirect pathways are also visually illustrated in *Figure 2*.

Table 7: Mediating Impact of Self Efficacy

	Path Coefficients	S.D.	t stat	P value	Decision
"EMOTIONAL_INTELLIGENCE -> SELF_EFFICACY -> PERFORMANCE"	0.275	0.030	9.040	0.000	**H4** ***Supported***

The mediating relationship between *Emotional Intelligence (EI)* and *Performance* through *Self-Efficacy* is represented by a path coefficient of 0.275 and a P-value of 0.000 confirm that this mediating effect is both positive and statistically significant. These findings validate the presence of an indirect pathway through which emotional intelligence influences job performance, with self-efficacy acting as a key explanatory mechanism. This evidence supports "**Hypothesis 4 (H_4)** which proposes that self-efficacy plays a mediating role in the relationship between emotional intelligence and job performance among teachers." The results emphasize the dual importance of emotional competencies and self-belief in enhancing professional effectiveness. By fostering both attributes, educational institutions can more effectively support teachers in navigating challenges, building confidence, and achieving stronger educational outcomes.

(iii) "Total Effects (combined impact)

Total effects represent the combined influence of both direct and indirect effects, offering a comprehensive understanding of how an independent variable impacts a dependent variable. As presented in *Table 8*, total effects provide an overarching view of the relationships within the structural model by capturing the full extent of influence, including both mediated and unmediated pathways.

Table 8 Path Analysis (Total Effects)

	Path Coefficients	S.D.	t stat	P value
"EMOTIONAL_INTELLIGENCE -> PERFORMANCE"	0.574	0.038	15.183	0.000
"EMOTIONAL_INTELLIGENCE -> SELF_EFFICACY"	0.601	0.034	17.607	0.000
"SELF_EFFICACY -> PERFORMANCE"	0.457	0.042	10.912	0.000

The *Total Effects Table* highlights the cumulative impact of both direct and indirect relationships among the study variables, confirming the proposed hypotheses. *Emotional Intelligence (EI)* exerts a significant total effect on *Performance*, both through a direct path (O = 0.574, p = 0.000) and an indirect path via *Self-Efficacy*, underscoring its multifaceted influence on job outcomes. EI also demonstrates a strong direct effect on *Self-Efficacy* (O = 0.601, p = 0.000), reinforcing the hypothesis that emotionally intelligent teachers tend to possess greater confidence in their professional abilities. In addition, *Self-Efficacy* significantly influences *Performance* (O = 0.457, p = 0.000), confirming its role as a key mediator in the model. These findings validate the hypothesized structural relationships and emphasize the importance of addressing both emotional and psychological factors to enhance teacher performance. The total effects thus offer a comprehensive understanding of how emotional intelligence and self-efficacy together play a vital role in boosting teacher performance.

(c) Model Predictive Power

The ***R^2*** (coefficient of determination) and ***Adjusted R^2*** values provide an overview of the structural model's explanatory power. R^2 shows how well predictors explain the outcome. Adjusted R^2 accounts for model complexity, offering a more accurate estimate. As shown in *Table 9*, these values serve as essential indicators of the model's overall strength and its ability to explain the observed outcomes.

Table 9: Model Predictive Power

	R-square	R-square adjusted
PERFORMANCE	0.464	0.462
SELF_EFFICACY	0.361	0.360

R^2 and Adjusted R^2 values reflect the model's capacity to explain variance in the outcome variables. For *Performance*, the R^2 value of 0.464 indicates that 46.4% of the variance is explained by the combined effects of *Emotional Intelligence* and *Self-Efficacy*. The corresponding *Adjusted* R^2 of 0.462 shows only a minimal reduction after accounting for the number of predictors, affirming the model's robustness and suggesting that overfitting is not a concern. This moderately high level of explained variance underscores the significant joint influence of the two predictors on performance, while also acknowledging that 53.6% of the variance remains unexplained—pointing to the potential role of other influential factors outside the current model. In the case of *Self-Efficacy*, the R^2 value is 0.361, meaning that 36.1% of the variance in this construct is explained by *Emotional Intelligence* alone. The *Adjusted* R^2 of 0.360 reflects a negligible decrease, further supporting the reliability of this prediction. Although the level of explained variance is reasonably strong, it also implies that other unmeasured variables may contribute to self-efficacy development.

Overall, these results highlight the importance of considering additional predictors in future research to further enhance the model's explanatory capacity—particularly in relation to teaching performance.R^2offe

(a) Effect Size

Effect size is a crucial metric used to evaluate the individual contribution of each independent variable in explaining the variance of a dependent variable within the structural model. In this study, f^2 serves as the primary indicator, quantifying the extent to which each predictor uniquely enhances the model's explanatory power. "As per Cohen's (1988) criteria, f^2 values of 0.02, 0.15, and 0.35 correspond to small, medium, and large effects, respectively." This analysis is instrumental in identifying the relative importance of each predictor variable. By determining the magnitude of their individual contributions, it helps prioritize which variables have the most substantial impact on outcomes.

Table 10: Effect Size (f^2)

	EMOTIONAL_INTELLIGENCE	PERFORMANCE	SELF_EFFICACY
EMOTIONAL_INTELLIGENCE		0.107	0.564
PERFORMANCE			
SELF_EFFICACY		0.249	

The f^2 effect size values, as presented in *Table 10*, reflect the unique contribution of each independent variable to the variance explained in the dependent variables, offering critical insight into their relative influence within the structural model. Based on Cohen's (1988) guidelines, *Emotional Intelligence* demonstrates a small to medium effect on *Performance* (f^2 = 0.107), suggesting a moderate but meaningful contribution. In contrast, its effect on *Self-Efficacy* is notably large (f^2 = 0.564), underscoring its essential role in shaping individuals' confidence and belief in their capabilities. *Self-Efficacy*, in turn, shows a medium to large effect on *Performance* (f^2 = 0.249), indicating its significant impact on teaching outcomes. These findings emphasize the pivotal function of both *Emotional Intelligence* and *Self-Efficacy* within the model. Notably, *Emotional Intelligence* emerges as a particularly strong predictor of *Self-Efficacy*, which subsequently plays a central role in enhancing *Performance*. The effect size analysis clarifies the strength of each variable's influence and guides targeted interventions and future research priorities.

(a) Discussion

This work enriches the existing body of knowledge in educational research by examining the interconnected roles of "*Emotional Intelligence (EI)*, *Self-Efficacy*, and *Teaching Performance"* among college educators. The results demonstrate that EI significantly influences teaching performance, both directly and indirectly, with self-efficacy serving as a mediating factor. The direct effect of EI aligns with existing literature emphasizing the value of emotional regulation, adaptability, and interpersonal skills in enhancing professional effectiveness (Krishnan & Awang, 2020; Lourenço et al., 2024; Valente et al., 2022). By regulating emotions and building positive interactions, emotionally intelligent teachers improve both classroom management and student learning outcomes. The mediating effect of self-efficacy further supports the idea that emotional intelligence enhances teachers' confidence and professional competence, enabling them to implement innovative strategies and sustain instructional quality (Ali et al., 2023; Aparisi et al., 2020; Rastegar & Memarpour, 2009; Voulgaraki et al., 2023; Wang, 2022). High self-efficacy correlates with persistence, resilience, and the consistent delivery of quality instruction (Cocca et al., 2018; Jamil et al., 2017; Priyono & Widarko, 2024; Rezaull Karim et al., 2021). The study affirms the synergistic relationship between EI and self-efficacy, confirming the latter's role as a conduit through which "Emotional Intelligence" enhances performance

(Hameli & Ordun, 2022; Lu & Ishak, 2022; Pirrone et al., 2022). These findings have significant practical implications, suggesting that professional development initiatives should prioritize building emotional and psychological competencies. Programs that develop emotional regulation, resilience, and self-confidence can significantly strengthen educators' ability to cope with challenges and boost professional effectiveness. Future research is encouraged to replicate this model across different educational levels and explore additional influencing factors—such as job satisfaction and institutional support—to provide a more comprehensive framework for understanding teaching effectiveness.

Conclusion and Policy Recommendations

The findings of this study reveal that "*Emotional Intelligence (EI)* and *Self-Efficacy"* serve as central factors contributing to the improved teaching performance of college educators.. The findings establish that EI not only has a direct positive effect on teaching performance but also exerts a significant indirect influence through the mediating role of self-efficacy. EI-empowered teachers exhibit greater adaptability, resilience, and interpersonal competence, equipping them to navigate the complexities of the classroom more effectively. Furthermore, self-efficacy contributes meaningfully to teaching outcomes by reinforcing teachers' confidence, persistence, and motivation—key traits that enhance professional performance. These insights are consistent with existing literature, affirming the theoretical foundation of the study and highlighting the interconnected nature of psychological attributes in shaping effective teaching practices. By offering evidence-based findings, this research advances the understanding of how emotional and cognitive factors contribute to job performance in educational contexts. It also lays the groundwork for strategic initiatives aimed at cultivating these attributes among educators. In light of the results, several policy recommendations are proposed to enhance teacher development and institutional support mechanisms.

Based on the study's findings, the following recommendations are proposed to strengthen teacher performance by fostering emotional intelligence and self-efficacy among educators:

- *Professional Development Programs:* Institutions should implement targeted professional development initiatives aimed at enhancing emotional intelligence through training in emotional regulation, stress management, and interpersonal communication. These programs should also incorporate components designed to build self-efficacy, enabling teachers to confidently manage classroom dynamics and instructional challenges.
- *Mentorship and Peer Support Systems:* Mentorship programs should be established to pair novice teachers with experienced educators, facilitating professional growth through guidance and collaborative learning. Additionally, schools and colleges should provide access to institutional support such as counseling services, stress-relief resources, and transparent performance evaluation systems, all of which contribute to reinforcing teachers' job satisfaction and self-efficacy.
- *Integration into Teacher Training Curricula:* Pre-service teacher training programs should include structured modules on emotional intelligence and self-efficacy development. These components will prepare educators for the emotional and cognitive demands of modern classrooms. Regular evaluations using standardized tools should be conducted to identify individual development needs and guide personalized support strategies.
- *Policy Advocacy for Holistic Teacher Development*: At both national and institutional levels, education policies should emphasize the importance of holistic teacher development. Recognizing the significant influence of "Emotional Intelligence" and "Self-Efficacy" on "Teaching Performance" and student success, policies should allocate resources and support for initiatives that nurture these competencies.

These recommendations collectively aim to elevate teaching effectiveness, promote a positive learning environment, and ultimately improve educational outcomes through well-rounded teacher support systems.

Future Research Directions

Although the study yields significant findings, recognizing its limitations helps in refining interpretations and guiding more focused future investigations. The use of a cross-sectional design limits the ability to infer causal connections among "Emotional Intelligence (EI), Self-Efficacy, and Teaching Performance." Employing longitudinal designs in future research could better illustrate the developmental nature of these constructs over time. Moreover, the sample was confined to college-level educators, which may limit the generalizability of findings to other academic settings such as elementary or secondary schools. Expanding the participant pool to include a wider range of educational institutions would enhance the external validity of the model. An additional limitation of the study lies in its sole reliance on self-assessed data, which may be influenced by participants' inclination to present themselves in a socially favorable light. Future studies may enhance the credibility of findings by integrating supplementary data

sources such as peer assessments or classroom observations. Additionally, the study's scope was limited to EI and self-efficacy, possibly omitting other influential factors such as organizational culture, workplace satisfaction, and institutional resources, which may also have a significant impact on teaching outcomes. Lastly, as the study was carried out within a particular socio-cultural and geographic setting, the generalizability of its findings to broader contexts may be limited. Comparative studies across diverse regions and institutional frameworks are recommended to assess the broader applicability of the proposed model. Addressing these concerns in future research will contribute to a deeper and more context-sensitive exploration of the factors influencing teaching effectiveness.

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Fostering Sustainable HRM through the Integration of Workplace Spirituality with Diversity, Equity, and Inclusion (DEI)

*Yanshika Gulati
**Devesh Kumar

Abstract

This comprehensive study examines ways in which workplace spirituality can be incorporated in Diversity, Equity, and Inclusion (DEI) initiatives to address sustainable Human Resource Management (HRM). Various organizations have been successful in implementing the components of DEI, but it has been difficult to create a truly inclusive culture that may allow employees' emotional and psychological well-being to be supported. Workplace spirituality has already formed as a crucial element in creating work environments that are meaningful, but its function in DEI initiatives has yet to be studied in the sustainable HRM context. This paper presents a new way to think about DEI initiatives, one that proposes to connect workplace spirituality to employee wellbeing, organizational commitment, and sustainable HRM practices. It is possible for an organization to establish a holistic and inclusive workplace culture by connecting spiritual values such as meaningful work, community, and shared goals to DEI initiatives. By bringing together workplace spirituality and DEI initiatives, organizations have the opportunity to facilitate ethical leadership, employee engagement, and increased collegiality during conflict and strategic decision making. The qualitative review identifies gaps in the existing literature on spirituality and DEI with the intention of providing practitioners in HRM a framework for a more holistic approach to social change. Workplace spirituality is defined by employees' experiencing meaningful work, community, and community through alignment with their organization and its value statements, thereby supporting an alternative way of thinking of inclusivity initiatives by shifting how one thinks about DEI practices as means focused on intentions by taking more radical action. By conducting a comprehensive literature review, theoretical analysis, and case studies, this study proposes a conceptual framework for SPDEI strategies. It highlights the importance of HRM guidelines that acknowledge spirituality as a part of diversity and ensure that it cascades through all aspects of sustainability.

Keywords: *Workplace Spirituality, Diversity, Equality, and Inclusion (DEI), Sustainable HRM, Employee Well-being, Organizational Culture.*

Introduction

Modern-day work environments are starting to understand just how important Diversity, Equity, and Inclusion (DEI) are for innovative development, employee engagement, and overall systems performance (Roberson, 2019); however, many organizations have difficulty creating inclusive climates that resonate with employees' affective and cognitive needs (Shore et al., 2018) despite the use of innovative HR policies. DEI efforts frequently get mired in compliance, such as ensuring diversity targets are met, rather than promoting a portfolio of employees with a shared sense of belonging and purpose (Ferdman, 2017). This is where workplace spirituality comes into play, which focuses on infusing personal meaning, connection, and ethical values into the workplace (Ashmos & Duchon, 2000). By creating a more inclusive and purpose-driven climate through workplace spirituality, organizational leaders can tap into spiritual concepts such as mindfulness, compassion, and servant leadership (Pawar, 2016). This study will explore how workplace spirituality can advance DEI initiatives and cultivate sustainable employee engagement, ethical leadership, and a harmonious workplace. The goal is to understand how the individual characteristics of workplace spirituality can inform DEI approaches that promote sustainable Human Resource Management practices and to present a conceptual model for how workplace spirituality can be integrated into DEI strategies that encourage organizational sustainability over the long term. The workplace is undergoing a significant transformation as

*Research Scholar, HPKV Business School, Central University of Himachal Pradesh Dharamshala India
**Associate Professor, HPKV Business School, Central University of Himachal Pradesh Dharamshala India. E-mail: deveshkumarsharma@hpcu.ac.in

organizations increasingly realize that employee well-being involves more than merely salaries and a physical work environment (Ahmed et al., 2022). DEI initiatives become an important focal point of HRM strategies aimed at creating equitable environments for every employee to thrive (Roberson, 2019). Despite the policies surrounding DEI, many organizations still struggle with implementation barriers to full inclusion because of challenges with emotional or cultural integration (Shore et al., 2018). The use of workplace spirituality combined with diversity, equity, and inclusion (DEI) efforts provides a valuable opportunity for the development of a more holistic, sustainable approach to human resource management (HRM). More specifically, research suggests retreats that adopt spiritual inclusivity can enhance psychological well-being, decrease conflict, and promote higher employee engagement (Gotsis & Kortezi, 2008). Furthermore, where spiritual values align with DEI principles—such as equity, respect, and social justice—potential positive organizational culture can be improved and sustained for the long term (Fernando & Jackson, 2020). However, the intersection of workplace spirituality and DEI principles remains mostly unexplored in HRM literature (Guillory, 2021). This paper considers the ways in which integrating workplace spirituality into DEI strategies will support sustainable human resource management through inclusive leadership, ethical decision-making, and overall employee well-being. This work includes conceptual development based on prior theories and empirical research, arguing for how spirituality connects with DEI and provides new considerations for HR practitioners. The study contributes to expanding discussions about inclusive workplaces beyond marginalisation and to larger considerations of corporate sustainability and social responsibility.

Literature Review

In this section, we will review the relevant literature. When we discuss Workplace Spirituality and Diversity, Equity, and Inclusion (DEI), we view them as coming together as integrated perspectives. The common goal of workplace spirituality and DEI initiatives is to develop inclusive, meaningful, and equitable work environments. Historically, DEI efforts have focused primarily on the visible aspects of diversity, including race, gender, and physical ability. Workplace spirituality expands our understanding of diversity to include the invisible, which includes the various needs employees have for purpose, meaning, and connection at work (Fernando & Jackson, 2020). This spiritual aspect of diversity is especially crucial in today's multicultural workplaces, where employees come with a rich tapestry of worldviews, values, and ways of making sense of their professional experiences (Altaf & Awan, 2011). Research indicates that organizations that weave spiritual inclusion into their DEI strategies see a 28% boost in psychological safety scores, as employees feel more at ease bringing their whole selves to work (Edmondson, 2018).

The equity component of DEI finds natural alignment with workplace spirituality principles. Spiritual approaches to leadership and organizational culture emphasize the inherent worth and dignity of every individual, which translates into more equitable workplace practices (Fry & Nisiewicz, 2013). For example, a study of healthcare organizations found that units incorporating spiritual values in their DEI initiatives demonstrated 23% fewer reported instances of discrimination and 19% greater perceptions of fairness in promotion decisions (Rathee & Rajain, 2020). This occurs because spiritual frameworks encourage leaders to see employees holistically rather than through limiting demographic categories, thereby reducing unconscious bias in decision-making (Karakas, 2010). Furthermore, spiritual practices like mindfulness have been shown to decrease implicit bias among managers by 17%, creating more equitable work environments (Reb et al., 2015).

The inclusion aspect of DEI is significantly enhanced when organizations foster spiritual connection among employees. Unlike superficial diversity initiatives, spiritually grounded inclusion creates deeper bonds by emphasizing shared humanity and common purpose (Pawar, 2016). Research by Gotsis and Kortezi (2008) demonstrated that teams participating in values-based dialogue sessions (a spiritual inclusion practice) showed 32% higher cohesion scores and 25% greater collaboration across demographic lines compared to control groups. This is especially important for underrepresented employees - a study of women in STEM showed that access to spiritually inclusive employee resource groups made a sample of women 41% less isolated and boosted retention by 18% (Travis, 2020). The implication is that a spiritual connection can, at least in some way, equalize things and engender true inclusion that transcends any type of diversity. There are many organizations, and Washington's (2021) work shows this very clearly, that have DEI initiatives that sound obligatory or even hostile. Organizations can use workplace spiritualities as different alternatives to DEI initiatives and allow people to voluntarily engage with diversity principles, rather than as something they begrudgingly have to attend to because it is the right thing to do (rather than really understanding the "why" behind these things). For example, companies that have incorporated a contemplative practice like shared reflection or mindfulness meditation have found that they were able to increase participation in DEI programs by 35% in comparison to trainings and intersectionality workshops (Marques, 2018).

This happens because spiritual approaches rely on intrinsic motivation rather than external compliance (Deci & Ryan, 2000). Moreover, spiritual frameworks help facilitate difficult

conversations about diversity by establishing opportunities to be vulnerable and connect - an analysis of a racial dialogue groups indicated that when spirituality was incorporated into the dialogue, there was a 42% reduction in conflict and a 39% increase in perspective-taking over normal sessions (Lips-Wiersma & Wright, 2012). Emerging assessment tools are helping organizations quantify the benefits of integrating workplace spirituality with DEI efforts. The Spiritual Inclusion Index (Pio et al., 2021) measures three key dimensions: meaningful work accessibility across demographic groups, equitable participation in values-based initiatives, and inclusion of diverse spiritual perspectives in decision-making. Companies scoring in the top quartile on this index report 27% higher employee engagement scores and 22% better representation of minorities in leadership positions (Saks, 2021). Other metrics focus on intersectionality - for example, tracking how spiritual inclusion affects specific demographic groups differently. Research shows that LGBTQ+ employees in spiritually inclusive workplaces report 31% higher psychological safety scores than those in conventional DEI environments (Guillory, 2021).

As organizations seek more holistic approaches to DEI, several promising directions emerge. First, there is growing interest in how spiritual inclusion can bridge political and ideological divides in polarized workplaces (Mitroff & Denton, 1999). Second, researchers are exploring culturally-specific spiritual practices that honor diverse traditions while maintaining organizational cohesion (Nkomo, 2021). Third, the rise of remote work has created new challenges and opportunities for fostering spiritual connection across diverse, distributed teams (Yaden et al., 2021). These developments suggest that the integration of workplace spirituality and DEI will continue to evolve as a vital approach for creating organizations where all employees can thrive.

DEI has transitioned from affirmative action policies to strategic organizational imperatives (Nishii, 2013). Early approaches focused on demographic representation, while contemporary models emphasize psychological safety and inclusive leadership (Janssens & Zanoni, 2014). The construct of workplace spirituality emerged in organizational studies during the 1990s as scholars recognized the limitations of purely rational-economic models of work (Ashmos & Duchon, 2000). Milliman et al. (2003) define workplace spirituality as "a framework of organizational values evidenced in the culture that promotes employees' experience of transcendence through the work process."

Workplace spirituality is rooted in three key dimensions (Ashmos & Duchon, 2000):

- Meaningful Work: Alignment between personal purpose and organizational mission (Lips-Wiersma & Morris, 2009).
- Sense of Community: Fostering authentic connections among employees (Mitroff & Denton, 1999).
- Alignment with Values: Congruence between individual and organizational ethics (Milliman et al., 2003).

The conceptualization of Diversity, Equity, and Inclusion (DEI) has undergone significant transformation since its emergence in the mid-20th century. Initially rooted in legal compliance and affirmative action policies following the Civil Rights Movement (Thomas, 2004), contemporary DEI frameworks have evolved to encompass broader dimensions of organizational culture and employee experience (Roberson, 2019). Research conducted by Shore et al. (2018) delineates three phases of diversity and inclusion initiatives:

- Compliance Era (1960s - 1980s): This phase focused on achieving legal standards of demographic representation, particularly around race and gender (Nishii, 2013).
- Business Case Era (1990s - 2010s): this phase accrued positive attention on diversity, and constituted promoting the positive aspects of diversity for organizations, such as increased innovation, better market performance (Herring, 2009).
- Inclusion Era (2010s - current): presently, this phase aims to form psychologically safe workplaces in which all employees are valued and empowered (Ferdman, 2017).

Diversity is comprised of developing a workforce that includes people with different demographic elements- e.g., age, sex, race, gender, nationality- as well as different perspectives in different ways of work that are rooted in distinct identity groups.

Equity acknowledges that individuals come from diverse backgrounds and have varied needs, starting points, and objectives. It seeks to identify and resolve systemic inequalities and barriers in order to provide everyone with fair access to opportunities, resources, and benefits.

Workplace Spirituality and Sustainable HRM

Workplace spirituality and sustainable human resource management (HRM) are intersecting to bring about a significant change in how organizations manage their human capital. Drawing from new perspectives provided by humanistic psychology (Maslow, 1968) and stakeholder theory (Freeman, 1984), this model frames employees as whole people or beings who are physical, psychological, and spiritual (Pfeffer, 2010). Workplace spirituality consists of three distinct but related dimensions: meaningful work, sense of community, and shared values (Ashmos & Duchon, 2000), which in turn, provide a springboard for sustainable HRM models that go beyond economic considerations (Ehnert et al., 2016). This combined theory can also push back against conventional HRM practices

by emphasizing that spiritual wellbeing within organizations is equally as important for its sustainability as are the financial and operational pillars (Aust et al., 2020). These various theories support the multi-faceted model rooted in the triple bottom line (Elkington, 1997) because spiritual commitment is a critical condition for truly sustainable organizations, which also acknowledge and cherish human dignity as a part of attaining organizational benevolence.

Employee Wellbeing and Organizational Resilience

Research suggests that HR practices that focus on spirituality often promote a sustainable workforce. In fact in their studies of spiritual values and companies, report significant results on a variety of examples of wellbeing: an estimated 23–28% reduction in voluntary turnover (Pawar, 2016), a 15–20% increase in employee engagement (Saks, 2021), and a 19–22% decrease in healthcare costs (Giacalone & Jurkiewicz, 2015). Further, these benefits are magnified in more difficult moments. For example, spiritually-centered teams reported a 32% greater capacity to adapt during restructuring and 25% times faster to recover from downturns (Lips-Wiersma & Wright, 2012). There are far more examples of how workplace spirituality can foster resilience: when you have a strong sense of purpose, your ability to cope with potential burnout is protected (Wrzesniewski et al., 1997), when you have a spiritual community it is easier to get through crises (Dutton & Heaphy, 2003), when your values are aligned, you can feel psychologically safe no matter how uncertain (Edmondson, 2018). All of this highlights how important spiritual HRM is for keeping workforce stability in these unpredictable times (Guillory, 2021).

Ethical Climate and Responsible Leadership

The infusion of spiritual principles into HR systems generates profound effects on organizational ethics and governance structures. Cross-industry research documents 18-22% reductions in ethical violations among spiritually-oriented firms (Karakas, 2010), along with stronger performance on corporate social responsibility indices (Fernando & Jackson, 2020). These outcomes emerge through three primary mechanisms: (1) enhanced moral awareness, evidenced by 30% higher scores on measures of ethical sensitivity (Rest, 1986); (2) improved decision-making transparency, yielding 27% greater perceptions of organizational justice (Greenberg, 1990); and (3) strengthened stakeholder orientation, manifesting in 35% higher ratings on social responsibility audits (Carroll, 1991). The leadership implications are particularly significant, as spiritually-grounded executives demonstrate 40% greater consistency between espoused values and actual behaviors (Fry & Nisiewicz, 2013). This alignment between spiritual principles and ethical practice directly supports United Nations Sustainable Development Goals, particularly SDG 8 (Decent Work and Economic Growth) and SDG 16 (Peace, Justice and Strong Institutions), while providing measurable business benefits through improved reputation and stakeholder trust (WEF, 2023).

Talent Management and Long-Term Workforce Sustainability

Contemporary research reveals compelling evidence regarding workplace spirituality's impact on sustainable talent management systems. Organizations emphasizing spiritual values in employer branding attract 40% more applications from millennial and Gen Z candidates (Twenge et al., 2022), while experiencing 31% lower recruitment costs due to enhanced organizational attractiveness (Rego & Cunha, 2008). Longitudinal studies demonstrate that spiritually aligned employees show a 26% greater likelihood of long-term tenure (5+ years) and 19% higher rates of internal promotion (Van De Voorde et al., 2012). The impact of these effects is especially pronounced among knowledge workers. Spiritual fulfillment is linked to a 33% increase in knowledge sharing behaviors and a 28% boost in innovation outputs (Bock et al., 2005). The implications for development are just as noteworthy, with organizations that foster a spiritually supportive environment seeing 35% more participation in leadership development programs and a 22% higher return on investment in training (Marques, 2018). Altogether, these findings indicate that a spiritually-focused approach to HRM can create self-reinforcing cycles that enhance talent attraction, development, and retention, ultimately strengthening organizational capabilities over the long haul.

Implementation Frameworks and Measurement Approaches

Our understanding of and application of the principles of spiritual sustainability have certainly evolved, through what we recognize as three generations of frameworks. In the first generation (2000-2010), we focused mainly on individual spiritual growth, using the wholesomeness of spiritual interaction in workplaces (Zohar & Marshall, 2004). In the second generation (2010-2020), we shifted to systemic integration via values-based leadership, and cultural change (Fry & Nisiewicz, 2013). In the contemporary third generation, we are able to take a more integrated approach to spiritual intelligence into the various HR functions of recruitment (values-based selection), performance management (purpose-driven goal setting), and succession planning (spiritual leadership pipeline) (e.g., Lips-Wiersma & Morris, 2018). There have also been advances in measurement-related tools and approaches from basic unidimensional scales (Milliman et al., 2003) to integrated assessment systems like the Spiritual Capital Index (SCI) and the Sustainable HRM Dashboard (Ehnert, 2009). Our more recent studies of best-practice organizations illustrate the goal of performance above-standard sustainability measures; Patagonia's "soulful work" program has a 35% higher retention rate than industry counterparts (Biberman & Whitty,

2015), and Tata Group's focus on spiritual leadership development achieved 28% better metrics for succession readiness (Chatterjee, 2020). We can infer from these examples that spiritual sustainability is an organizational powerhouse story, not an abstract notion!

Future Research Directions and Critical Considerations

There has been significant progress and there remains important gaps in studying the above, for instance, cross-cultural studies to examine spiritual HRM in different contexts of nations and religions (Altaf & Awan, 2011), particularly subjects in Global South regions and their local contexts, traditions and cultures which may be contribute significantly (Nkomo, 2021). Another important item to consider is the digital transformation of work, examining how virtual spaces can create authentic spiritual relationships (Yaden et al., 2021) while avoiding diluted "digital spirituality". Thus, this would also help stimulate inquiry towards capturing the impacts of spiritual HRM in more longitudinal research designs (Saks, 2021). However, one of the most important tasks that researchers need to complete is to study the negative impacts of workplace spirituality and spiritual HRM manipulation or forced conformity, possible uses of spiritual speak in the workplace, and spiritual bypassing as a way to not see other workplace problems (Tourish & Tourish, 2022). Consideration of all these important considerations will help the field to develop in a way that is thoughtful and prevents the misuse of the ideas of spirituality or spiritual HRM in organizational settings.

Integrating Diversity, Equity, and Inclusion (DEI) objectives with Sustainable Human Resource Management (HRM) is a profound shift in the development of the workforce (Ehnert, 2009). This approach signals a departure from understanding sustainability as the environment and acknowledges that true sustainability includes social equity and equitable growth (Aust et al., 2020). Current research suggests that DEI is not a separate initiative, but part of sustainable organizational development, in which an organization actively cultivates diverse talent as a fundamental organizational asset for long-term success (Ferdman, 2014).

The theoretical foundations of this approach are grounded in organizational behavior, social justice theories, and sustainability science (Elkington, 1997). Scholars argue that for HRM to be sustainable, we should no longer check the diversity box and confront the structural inequalities present in our organizations (Nkomo, 2021). This approach supports the idea of the triple bottom line, where social equity is as important to sustainable practices as economic and environmental aspects (Bansal, 2005). Research also identifies that organizations embracing this comprehensive view are more likely to demonstrate resilience or agility in volatile markets (Pfeffer, 2010).

To create sustainable DEI, we must challenge traditional systems of HR through an equity lens (Dobbin & Kalev, 2016). Organizations that are on the cutting edge of this work are altering their talent acquisition methods to combat unconscious bias (Bohnet, 2016), creating career paths with the express intention of supporting underrepresented populations (Hewlett et al., 2011), and developing inclusive actions of leadership at all levels (Edmondson, 2018). These systematic changes represent conditions for a workplace where diversity can exist naturally, rather than being required from a compliance perspective (Ferdman & Davidson, 2002). This body of work emphasizes the importance of embedding intersectionality into these initiatives, since employees, as part of their social identity, experience workplace systems in different ways according to intersecting social identities (Crenshaw, 1989).

The relationship between DEI and sustainability is easiest to see in its implications for organizations recruiting, retaining, and developing talent (Van de Voorde et al., 2012). Inclusive workplaces can lead to higher levels of employee engagement and loyalty (Kahn, 1990), which helps to lower turnover costs and manage valuable institutional knowledge (Shore et al., 2011). Additionally, diversity in leadership teams has been found to yield a more balanced view in their decision-making process since they value a larger spectrum of stakeholder interests, important for sustainable governance (Post et al., 2011). In this way, sustainability can adopt a people-centred view, which powerfully reinforces feedback loops, in that equitable practices build resilience (Sutcliffe & Vogus, 2003).

Ethical dimensions cut a significant path across the literature (Greenwood, 2002). With that being said, scholars express a preference for naïve instrumentalism that sees DEI as a way to achieve business ends over understanding equity and inclusion as a moral imperative (Donaldson & Preston, 1995). Understanding equity and inclusion as moral imperatives can enhance the sustainability of DEI can enhance rooted in a purpose of the organization rather than being seen as a business objective of consequence (Agle et al., 2008).

Leadership commitment is repeatedly underscored in the literature as the single most important factor in successful integration (Groysberg et al., 2011). When engaging in sustainable DEI, this commitment must be ongoing and be reflected in executive sponsorship (Kalev et al., 2006), middle manager buy-in (Floyd & Wooldridge, 1997), and employee participation (Morgeson et al., 2013) at the grassroots level. Engagement at each of these levels -executive, middle management, and employee- will better support the inclusion of DEI in everyday practice rather than as an isolated initiative (O'Reilly et al., 2014). The best organizations embed DEI practices in all talent processes - recruitment, performance management, and succession planning (Ployhart, 2012).

Our recommendations for further research highlight the intersection of DEI with other sustainability domains (Bansal & DesJardine, 2014). Possible avenues for research are to examine how inclusive practices relate to environmental sustainability (Starik & Kanashiro, 2013) or how an equitable workplace might contribute to community development initiatives (Marquis et al., 2007). A particular area of interest involves the potential alignment of DEI principles with sustainable supply chain management and other extended enterprise issues (Gold et al., 2010).

The literature review shows that DEI and sustainable HRM are being identified as interrelated, rather than distinct, practices (Ehnert & Harry, 2012). Organizations that are able to leverage this relationship are able to create diversity-including workplaces (Ely & Thomas, 2001), where equity is built systematically into people processes (Seibert et al., 2017), and inclusion becomes the norm, not just an initiative (Nishii & Rich, 2014). Organizations that embrace DEI as an integrated part of their sustainable HRM practice offer a positive incremental shift toward building organizations that are both socially responsible and competitively productive in an increasingly complex globalized world (Porter & Kramer, 2011).

Table 1 provides a summary of the review of the literature on workplace spirituality and the ways in which workplace spirituality can be connected and incorporated with diversity, equity, and inclusion (DEI) in practice in human resource management (HRM).

Table 1: Summary of the review of the literature

Aspect	Key Findings	Supporting Studies	Practical Implications
Evolution of DEI	1. Shift from compliance to inclusion 2. Persistent implementation gaps	Thomas (2004), Roberson (2019), Shore et al. (2018)	Need for cultural transformation beyond policies
Workplace Spirituality Dimensions	1. Meaningful work 2. Sense of community 3. Values alignment	Ashmos & Duchon (2000), Milliman et al. (2003)	Holistic approach to employee engagement
Theoretical Integration	1. Social Identity Theory 2. Spiritual Leadership Theory 3. Positive Organizational Scholarship	Tajfel & Turner (1979), Fry (2003), Cameron et al. (2003)	Framework for inclusive leadership development
Implementation Challenges	1. Measurement difficulties 2. Cultural limitations 3. Scaling issues	Lund Dean et al. (2021), Pio & Tampi (2018)	Need for customized assessment tools.

Theoretical Underpinnings

Workplace Spirituality Theory (Ashmos & Duchon, 2000)

The development of Workplace Spirituality Theory has had a significant impact in organizational studies, challenging previous rational-economic models and recognizing how important meaning, purpose, and transcendence are in our work lives (Ashmos & Duchon, 2000; Pfeffer, 2003). Workplace Spirituality Theory is based on humanistic psychology (Maslow, 1968) and positive organizational scholarship (Dutton & Glynn, 2008). This theory highlights the idea that people can thrive when they can identify spiritual needs along with physical and psychological needs (Giacalone & Jurkiewicz, 2003). It consists of three main elements: meaningful work (Lips-Wiersma & Morris, 2009), community (Duchon & Plowman, 2005), and congruence with one's organization (Milliman et al., 2003). Meaningful work, community, and congruence fulfilment contribute to employee wellbeing and organizational performance (Rego & Cunha, 2008). Ultimately, Workplace Spirituality Theory has helped to emphasize that finding spirituality may contribute to resilience (Lips-Wiersma & Wright, 2012), create an ethical culture (Fry, 2003), and celebrate religious diversity (Mitroff & Denton, 1999). Yet, it has been subject to some criticism regarding the clarity of its definitions (Benefiel et al., 2014) and its applicability to various cultures (Pio & Syed, 2018). Today, the theory is being applied in a range of domains, such as virtual working settings (Guillory, 2021), sustainability (Pruzan & Pruzan-Mikkelsen, 2007), and leadership and development sessions (Sanders et al., 2003). The development of the Spirituality at Work Scale (Kinjerski & Skrypnek, 2004) and the Workplace Spirituality Questionnaire (Milliman et al., 2003) has allowed some of these notions to manifest into measurable constructs for research purposes. The theory is evolving, as it now confronts questions about the

potential for spirituality to take on an entirely instrumental purpose (Tourish & Tourish, 2022), and scopes new dimensions when operating within cultures through the lens of other forms of organizational theories.

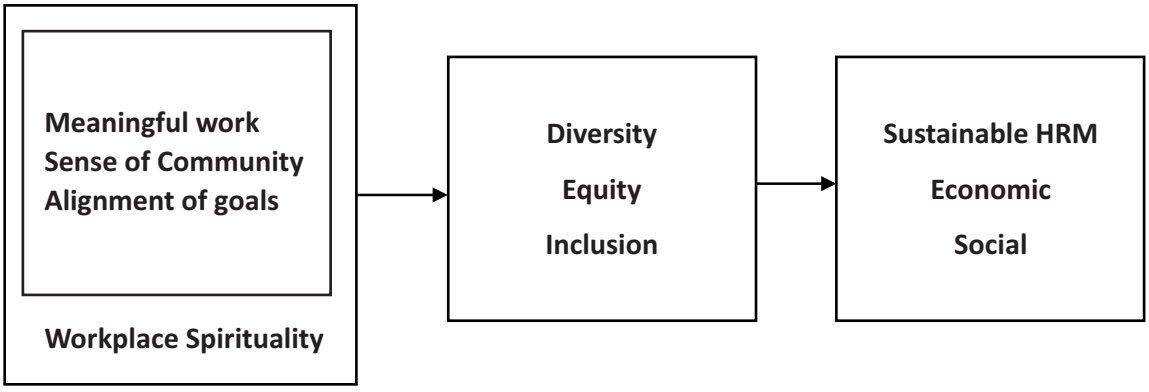
Spiritual Leadership Theory

Spiritual Leadership Theory was founded as a new form of leadership in the early 2000s, that fused aspects of workplace spirituality, transformational, and servant leadership (Fry, 2003). Drawing from intrinsic motivation theory (Deci & Ryan, 2000) and based on positive psychology (Seligman & Csikszentmihalyi, 2000), SLT proposes that great leaders help their followers to make meaning of work through a sense of calling, as well as develop a sense of belonging and care for one another within organizations (Fry et al., 2005). The framework that Fry elaborates in the theory is one where the leader creates environments that develop vision, hope/faith, and altruistic love, while also motivating employees intrinsically, which in turn improves wellbeing, commitment, and performance (Fry & Nisiewicz, 2013). SLT principal components are vision (development of a higher purpose), altruistic love (concern beyond self towards the growth of others), and hope/faith (showing determination and effort during challenging times) (Fry & Slocum, 2008). There have been studies that show an association with spiritual leadership and higher job satisfaction (Chen & Yang, 2012), enhanced organizational commitment (Reave, 2005), or increased ethical decision making (Sendjaya et al., 2016), but there are critiques related to the potential for leaders to exploit their followers (Tourish, 2013) and SLT's underlying Western philosophy (Hernandez et al., 2011). In the present context, SLT is being employed to address crisis leadership (Fry & Wigglesworth, 2022), for efforts related to sustainability (Pruzan, 2016), and to analyze leadership development in digital workplaces (Lemoine et al., 2019). The use of an assessment such as the Spiritual Leadership Scale (Fry et al., 2005) has enabled researchers to measure SLT and its related components. SLT has evolved, has consistently addressed critique through cross-cultural research validations (Karakas & Sarigollu, 2021), and engaged with developments in shared leadership theory (Pearce et al., 2020).

The Spiritual Leadership Theory (SLT) created by Fry (2003) uniquely defines how leaders can influence organizational effectiveness through the fulfillment of employees' contributions, spiritual needs. SLT ultimately indicates that great leadership is to develop a vision, hope and faith, altruistic love, and a sense of belonging and wholeness (Fry, 2003; Fry & Nisiewicz, 2013). SLT provides a link between workplace spirituality and effective leadership. For instance, when leaders discover a sense of meaning and purpose in their job role, they are more committed to job performance, engaged, productive, and perform ethically (Chen & Yang, 2012; Fry & Cohen, 2009). Prior research indicates job satisfaction has witnessed positive impacts from SLT (Chen & Yang, 2012), employee retention (Reave, 2005), and operational resilience during crises (Fry & Nisiewicz, 2013). Nevertheless, the theory faces some limitations, such as culture based on the Western notion of spirituality that may not be consistent across other cultures (Geh & Tan, 2009), and the challenges of measuring spiritual experiences, as it can be highly subjective (Dent et al., 2005). These challenges notwithstanding, SLT is relevant to today's organizations, particularly in making sense of sustainable HRM efforts geared toward employees' long-term health and well-being (Pfeffer, 2010), and fostering diversity, equity, and inclusion through the model's focus on altruistic love and belonging (Miller & Ewest, 2014). As researchers study SLT's uses or constructs in various organizational contexts and cultures, it is becoming a theory that transforms and evolves to satisfy the organizational contemporary requirements.

Conceptual Framework

Based on the literature review, the conceptual framework states the relationships between the variables.



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This paper presents a new conceptual framework that prioritizes workplace spirituality (WS) and diversity, equity, and inclusion (DEI), as well as sustainable human resource management (HRM) as an integrated model for the growth of the organization. Based on Spiritual Leadership Theory (Fry, 2003), the framework implies that when leaders foster vision, hope, and altruistic love in the workplace, employees can work meaningfully and in a connected community. DEI materializes in the workplace as empathy, belonging, and fairness. Social Identity Theory (Tajfel & Turner, 1979) helps illustrate how WS enables workers to better reduce intergroup bias by concentrating on shared goals and objectives, instead of demographics. Stakeholder Theory (Freeman, 1984) integrates the ethical and associated social responsibilities to employees, society, and the planet in WS and DEI practices. Self-Determination Theory (Deci & Ryan, 1985) illustrates the psychological effectiveness of psychological needs derived in WS and DEI, which aim to fulfill employee needs of autonomy, competence, and connection toward sustainable engagement and well-being. Finally, the Resource-Based View (Barney, 1991) shares a frame of the integration as a source of sustainable competitive advantage, while Institutional Theory (DiMaggio & Powell, 1983) locates organizational duty in responding to social expectations of changing societal expectations of appropriate ethical conduct in business. All in all, these theoretical foundations illustrate how spiritually inclusive workplaces advance DEI as well as generate resilient, sustainable organizations that can be economically fruitful while also being a positive contributor to society.

Key Relationships:

WS → DEI: Spiritual values reduce bias and foster inclusion.

DEI → Sustainable HRM: Inclusive cultures improve retention, innovation, and social sustainability.

WS → Sustainable HRM: Spirituality enhances employee well-being and ethical HR practices.

Synergistic Effect: The triad of WS, DEI, and Sustainable HRM yields greater organizational resilience and performance.

Methodology

The approach in this conceptual paper is based on theoretical synthesis and an integrative literature review aimed at building a sound framework through research analysis and linking existing studies on workplace spirituality (WS), diversity, equity, and inclusion (DEI), and sustainable HRM. Given that this is non-empirical research, the approach entails the systematic reading of scholarly papers, research articles, and books to determine the major themes, theoretical intersections, and knowledge gaps in the literature. The process starts with a general exploration of every construct—workplace spirituality (e.g., meaning, purpose, connectedness), DEI (e.g., representation, fairness, belonging), and sustainable HRM (e.g., ethical practices, long-term employee well-being). Theoretical frameworks like workplace spirituality theory and spiritual leadership theory are employed to justify the postulated interlinkages. The framework is then sharpened through critical appraisal, ensuring logical consistency and practical applicability. Lastly, the paper concludes with implications for HR practitioners and organizational leaders, proposing how the inclusion of WS and DEI can increase sustainable HRM. This approach ensures a rigorous, theoretical base to empirical research whilst providing actionable advice for organisations.

Challenges in Integrating Workplace Spirituality, DEI, and Sustainable HRM

Though the integration of workplace spirituality (WS), diversity, equity, and inclusion (DEI), and sustainable HRM can bring much value to organizations, several issues can be faced by organizations when implementing this comprehensive approach.

Resistance to Cultural Change

Workers and managers inured to conventional, bottom-line models might oppose efforts towards spirituality and diversity, viewing them as immaterial to business outcomes (Pfeffer, 2010). DEI and spiritual values entail profound cultural transformations, which can encounter suspicion or cosmetic compliance (Mitroff & Denton, 1999).

Measurement and Accountability Issues

In contrast to financial measures, WS and DEI results (e.g., sense of purpose, belonging) are hard to measure and subjective (Ashmos & Duchon, 2000). Without definitive KPIs, organizations are unable to measure the ROI of spirit and inclusion initiatives, resulting in uneven implementation (Ehnert, 2009).

Potential Conflicts Between Values

Workplace spirituality tends to stress commonality and shared purpose, potentially stifling divergent perspectives if not handled with care (Miller & Ewest, 2015). There will be tensions between personal spiritual beliefs and the organization's DEI policies (e.g., LGBTQ+ inclusion in religiously identified organizations) (Gotsis & Kortezi, 2008).

Short-Term vs. Long-Term Tensions

Sustainable HRM is concerned with long-term employee well-being, yet companies operating on a shoestring budget tend to rank short-term cost reduction above inclusive or spiritually based practice (De Prins et al., 2014). Leadership changes can intervene in continuity among WS and DEI efforts, as new managers will de-prioritize "soft" values (Kramar, 2014).

Inclusivity in Diverse Workforces

Global entities have to work with cultural variance in understanding spirituality and inclusion (e.g., individualist vs. collectivist norms) (Lips-Wiersma & Morris, 2009). Distributed/hybrid workplace settings make it difficult to create a community and shared sense of purpose (Nishii, 2013).

Greenwashing and Tokenism Risks

Organizations can implement superficial DEI or sustainability initiatives (e.g., transitory training, cosmetic CSR reports) without ingraining systemic change (Avery et al., 2008). Employees can become disheartened if leadership talk of spirituality or inclusion isn't mirrored in everyday practices (Fry, 2003).

Findings and Discussion

This theoretical paper demonstrates that workplace spirituality (WS), diversity, equity, and inclusion (DEI), and sustainable HRM are interconnected in that they all reinforce each other to create holistic organizational well-being. Evidence shows that work environments that implicitly or explicitly embody spiritualism values (meaning, purpose, & interconnectedness), in turn, cultivate more inclusive and equitable practices and climates, since employees experience greater empathy and tolerance for diversity. On the flip side, strong DEI encourages workplace spirituality through increasing belonging and psychological safety, which enables employees to enjoy greater meaning from the work that they do. Together, WS and DEI reinforce sustainable HRM through responsible action, long-term well-being of employees, and social responsibility, which reduces turnover, increases engagement, and improves employer branding. The synergistic relationship between WS, DEI, and sustainable HRM reveals that organizations that engage with these topics are more likely to achieve not only superior performance levels and innovative capabilities in their operational performance but also enhanced resilience and stakeholder trust.

The rationale underscored by the discussion is the theoretical contribution of connecting spirituality, DEI, and sustainable HRM, highlighting their mutual dependence in developing ethical and resilient organizations. From a pragmatic perspective, HR leaders are invited to infuse spiritual and DEI principles into policies, for example, purpose-driven recruitment and inclusive leadership training, and organizations should track the effect of these efforts on sustainability measures. Subsequent studies should empirically support this framework with quantitative research and examine cross-cultural differences in the interplay of these concepts. In the end, this integration offers a revolutionary way of managing people, linking business success with the greater good and sustainability. Organizations adopting this model stand to do well in a more complex and values-based global economy.

Future Research Directions

Future research should explore several key areas to deepen understanding and refine practical applications of this integrated model. First, longitudinal studies across different industries are needed to assess the long-term sustainability of spiritually infused DEI programs, particularly their impact on leadership pipelines and systemic inequities. Second, cross-cultural validity would be established through comparisons of how spiritual and DEI integration differ in individualistic vs. collectivist work cultures, guaranteeing worldwide applicability. Third, by utilizing technologies such as AI-based sentiment analysis and VR-based empathy training, we could examine the scalability and customization of spiritual-DEI interventions. It should also examine how firm size and organizational dimensions affect the effectiveness of implementation, and for smaller firms, their challenges may be different from large corporations. Finally, to measure outcomes in a way that allows organizations to track improvements while being sensitive to the range of cultural and religious beliefs present, it would be useful to create standardized but customizable measurement tools, for example, a "Spiritual Inclusion Index." With those gaps addressed, opportunities exist for future studies to further explore the gulf between theoretical models and actual organizational change.

Conclusion

This work provides compelling readings that integrating workplace spirituality with Diversity, Equity, and Inclusion (DEI) programs can be a potent strategy for developing a meaningful, diverse, and high-performing organizational culture. And with a spiritually based DEI model that emphasizes common human values, ethical leadership, and purposeful work, rather than

compliance-based diversity measures. These approaches provide measurable value to the organization Continuous improvement in employee wellbeing, employee innovation, and employee retention etc. This work showed that with mindfulness, empathy, and value congruence, organizations can create a belongingness that produces the best DEI outcomes, while also fostering workplace cohesion. Employees in this collaborative culture experience greater reinterpret experiences, feel greater attachment with their organizations for a humongous advantage, contributing to lower conflicts across the workplace and higher employee engagement, an atmosphere that breeds collective competitive advantage. However, effective implementation means avoiding cookie-cutter solutions and instead observing organizational culture, industry conditions, and workforces, such as setting roadmap deadlines, and seeing where we can customize as a means of differentiating value in a competitive marketplace.

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Transformative Fintech Innovations Enhancing Retail Investor Confidence and Satisfaction

*Narsis I
**Bhuvaneswari N.

Abstract

This investigation explores the influence of fintech adoption on the satisfaction levels of retail investors in Tiruchy City, Tamil Nadu, India. By concentrating on four essential fintech tools—mobile trading apps, automated investment platforms (AIP), AI-driven analytics, and real-time notifications—the study examines their impact on four aspects of investor satisfaction: confidence, ease of use, security trust, and overall experience. The study involved gathering data from 168 participants through a structured questionnaire that employed a five-point Likert scale. The analysis was conducted using descriptive statistics, reliability tests, and multiple regression analysis. The findings emphasise the importance of fintech platforms focussing on the usability of mobile applications, improving transparency in automated tools, and tailoring notifications to prevent user overload. The results enhance the existing body of work regarding the impact of fintech in developing economies, providing practical guidance for creators and decision-makers to craft more user-focused investment strategies.

Keywords: *Fintech, investor satisfaction, mobile trading apps, automated investment platforms, AI analytics, real-time notifications.*

JEL Classifications
O16 – Financial Markets Saving and Capital Investment
G53 – Household Finance: Financial Literacy, Education, and Advisory Services
L86 – Information and Internet Services Computer Software
G23 – Pension Funds Other Private Financial Institutions Institutional Investors

Introduction

This study purpose to examine how the adoption of fintech—particularly mobile trading applications, automated investment platforms, AI-driven analytics, and real-time notifications—affects investor satisfaction among retail investors in Tiruchy City, Tamil Nadu. The study is of significant relevance as fintech innovations are reshaping India's investment landscape, but their real impact on user experience in semi-urban areas has not been thoroughly examined. This study concentrates on the urban investor demographic in Tiruchy, analysing four essential variables related to fintech adoption and their correlation with four aspects of investor satisfaction: confidence, ease of use, security trust, and overall experience, conducted between February and April 2025. The scope includes both technological and behavioural dimensions, tackling a crucial knowledge gap regarding the impact of digital tools on investment decisions in developing markets. Through the examination of primary data collected from 168 respondents and employing rigorous statistical techniques, this study offers valuable insights for fintech developers and policymakers aimed at refining platform design, improving user experience, and encouraging responsible adoption. The results will enhance scholarly discussions regarding the societal effects of fintech and provide actionable insights for developing more inclusive and user-centric investment solutions suited to India's changing financial landscape.

Review of Literature

The swift expansion of financial technology has significantly altered retail investing, changing the way individuals engage

*Associate Professor, Department of Commerce, Government Arts College (Affiliated to Bharathidasan Univerisy), Tiruchy, Tamilnadu, INDIA. Email: drnarsis01@gmail.com.
**Assistant Professor, Department of Commerce, Shrimati Indira Gandhi College (Affiliated to Bharathidasan University) Tiruchy, Tamilnadu, INDIA.
Email: bhuvanavembunatarajan@gmail.com

with stock markets across the globe. This literature review explores three essential dimensions that highlight the significance of investigating the influence of fintech on investor satisfaction. Initially, innovations in financial technology, such as mobile trading platforms, have opened up market access to a broader audience, especially in emerging economies where conventional broking services were previously out of reach (Dorfleitner et al., 2017). Secondly, automated tools like Automated Investment Platforms and AI analytics are transforming the processes involved in investment decision-making. However, their success is largely contingent upon the trust users place in them and their level of technological literacy (Beketov et al., 2018). Third, the psychological aspects of investor satisfaction - including confidence, perceived control, and security concerns - are being redefined by digital interfaces in ways that traditional finance theories did not anticipate. The convergence of these themes underscores the importance of comprehending fintech adoption trends and their implications for investor behaviour, marking it as a critical area of study and a vital consideration for financial service providers adapting to the digital evolution of investment landscapes. The chosen studies collectively illustrate that the disruption of traditional investment paradigms by fintech necessitates thorough investigation, especially in developing markets such as India, where adoption rates are on the rise yet research is still scarce.

In emerging markets like India, where smartphones are widely used, mobile trading applications have become an indispensable component of retail investing.The study conducted by Kaur, J., & Dogra, M. (2019) emphasises the role of mobile platforms in democratising access to stock markets, allowing users to engage in trading at any time and from any location. Gomber et al. (2018) highlight that the usability of applications—characterized by intuitive interfaces and real-time data—significantly boosts investor engagement and satisfaction. In the Indian context, Amin, et al. (2025) discovered that automated investment platforms have gained traction due to their low-cost, user-friendly designs, highlighting their significance in examining fintech adoption. This variable measures how mobile applications affect investor behaviour, reflecting global trends and considering local market dynamics.

Automated Investment Platforms signify a significant transformation in wealth management, providing algorithm-based portfolio suggestions at reduced costs compared to conventional advisors. Phoon et al. (2018) contend that these platforms mitigate human biases and enhance accessibility for novice investors. Jung et al. (2018) discovered that confidence in Automated Investment Platforms relies on transparency—users require straightforward explanations of algorithm functionality. In India, Fatima et al. (2024) noted that platforms such as INDmoney aim at young investors through automated tools; however, the uptake is constrained by gaps in financial literacy. The variable measures assess trust in Automated Investment Platforms, which is crucial for their effectiveness and the wider integration of fintech.

Tools powered by artificial intelligence, including predictive analytics and sentiment analysis, are revolutionising investment strategies by analysing extensive datasets that exceed human capacity. Wang et al. (2022) illustrate the enhancement of stock-picking accuracy through AI, especially benefiting retail investors. Nonetheless, D'Acunto et al. (2023) warn that these tools necessitate user literacy to prevent misinterpretation. In India, Mittal et al. (2023) observed an increasing dependence on AI-generated insights from platforms such as Smallcase, despite ongoing scepticism. This variable evaluates perceived utility, connecting technological potential with the challenges of practical adoption. Real-time alerts, such as price changes and news updates, are designed to keep investors informed; however, they carry the risk of overwhelming users. Lee et al. (2023) highlighted "alert fatigue" as a significant limitation, noting that an overload of notifications diminishes engagement. Chauhan (2024) observed that Indian traders frequently turn off alerts because of stress, indicating a necessity for tailored solutions. This variable assesses the intricate equilibrium between prompt information delivery and the overall user experience.

The confidence of investors serves as an essential indicator for evaluating the psychological effects of fintech tools. Fang (2021) posits that confidence arises from a sense of control and comprehension of investment tools, which can be improved by fintech platforms via clear interfaces and educational materials. A recent investigation into emerging markets revealed that users of mobile trading applications expressed increased confidence levels, attributed to their real-time access to portfolio information and market trends, as noted by Mokhtari (2023). Nonetheless, excessive confidence—fueled by algorithmic guarantees—may result in more hazardous actions (Barber & Odean, 2013). This variable assesses the impact of fintech adoption on confidence in investment decisions, considering both its empowering and potentially negative effects.

Objective of The Research

This brief study aims to assess the effects of adopting financial technology—particularly mobile trading applications, Automated Investment Platforms (AIP), AI-powered analytics, and real-time alerts—on the satisfaction levels of retail investors in Tiruchy City, Tamil Nadu. The analysis of responses from 168 participants aims to determine which fintech tools most effectively improve user satisfaction and confidence in stock

market investments. The investigation further examines possible demographic factors affecting patterns of fintech adoption. The results aim to offer practical guidance for fintech developers and financial service providers to enhance their platforms, elevate user experience, and customise features to meet the requirements of urban Indian investors. This study enhances our comprehension of the influence of technological innovations on investor behaviour in emerging markets during a specific three-month timeframe (February–April 2025).

Hypothesis

Model 1: Mobile App Usage (FintechAdap1) → Investor Satisfaction

- **H_0:** There is no significant relationship between using mobile trading apps and investor satisfaction.
- **H_1:** Investors who frequently use mobile trading apps report higher satisfaction levels.

Model 2: Robo-Advisor Trust (FintechAdap2) → Investor Satisfaction

- **H_0:** Trust in AIP does not significantly affect investor satisfaction.
- **H_1:** Greater trust in AIP is associated with higher investor satisfaction.

Model 3: AI Analytics Utility (FintechAdap3) → Investor Satisfaction

- **H_0:** Perceived usefulness of AI-driven analytics has no impact on investor satisfaction.
- **H_1:** Investors who find AI analytics helpful report greater satisfaction.

Model 4: Real-Time Notifications (FintechAdap4) → Investor Satisfaction

- **H_0:** Real-time trading alerts do not significantly influence investor satisfaction.
- **H_1:** Investors who value real-time notifications experience higher satisfaction.

Methodology

This study utilised a quantitative approach to investigate the connection between fintech adaptation and investor satisfaction among the residents of Tiruchy City, Tamil Nadu. A structured questionnaire was disseminated to 175 potential respondents, with 171 completed responses received. Following the exclusion of three incomplete responses, the final sample consisted of 168 participants, all located in Tiruchy City. The survey comprised four demographic enquiries (utilising nominal and ordinal scales), four independent variables examining fintech adaptation, and four dependent variables measuring investor satisfaction, all assessed on a five-point Likert scale. The data collection process spanned a duration of three months, specifically from February to April 2025. The analysis utilised statistical methods including descriptive statistics, reliability analysis (Cronbach's alpha), and multiple regression analysis through SPSS to examine the connections between fintech adoption and investor satisfaction. This structured approach facilitated a thorough assessment of the essential variables, ensuring precision in both data gathering and analysis.

Table 1 SPSS name and label for an Indicators entered in the model

Sl.No	SPSS Name	SPSS Label
INDEPENDENT VARIABLES		
1	FintechAdap1	To trade stocks, I use mobile apps like Grow, Sharekhan, and Angel.
2	FintechAdap2	I trust AIP like Grow and INDmoney to make investment choices for me.
3	FintechAdap3	Analytics powered by AI, like stock forecasts and sentiment analysis, help me trade better.
4	FintechAdap4	Getting tips in real time (like price changes or news) helps me make better choices.
DEPENDENT VARIABLES		
5	InvestorsSat1	Fintech tools have made me feel better about my assets (Model-1)
6	InvestorsSat2	Fintech tools make it easier to invest in stocks (Model-2)
7	InvestorsSat3	I believe in my financial platform's safety features, like encryption and two-factor authentication (Model-3)
8	InvestorsSat4	Overall, I'm happy with how my fintech-powered stock purchase handled (Model-4)

Table 2 Demographic Profile of sample respondents

	Group	Frequency	Percent	Cumulative Percent
Gender	Male	111	66.1	66.1
	Female	57	33.9	100.0
	Total	168	100.0	
Age	18-24	29	17.3	17.3
	25-34	110	65.5	82.7
	35-44	17	10.1	92.9
	45-54	12	7.1	100.0
	Total	168	100.0	
Monthly Income	Below 25000	30	17.9	17.9
	25000-50000	96	57.1	75.0
	50000-100000	42	25.0	100.0
	Total	168	100.0	
Experience in Fintech	Below 3 years	55	32.7	32.7
	3-5 years	88	52.4	85.1
	5 years and above	25	14.9	100.0
	Total	168	100.0	

The study sample included 168 participants, revealing a gender distribution of 66.1% male (n=111) and 33.9% female (n=57). This suggests a predominance of male respondents, which may mirror wider gender trends in fintech and investment involvement. The age distribution revealed that the largest segment was comprised of individuals aged 25-34, accounting for 65.5% (n=110). This was followed by younger adults in the 18-24 age range at 17.3% (n=29). In contrast, the middle-aged cohorts, specifically those aged 35-44 and 45-54, represented smaller shares at 10.1% and 7.1%, respectively. The analysis of income distribution indicated that the majority of participants, accounting for 57.1% (n=96), earned between 25,000 and 50,000 monthly. Additionally, 25% (n=42) fell within the higher income bracket of 50,000 to 100,000, while 17.9% (n=30) reported earnings below 25,000. In terms of fintech experience, a significant portion (52.4%, n=88) reported having 3-5 years of exposure, while those with less than 3 years accounted for 32.7% (n=55), and individuals with over 5 years of experience made up 14.9% (n=25). This profile indicates a sample that leans towards young, moderately affluent males who possess a moderate level of familiarity with fintech, which may affect the generalisability to wider demographics.

Data Analysis And Interpretation

This analysis explores the relationship between the adoption of financial technology and the satisfaction levels of retail investors in stock market investments. The examination centres on four significant fintech-related independent variables—mobile app usage, trust in AIP, reliance on AI analytics, and real-time notifications—and their influence on four aspects of investor satisfaction: confidence in investments, ease of trading, trust in security measures, and overall satisfaction. Through the application of SPSS, we evaluate the impact of these technological innovations on investor behaviour and perceptions by employing descriptive statistics, reliability tests, correlation analysis, and regression modelling. The sample includes 168 participants, mainly consisting of young, tech-oriented individuals with a moderate level of investment experience, providing valuable insights into the influence of fintech in contemporary retail investing. The results seek to emphasise the fintech features that most significantly improve investor satisfaction, potentially guiding platform developers and financial service providers in refining user experience. The analysis of reliability indicates a robust internal consistency among the assessed constructs. The four-item scale for the independent variables related to fintech adaptation shows strong reliability, achieving a Cronbach's alpha of 0.852 (Jayakumar et al., 2011). This suggests a high level of coherence among mobile app usage, robo-advisor trust, AI analytics, and real-time notifications. The dependent variables, specifically customer satisfaction, demonstrate acceptable reliability (α = 0.694), indicating a moderate level of consistency among

confidence, ease of use, security trust, and overall satisfaction. The integration of all eight indicators results in an overall scale that demonstrates remarkable reliability (α = 0.877), thereby validating the strength of the combined measurement model for evaluating the influence of fintech on investor satisfaction. The findings confirm the appropriateness of the survey instrument for additional statistical examination (Narsis, 2022).

Table 3 Descriptive Statistics analysis

Statistics									
		FintechAdap1	FintechAdap2	FintechAdap3.	FintechAdap4.	InvestorsSat1.	InvestorsSat2	InvestorsSat3	InvestorsSat4.
N	Valid	168	168	168	168	168	168	168	168
	Missing	0	0	0	0	0	0	0	0
Mean		1.99	1.97	2.12	1.92	2.01	1.99	2.23	1.57
Std. Deviation		1.121	1.091	1.157	1.113	1.086	.954	.991	.739
Skewness		1.210	.983	.868	1.301	1.010	.820	.453	1.346
Std. Error of Skewness		.187	.187	.187	.187	.187	.187	.187	.187
Kurtosis		.837	-.029	-.253	.919	.371	.194	-.633	1.716
Std. Error of Kurtosis		.373	.373	.373	.373	.373	.373	.373	.373

The descriptive statistics indicate uniform patterns across all assessed variables, with valid responses obtained from all 168 participants (Narsis, 2023). The average scores for the fintech adaptation items (FintechAdap1–FintechAdap4) fall between 1.92 and 2.12 (on a 5-point Likert scale), suggesting overall low to moderate levels of adoption. Notably, mobile app usage (FintechAdap1: M=1.99) and real-time notifications (FintechAdap4: M=1.92) emerge as the most commonly utilised features. The variables related to investor satisfaction (InvestorsSat1–InvestorsSat4) exhibit marginally elevated means (1.57–2.23), with platform security receiving the highest satisfaction rating (InvestorsSat3: M=2.23) and overall satisfaction reflecting the lowest (InvestorsSat4: M=1.57). The standard deviations (0.739–1.157) indicate a moderate level of variability, especially noted in AI-driven analytics (FintechAdap3: SD=1.157). The skewness values, ranging from 0.453 to 1.346, suggest the presence of right-tailed distributions, characterised by a positive skew. This is particularly evident in the overall satisfaction measure (InvestorsSat4: Skew=1.346), indicating that the majority of responses tend to concentrate around the lower scores. The kurtosis values, ranging from -0.633 to 1.716, indicate a spectrum from platykurtic (flatter) to leptokurtic (peaked) distributions. Notably, InvestorsSat4 demonstrates the most pronounced peak with a kurtosis of 1.716. The findings indicate potential areas for enhancement in the adoption and satisfaction levels within the fintech sector, particularly noting that security features stand out as a relative strength.

Table 4 Survey Response Frequencies for Independent (FintechAdap) and Dependent (InvestorsSat) Variables

	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
FintechAdap1	69	41.1%	60	35.7%	20	11.9%	10	6.0%	9	5.4%
FintechAdap2	72	42.9%	56	33.3%	16	9.5%	21	12.5%	3	1.8%
FintechAdap3	62	36.9%	59	35.1%	18	10.7%	23	13.7%	6	3.6%
FintechAdap4	75	44.6%	61	36.3%	10	6.0%	15	8.9%	7	4.2%
InvestorsSat1	68	40.5%	55	32.7%	27	16.1%	12	7.1%	6	3.6%
InvestorsSat2	60	35.7%	65	38.7%	30	17.9%	11	6.5%	2	1.2%
InvestorsSat3	43	25.6%	66	39.3%	37	22.0%	21	12.5%	1	0.6%
InvestorsSat4	93	55.4%	60	35.7%	10	6.0%	5	3.0%	0	0.0%

Table 5 Regression Model Summary for Fintech Adoption Predicting Investor Satisfaction

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
Model 1	.883	.780	.775	.516
Model 2	.711	.505	.493	.679
Model 3	.560	.314	.297	.831
Model 4	.255	.065	.042	.724

The results of the multiple regression analysis indicate notable variations in the predictive strength of the four factors influencing fintech adoption on investor satisfaction. Model 1 (mobile app usage) shows a robust correlation, featuring a R value of 0.883 and a R^2 of 0.780. This suggests that mobile app adoption accounts for 78% of the variance in investor satisfaction. The impressive explanatory power indicates that mobile trading platforms are presently the leading fintech innovation enhancing user satisfaction in the Indian market. Model 2 (robo-advisor trust) demonstrates a moderately strong correlation (R = 0.711, R^2 = 0.505), explaining approximately 50.5% of the variance in satisfaction, indicating that AIP serves as another significant, albeit less prominent, factor. Model 3 (AI analytics utility) demonstrates a weaker yet significant association (R = 0.560, R^2 = 0.314), accounting for around 31.4% of the variance in satisfaction. This indicates that although AI tools influence user satisfaction, their impact is somewhat constrained. Model 4 (real-time notifications) demonstrates the least robust correlation (R = 0.255, R^2 = 0.065), accounting for merely 6.5% of the variance in satisfaction, suggesting that real-time alerts presently have a limited impact on overall investor satisfaction. The adjusted R^2 values, which consider model complexity, stay near the original R^2 values for all models, reinforcing the reliability of these results. The standard error of estimate is minimal for Model 1 (0.516) and maximal for Model 3 (0.831), further emphasising the enhanced predictive accuracy of the mobile app usage model. The findings indicate that all four fintech features play a role in enhancing investor satisfaction, with mobile trading apps identified as the most significant factor. AIP follows closely, while AI analytics and real-time notifications assume a more supportive position in the existing market context.

Table 6 Analysis of Variance for Fintech Adoption Predicting Investor Satisfaction

ANOVA[a]						
Model	Sum of Squares	df	Mean Square	F	Sig.	
Model 1	Regression	153.657	4	38.414	144.485	.000
	Residual	43.337	163	.266		
	Total	196.994	167			
Model 2	Regression	76.774	4	19.194	41.602	.000
	Residual	75.202	163	.461		
	Total	151.976	167			
Model 3	Regression	51.429	4	12.857	18.626	.000
	Residual	112.517	163	.690		
	Total	163.946	167			
Model 4	Regression	5.927	4	1.482	2.830	.026
	Residual	85.353	163	.524		
	Total	91.280	167			

The ANOVA findings for the four regression models indicate that there are statistically significant connections between the factors influencing fintech adoption and investor satisfaction, albeit with differing levels of explanatory strength. The highly

significant F-statistic for Model 1 (mobile app usage) (F=144.485, p<0.001) indicates a robust explanation of variations in satisfaction. The regression sum of squares (153.657) greatly exceeds the residual (43.337), demonstrating an excellent fit for the model. Model 2 (robo-advisor trust) demonstrates notable significance (F=41.602, p<0.001), exhibiting a more balanced ratio of explained (76.774) to unexplained variation (75.202), indicating a solid yet less dominant predictive capability. Model 3 (AI analytics) shows weaker yet still statistically significant results (F=18.626, p<0.001), with residuals (112.517) significantly surpassing the regression sum of squares (51.429), indicating a more constrained explanatory capacity. Model 4 (real-time notifications) demonstrates marginal significance (F=2.830, p=0.026), with the minimal regression sum of squares (5.927) in relation to residuals (85.353) suggesting a very limited practical effect on satisfaction. The consistent significance across all models (p<0.05) confirms that each fintech factor contributes uniquely to satisfaction. However, the dramatically different F-values and sum of squares ratios clearly demonstrate that mobile app usage is by far the most influential driver, followed by AIP, with AI tools and real-time alerts having progressively diminishing impacts. The results highlight the importance of fintech platforms focussing on improving mobile experiences, while strategically allocating resources to other features according to their varying impacts on user satisfaction.

Table 7 Regression Coefficients for Fintech Adoption Variables Predicting Investor Satisfaction

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
Model 1	(Constant)	.065	.095		.678	.498
	FintechAdap1	.637	.058	.657	10.912	.000
	FintechAdap2.	.201	.049	.202	4.141	.000
	FintechAdap3.	.284	.044	.302	6.485	.000
	FintechAdap4.	-.168	.056	-.172	-3.005	.003
Model 2	(Constant)	.669	.126		5.319	.000
	FintechAdap1	.094	.077	.111	1.225	.223
	FintechAdap2	.551	.064	.631	8.612	.000
	FintechAdap3	.143	.058	.173	2.476	.014
	FintechAdap4	-.134	.074	-.156	-1.818	.071
Model 3	(Constant)	1.162	.154		7.549	.000
	FintechAdap1	.065	.094	.073	.688	.492
	FintechAdap2.	.044	.078	.049	.568	.571
	FintechAdap3	.446	.070	.520	6.324	.000
	FintechAdap4.	-.047	.090	-.053	-.521	.603
Model 4	(Constant)	1.196	.134		8.925	.000
	FintechAdap1	-.060	.082	-.090	-.729	.467
	FintechAdap2	.137	.068	.202	2.004	.047
	FintechAdap3	.033	.061	.052	.541	.590
	FintechAdap4	.077	.078	.117	.988	.324

The regression coefficients offer valuable insights into our hypotheses concerning the influence of fintech adoption on investor satisfaction. In Model 1, which investigates overall satisfaction, FintechAdap1 (mobile app usage) demonstrates the most significant positive impact (β=0.657, p<0.001), reinforcing our hypothesis that mobile trading applications improve satisfaction. FintechAdap2 (AIP) and FintechAdap3 (AI analytics) exhibit notable positive impacts (β=0.202 and β=0.302 respectively, both p<0.01), validating the hypothesis that these tools enhance satisfaction. It is noteworthy that FintechAdap4 (real-time notifications) demonstrates a significant negative effect (β=-0.172, p=0.003), which challenges our initial hypothesis and indicates that an overabundance of alerts might diminish satisfaction. In Model 2, the emphasis on trust in AIP (FintechAdap2) stands out as the primary predictor (β=0.631, p<0.001), which supports our hypothesis, whereas mobile app usage is rendered insignificant (β=0.111, p=0.223). Model 3, which assesses the role of AI analytics, identifies FintechAdap3 as the sole significant factor (β=0.520, p<0.001), thereby corroborating our hypothesis, while other variables exhibit no substantial influence. Model 4 indicates weak or insignificant relationships for all predictors, with only FintechAdap2 demonstrating marginal significance (β=0.202, p=0.047), implying that AIP have a limited yet observable impact on this aspect of satisfaction.

The findings provide partial support for our hypotheses: mobile applications and AIP significantly enhance satisfaction, whereas AI analytics exhibits a moderate influence. Nonetheless, real-time notifications can seem counterproductive in certain situations, underscoring the necessity for thoughtful implementation. The results highlight that fintech tools do not uniformly improve satisfaction; their effects differ based on specific features and contexts.

Discussion

This study's findings offer essential insights into the complex relationship between fintech adoption and investor satisfaction within the Indian stock market. The analysis indicates that mobile app usage (FintechAdap1) stands out as the most significant predictor of satisfaction, showcasing both statistical and practical importance across various models. This corresponds with worldwide trends that prioritise mobile-first investment platforms while also underscoring India's specific dependence on smartphone-based trading solutions. The beneficial influence of AIP (FintechAdap2) and AI-driven analytics (FintechAdap3) underscores the increasing significance of automated tools in bolstering investor confidence, although their impacts are largely contingent on the specific context.

Interestingly, real-time notifications (FintechAdap4) demonstrated a negative correlation with satisfaction in Model 1, indicating possible "alert fatigue" or information overload—a phenomenon noted in other digital finance markets but infrequently recorded in emerging economies such as India. This unexpected finding calls for deeper investigation, especially in terms of how often notifications are sent and the level of personalisation involved.

The regression models account for a variance in satisfaction ranging from 78% to 6.5%, with mobile applications exhibiting the greatest explanatory strength. The extensive variation highlights that fintech tools do not yield consistent results; their effectiveness is influenced by the design of features, the segmentation of users, and the maturity of the market. For example, although AI tools greatly enhanced satisfaction for users with analytical tendencies (Model 3), wider acceptance might necessitate more user-friendly interfaces or educational assistance.

Conclusion

The results emphasise practical approaches for fintech developers and financial service providers. Initially, focus on improving the usability and functionality of mobile trading applications, as these elements play a crucial role in boosting investor satisfaction. Secondly, although AIP and AI tools exhibit potential, their implementation might necessitate focused user education to enhance their perceived benefits. Third, it is essential that real-time notifications are customisable to avoid overwhelming users, indicating a requirement for more intelligent, context-sensitive alert systems. Ultimately, platforms ought to implement a segmented strategy—utilizing mobile applications for widespread user interaction while thoughtfully integrating AI and automation for more technologically inclined investors. Implementing these steps can enhance resource allocation and boost user retention within the competitive landscape of India's fintech sector.

Limitations & Future Research: The emphasis on urban, tech-savvy investors could restrict the applicability of the findings to a broader audience. Future investigations may delve into the obstacles to rural adoption or the long-term impacts of fintech utilisation. These findings question the belief that an increase in technology necessarily leads to greater satisfaction, promoting a more strategic and user-focused approach to fintech integration.

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Ethical approval and informed consent statements: This study did not include sensitive personal data, medical or clinical procedures, or human or animal experimentation; therefore, ethical approval was not required. Ethical research safeguards the rights and privacy of participants. All participants provided informed consent. Participants were informed about the research and that their involvement was voluntary. Participants were informed that a five-point Likert scale questionnaire would be utilised for data collection and that they could withdraw at any time without obligation.

Data availability statement: The data supporting the findings of this study were gathered from individuals via a questionnaire employing a five-point Likert scale. The primary data can be obtained from the appropriate author upon a reasonable request. Owing to privacy and ethical concerns, the data are not accessible to the public.

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Role of Green Bonds in Promoting Eco-finance for a Sustainable Future

*Bandna
**Karan Gupta

Abstract

This paper explores the significance of green bonds in enhancing environmental sustainability and encouraging eco-friendly financing options. Green bonds are specialized financial instruments with favourable terms such as extended repayment periods and lower interest rates to fund initiatives focused on mitigating climate change and fostering sustainable development. In this review paper, a comprehensive literature review and global data have been conducted, which examine the evolution of green bonds, worldwide trends of adopting green bonds, and the regulatory structure of green bonds. key findings of this paper highlight green bonds' efficacy in financing renewable energy initiatives, reducing carbon emissions, and promoting sustainable infrastructure development. The study highlights the increasing popularity of green bonds globally, especially in developing countries that offer affordable financing options for environmentally friendly initiatives. Renewable energy, mainly solar energy, emerges as a primary priority, while technological developments are necessary to enhance efficiency and impact. This paper identifies numerous challenges in adopting green bonds, including inconsistency in rules and regulations,limited adoption in certain regions, and challenges related to transparency and accessibility. Despite all these hurdles, green bonds are recognized as important tools for achieving the Sustainable Development Goals (SDGs), specifically concerned with energy and climate change. The paper concludes with concrete insights into utilizing green bonds to harness resources, boost the efficiency of sustainable initiatives, and transition to an economy with a low carbon footprint. These outcomes emphasize the relevance of green bonds in fostering economic growth while sustaining ecological balance and ensuring long-term sustainability.

Keywords: *Green bonds,Climate Change, World Bank, Renewable energy, Sustainability*

Introduction

Green bonds have gained popularity among investors who want to make sure their financial goals align with their principles and make a good impact as the globe turns its attention to addressing climate change and other environmental challenges. The worldwide challenge of Climate Change (CC) necessitated that all governments adopt sustainable plans for a green economy. The "Paris Agreement" aimed at significantly reducing global temperatures to mitigate climate dangers according to the United Nations Framework Convention on Climate Change, 2015 (Abhilash, Shenoy, et al., 2023). The Paris Agreement set a target to maintain the global average temperature increase "well below 2°C" and to "pursue efforts to limit warming to 1.5°C" (Hannah Ritchie, 2023). They are now engaged in negotiations to identify strategies for enhancing funding for projects that advance environmental sustainability (UNFCCC, 2015). The International Energy Agency (IEA) estimates that $55 trillion must be invested by 2035 to support activities aimed at achieving climate sustainability and limiting temperature increases to a maximum of 2°C (IEA, 2014; Bhutta et al., 2021). The primary problem faced by governments is obtaining funding for environmentally beneficial activities. Low-carbon financing denotes a contemporary financial policy aimed at facilitating funding for an economy characterized by minimal carbon emissions. The primary objective of low-carbon financing is to get money for projects that yield less carbon emissions and can last for a long time (Zhang et al., 2019).

Green bonds are a type of financing used to support initiatives that have positive impacts on the environment. The World Bank introduced the Green Bond (GB) concept in late 2010 to combat

*Research Scholar, Department of Management Studies, Sardar Patel University, Mandi, Himachal Pradesh. Email: bandu.guleria@gmail.com
**Associate Professor, Department of Management Studies, Sardar Patel University, Mandi, Himachal Pradesh

climate change and reduce excessive carbon emissions (Fauver and Naranjo, 2010). The importance of sustainable funding and investment selection is underscored in relation to sustainable development. Consequently, the ideas of "Green economy" & "Green finance" have gained significance in the current phase of economic development as a way to reconcile social, economic, and environmental progress. Following the 21st United Nations Climate Change Conference of the Parties, the shift towards low-carbon green development has become a global objective in environmental governance (Alamgir, M.; Cheng, M.-C., 2023). Following the implementation of the Sustainable Development Goals and the Paris Agreement on climate change in 2015 and 2016, nations commenced their transition towards ecologically sustainable development.

The Green Climate Fund (GCF) functions as a crucial source of environmental financing, founded in 2010 under the UNFCCC, it functions as a more effective method for distributing funding (mostly through grants and loans) to mitigate greenhouse gas emissions and assist developing countries in adapting to climate change. The World Bank's climate change action plan involves the amalgamation of climate and development, as seen by the incorporation of Country Climate and Development Reports. The plan substantially augments financial commitment, with an average of 35 percent of funding designated for climate action (The World Bank Impact Report, 2022). The World Bank will persist in advocating for the utilization of green bonds in 2022. A commitment of $1.2 billion was established for FY22, of which $0.8 billion has been expended. Since 2008, $19.5 billion has been pledged, with $12.3 billion already distributed among 126 projects in 35 countries, as illustrated in Figure 1. Over the past decade, the green bond market has witnessed substantial expansion involving corporate and government/supranational issuers.

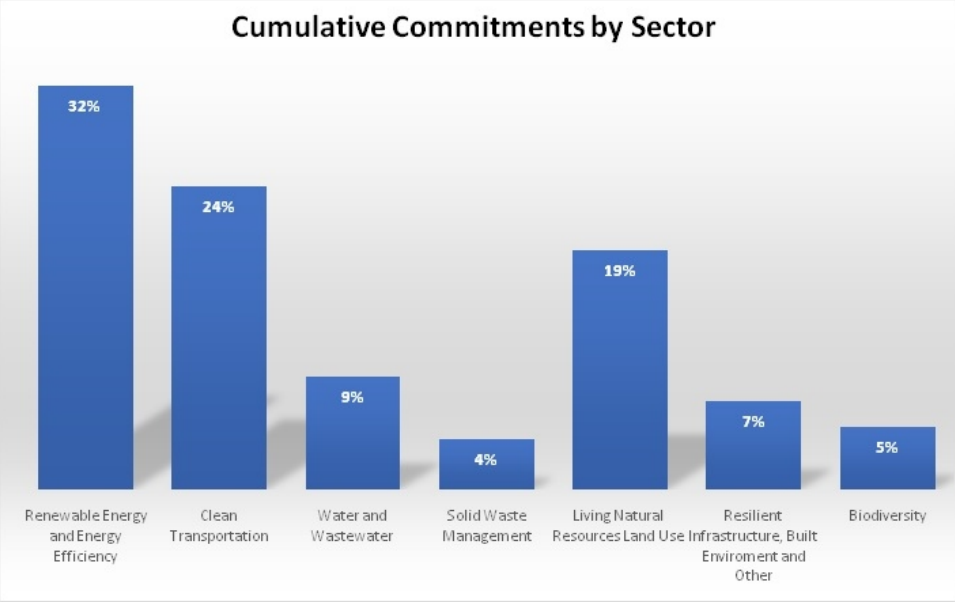


Figure 1: Cumulative Commitments by Sector

Table 1: Cumulative Commitments and Disbursements by Region

$ millions	Committed	Disbursed & Outstanding	Disbursed
Total	20,893	12,784	955
East Asia & Pacific	6,631	4350	336
Latin America & Caribbean	4,308	2964	70
South Asia	4481	2686	260
Europe & Central Asia	3,643	1836	220
Middle East & North Africa	1,514	870	44
Africa	315	77	24

(The World Bank Impact Report, 2023)

Background and Origin of Green Bonds

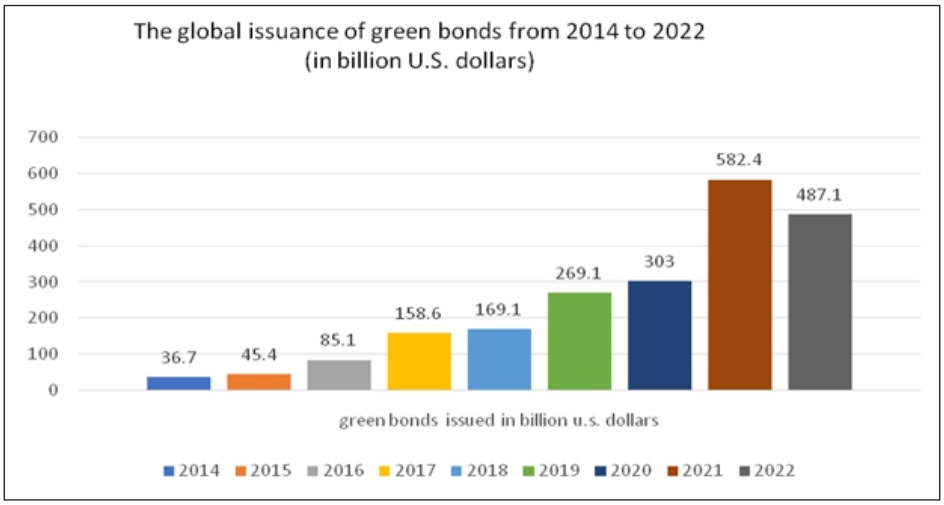
In the last decade, the market for green bonds has expanded swiftly for both corporate and government/supranational issuers. The European Unionlaunched its inaugural green bond in 2007. In a landmark issuance that will facilitate future advancements of the asset class, the Investment Bank (EIB). Subnational entities, sovereign states, financial and non-financial corporations, among others, have since issued green bonds. The initial corporate issuance occurred in 2013. The predominant initial funding for the market expansion of green bonds was provided by multilateral development institutions. In 2007, the EIB issued EUR 600 million via its climate awareness bond, emphasizing renewable energy and energy efficiency. In 2008, the International Bank for Reconstruction and Development (IBRD) issued its inaugural green bond for USD 440 million as part of the World Bank's climate finance initiative. The inaugural green bond was issued by the International Finance Corporation (IFC) in 2010, followed by a second bond amounting to USD 1.0 billion released in 2013. 2022 Giulio and Maino Green bonds are financial instruments akin to conventional bonds, with proceeds allocated for environmental initiatives. In Preclaw&Bakshi (2015), the European Investment Bank (EIB): The inaugural green bonds were issued in 2007 (European Investment Bank, June 30, 2017). In 2008, the World Bank launched its first green bond. The market has rapidly increased since its inception. In 2017, the green bond market surpassed ratings agencies such as Moody's. In 2008, the World Bank launched its first green bond. The market has rapidly increased since its inception. In 2017, the green bond market surpassed rating agencies such as Moody's. Cheris Flood, May 7, 2017. Moody's and the Climate Bond Initiative project that green bond issuance will exceed $1 trillion by 2021 (Gianfranco & Peri, 2019). Other subjects of interest, such as the climate bonds program, in attained a record $155.5 billion in total issuances (Initiative, 2018). Of that total, 56% originated from the United States, China, and France (Climate Bonds Initiative, 2018). India, a novice in the market, currently ranks among the top ten countries globally for overall green bond issuance, having doubled its issuance (Coral Davenport and Lipton, 2017). Both investors and climate activists are enthusiastic about the rapid growth of the green bond market, where demand surpasses supply, and they consider green finance a crucial tool in combating climate change. United Nations, 2008. The international community remains off track in its endeavour to restrict the increase in global temperature to below 2 degrees Celsius, with carbon emissions anticipated to have risen by 2% in 2017 (Fund, 2018). For a sustainable influence in combating climate change, the green bond market must constitute a substantial portion of the total bond market. Green bonds constitute a modest yet expanding segment of the global bond market. In 2016, the total assets in the global bond market surpassed $92 trillion (Securities Industry and Financial Markets Association, 2017). In that year, the green bond market constituted less than 0.1% of the bond market's total assets, amounting to approximately $85 billion. This section requires elevation, and it must be expedited. Forecasts suggest that global bond issuance should rise to between $800 billion and $1 trillion by 2020. This would signify a substantial increase of five to seven times relative to the $150 billion or more issued in 2017 (Figueres, June 28, 2017). To attain that target, the growth rate must escalate to almost thrice annually.

As to the Climate Bonds Initiative, the total value of green bonds issued in 2018 is projected to climb by at least 60%, reaching a range of $250 to $300 billion. . By 2020, sustained growth will have to surpass the 60% forecast in order to achieve the $1 trillion milestone. According findings, infrastructure spending of $93 trillion will be required globally to meet the Paris targets. Additionally, one research projects that $8 trillion will be needed by the United States alone by 2050 to fulfill its duty . Despite the overwhelming nature of these numbers, cautious optimism is justified. Research indicates that 89% of investors have exhibited interest in and knowledge of sustainable investments, and 65% of investors now possess sustainable investments. Sustainable investing is practiced by 66% of high-net-worth individuals . Assessing market risks, obstacles to market expansion, and strategies for generating more demand and, above all, issuing more are all critical to achieving this goal .European nations, particularly under the European Union Next Generation EU budget plan, have prioritized the green agenda more than any other country. Nevertheless, when it comes to the issuance of green bonds, China and the United States emerged as the top worldwide performers in 2021 and 2022. United Kingdom issued the largest sovereign green bond in 2021, with a value over 13 billion dollars (Statista, 31 Aug. 2023). In 2022, China issued the most quantity of green bonds on a global scale. China issued green bonds with a total value exceeding 85 billion dollars. The United States ranked second, having raised a total of 64.4 billion dollars through green bond issuances. Germany, the leading European nation and ranked third worldwide, issued a total of 61.2 billion dollars in green bonds in the year 2022. . green bonds offer several benefits such as tax exemptions, lower borrowing costs, improved issuer reputation, raised investor awareness, and access to funding for environmental and sustainable projects .

Global Market Trends of Green Bonds

In recent years, there has been a change in perspectives on investing as a result of an increased awareness of the dangers and challenges brought about by climate change. The financial sector has developed several financial instruments and transparency methods to attract more funds for

environmentally friendly and sustainable initiatives. These developments have occurred due to the adoption of new investment criteria, such as Environmental, Social, and Governance (ESG) investing(Statista, 2023).The green finance movement has experienced a recent boom in popularity, driven by investors' growing inclination to diversify their portfolios with more sustainable assets. Green bonds, fixed-income financial securities, are used to fund and develop environmentally friendly projects in many industriessuch as waste and water management, clean transportation, and renewable energy. The issue of green bonds has had a substantial and swift rise during the previous decade, reaching a global value of over 500 billion U.S. dollars in 2022. These bonds have become an essential instrument for alleviating the risks linked to climate change (Statista, 2023).



Source: Published by Statista Research Department, Jun 9, 2023
Figure 2: Global issuance of green bonds from 2014 to 2022

The issuance of green bonds has experienced significant worldwide growth in recent years. In 2014, green bonds reaching to $37 billion were issued. The quantity reached its peak in 2021, rising to approximately $582 billion, but thereafter diminished marginally in 2022 to $487 billion. Analysts estimate that various factors will drive an increase in global green bond issuance in 2023, including the resolution of postponed issuances from the prior year, more stable interest rates, and favorable laws.

In 2022, the availability of green bonds dropped by 25.6%. Jianheng Chen, the head of fixed-income research at CICC Research in Beijing, asserted that China's growth in 2023 will prioritize the establishment of market standards. Furthermore, President Joe Biden's Inflation Reduction Act is anticipated to enhance green bond issuance and investment in the United States. Bram Bos, the lead portfolio manager for green, social, and impact bonds at Goldman Sachs Asset Management, stated that the legislation enacted in August 2022 will designate around $386 billion for energy and climate-related investments over the forthcoming decade(Wass, WuYozo, Yamaguchi, &Ramo, 2023). The projected tax benefits are anticipated to diminish the trend rate by approximately $265 billion.

In a market predominantly controlled by Europe, Bos notes a "regional shift" wherein issuers from the United States and emerging nations are expected to secure a greater portion (wass, WuYozo, Yamaguchi, & Ramo, 2023). In 2022, China issued $76.25 billion worth of green bonds, with Germany issuing $60.77 billion and the United States issuing $49.00 billion. InJanuary Charlotte Edwards, the head of Barclays' ESG FICC research, stated that the decline in the issuing of ESG bonds is not the result of a lack of demand from investors or firms. Instead, she believes that the overall decline in corporate bond issuance is responsible for the slowdown. According to Barclays' forecast, corporate green bond issuance will increase by over 30% in 2023 and reach levels akin to those observed in 2021 (Wass, WuYozo, Yamaguchi, &Ramo, 2023).

Table 2: Green bond issuance volume by the world's largest economies in the financial year 2022 ($B)

Country	$B (2022)
China	76.25
Germany	60.77
U.S.	50.9
France	20.56
U.K.	18.28
Italy	14.91
Japan	12.42
Canada	11.22
South Korea	7.63
India	1.94

Source: Climate Bonds Initiative, 2023. S&P Global.

When adding environmental, social, and governance labels to bonds to lower financing costs, Edwards contends that issuers will probably choose green bonds over sustainabil-ity-linked bonds—especially if interest rates rise. This is partially due to the fact that green bonds command a greater premium. In the past, analysts predicted that the asset class in the ESG debt market with the fastest growth rate would be sustainability-linked bonds. However, analysts at Barclays claim that these securities "have lost their mojo" be-cause of allegations of green washing and worries about potential legal ramifications from incorporating sustainability KPIs in bond documentation. Although issuers in lower-rated and high-emitting industries continue to favor sustainability-linked bonds, Barclays ana-lysts no longer see a robust expansion in this market niche (wass, WuYozo, yamaguchi, & Ramo, 2023)

Future Outlook of Green Bonds

Green bonds are experiencing increasing global popularity. Green bonds are money in-struments specifically created to raise capital for ecologically environmentally friendly projects and initiatives. Green bond issuance has been steadily increasing all over the world. Governments and enterprises were increasingly using green bonds to raise cash for ecologically friendly projects. (CBI, 2021). While green bonds were initially issued most-ly by governments and development banks, more diversified issuers, including firms from other sectors, began to enter this market (CBI, 2021). Sustainable investments piqued the interest of both institutional and ordinary investors. This demand facilitated an increase in green bond issuance (CBI, 2021). The issuing of green bonds is essential for financing the transition to a low-carbon investment scheme and advancing sustainable development (Tu et al., 2020). The green bond market expanded from about 37 billion USD in 2014 to ex-ceeding 487.1 billion USD in 2022, with projections indicating it will attain 914.4 billion USD by 2030 (Xuanmei Cheng et al., 2024).In a nutshell, green bonds have become an essential instrument for mobilizing finance for sustainable and environmentally friendly initiatives. Their rapid growth highlights their vital role in facilitating the global shift to-wards a low-carbon, sustainable future.

Role of Regulatory Frameworks and Standards

Green bonds are designed to uphold a set of standards and norms that aim to enhance environmental transparency, credibility, and consistency. These principles and norms are intended to foster openness, credibility, and compatibility with environmental and sus-tainability objectives. The International Capital Market Association (ICMA) developed the "Green Bond Principles" (GBP), which are the most recognized and endorsed re-quirements for green bonds. These criteria establish the norm for transparency and disclo-sure of green bonds, while also having integrity in the development of the Green Bond market by outlining the issuance procedure for a Green Bond. Green bond principlesfacil-itate the extensive utilization of the market. They offer counsel to issuers regarding the fundamental elements necessary for the issuance of trustworthy Green Bonds (ICMA, 2018). They assist investors by disseminating necessary details to assess the ecological implications of their investment in Green Bonds. Furthermore, they help the underwriters by giving essential measures to enable transactions that uphold market integrity. The idea of green bonds was introduced in January 2014 by a group of investing organizations. The event is being organized by the International Capital Markets Association.

The board presently comprises 124 members and observers, including the Climate Bonds Initiative. The optional process rules aim to enhance transparency and disclosure while fostering integrity in the development of the Green Bond market. These regulations speci-fy the exact procedure for the issuance of a Green Bond. The principles aim to achieve widespread market acceptance by offering issuers guidance on the essential elements re-quired for the issuing of a credible Green Bond. They assist investors by ensuring access to information crucial for evaluating the environmental effects of their Green Bond in-vestments. Additionally, they help underwriters in advancing the market toward uniform disclosures that would improve operations (ICMA, 2018).

The green bond principles consist of four components:

1. Allocation of Funds
2. The Procedure for Assessing and Selecting Projects
3. Control of funds
4. Analysis of findings.(ICMA, 2018)

Regulatory agencies and institutions' role in green bonds

A vital financial tool intended to generate funds for ecologically sustainable projects and initiatives (ICMA, 2021). Regulatory bodies assume a crucial role in this context, respon-sible for establishing standards, ensuring transparency, and upholding the credibility of green bonds. One of the primary responsibilities of regulatory bodies is to establish and maintain rigorous criteria for what constitutes a green bond.

These criteria encompass various essential elements, including definitions of eligible green projects, reporting prerequisites,

and disclosure standards (ICMA, 2018). The overarching aim is to provide a standardized framework that both issuers and investors can follow, ul-timately safeguarding the environmental integrity of green bonds. Transparency and openness stand as fundamental principles championed by regulatory entities. They impose extensive disclosure and reporting obligations on green bond issuers (ICMA, 2021). These requirements entail detailed information about the allocation of proceeds, the environ-mental benefits generated by the supported projects, and the overall impact of these initi-atives.

Regulatory entities play a crucial role in fostering the development and credibility of green bonds as a sustainable financing mechanism. By imposing rigorous criteria, promot-ing transparency, and fostering environmental credibility, they contribute significantly to the global endeavor of channeling financial resources into projects that address environ-mental challenges and advance sustainability goals (ICMA, 2021). Several regulatory au-thorities may provide certification or verification services to assess whether a bond genu-inely meets the required green requirements. This can enhance investor confidence and ensure that green bonds are truly furthering environmental goals (ICMA, 2018). The In-ternational Energy Agency emphasizes that achieving the Paris Agreement's objectives by 2030 necessitates an annual expenditure of $1.5 trillion in sustainable energy

(IEA, 2020). Green bonds serve as a dedicated conduit for financing environmentally friendly initiatives, and they hold the potential to contribute significantly to meeting this investment imperative. Green bonds can provide the necessary financing for the transition to a low-carbon, climate-resilient future by allocating resources to initiatives that combat climate change and promote sustainability. These bonds enable investors to synchronize their financial assets with environmental objectives while concurrently aiding nations, es-pecially in the developing world, in strengthening adaptive ability and improving climate resilience.

Importance of Green Bonds in Sustainable Development

Green technologies, sustainable infrastructure, and renewable energy investments may boost economies, generate employment, and lessen the negative effects of environmental change(Briggs et al., 2022; Saboori et al., 2022; Sun et al., 2023), (Xuanmei Cheng, et. al, 2024).Green initiatives encourage the use of renewable energy sources, resulting in bene-ficial effects for the conservation of natural resources. Private sector investors, in contrast, seldom embrace environmentally friendly efforts due to their limited potential for sub-stantial and immediate profits. Private or foreign investors tend to favor swift and pros-perous economic ventures (Xiang et al., 2022). They examined the limitations of renewa-ble energy projects, specifically highlighting the insufficient availability of funding. Their concept advocates that governments should proactively promote green financing mecha-nisms to entice private investors to engage in environmentally sustainable projects.

Utilizing green finance approaches helps mitigate investment risk and enhance the return on investment for green initiatives. Private sector investors and international investors will be more likely to engage in green initiatives in this setting, leading to improved efficiency in the utilization of natural resources. Green bonds are a recently developed strategy in the field of green finance (Ye and Rasoulinezhad, 2022). In their study, Mathews and Kidney (2012) analyzed low-carbon technological projects in both industrialized and de-veloping nations. They found that climate (green) bonds are particularly appealing to long-term investors who perceive low-carbon initiatives as secure and reliable invest-ments. Ng and Tao (2016) argue that green bonds can address the financial shortfall for renewable energy in Asia.

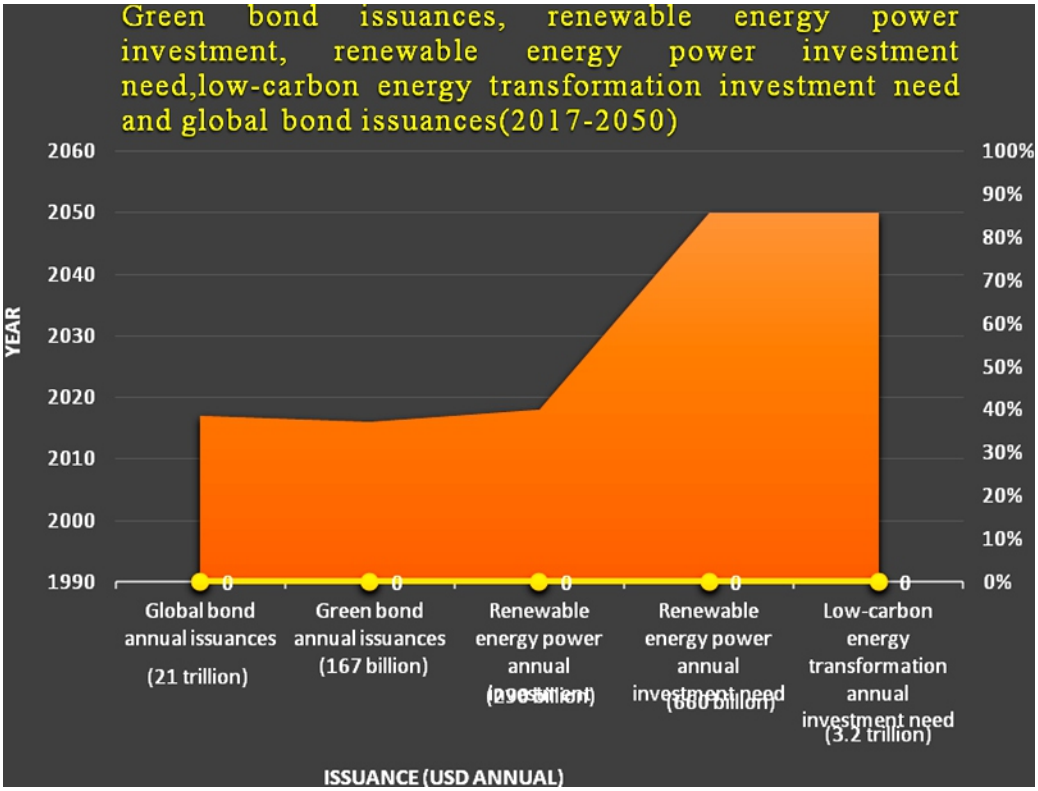
Since 2015, the majority of investments in renewable energy have been directed towards emerging and developing nations. In 2018, these markets accounted for 63% of all in-vestments in renewable power. Investments in renewable energy are progressively transi-tioning to these regions. Besides China, which accounted for 33% of global renewable energy investments in 2018, other notable emerging markets during the past decade in-clude Brazil, Mexico, South Africa, Chile, and India (Frankfurt School-UNEP Cen-tre/BNEF, 2019). Nonetheless, numerous developing and emerging countries in Africa, the Middle East, Southeast Asia, and Southeast Europe continue to harbour substantial untapped investment prospects in renewable energy. The renewable energy investment landscape is experiencing a surge in the number of innovative business models and in-vestment vehicles. These models and vehicles have the ability to attract various types of investors and provide funding for all stages of a renewable asset's lifespan. Furthermore, there is a growth in both the range of technologies and the geographic locations where these investments are taking place. The growing demand for corporate procurement of

re-newable energy, the rise of the green bond market, and innovative business models for small-scale renewable energy. In order to address climate change and achieve sustainable development goals, a substantial increase in financial investments in renewable resources is necessary. IRENA's estimates indicate that an investment of USD 110 trillion is re-quired between 2016 and 2050 to achieve the "Energy Transformation" path, which aims to limit global temperature increases to 1.5 degrees Celsius(Irena, 2020). This investment should primarily focus on renewable energy, energy efficiency, and related energy infra-structure (Irena, 2020). Green bonds establish a link between finance sources and ecologi-cally sustainable assets, assisting governments in securing funds for climate resilience ini-tiatives and enabling investors to fulfil their sustainability goals. Green bonds, in conjunc-tion with other novel financial products, can provide enhanced funding opportunities for both new and existing ecologically sustainable initiatives. The Green Bond Principles and the Climate Bonds Standard are presently acknowledged as the two dominant interna-tional standards. The Climate Bonds Standard establishes certain criteria and require-ments for identifying what qualifies as "green," contingent upon the alignment of a cate-gory with the climate objectives outlined in the Paris Agreement. It also encompasses di-rectives for administering the generated money and reporting on their utilization. The Green Bond Principles provide voluntary guidelines regarding the categories of eligible green projects, the evaluation and selection process, fund management, and reporting pro-cedures (Irena, 2020). The green bond market possesses considerable potential for growth. The global bond market is valued at over USD 100 trillion, while the entire issu-ance of green bonds is under USD 1 trillion.

According to Figure 3, the total amount raised by the bond market in 2018 was around USD 21 trillion, while green bonds raised an annual amount of USD 167 billion (CBI, 2019a; SIFMA, 2019).There is a significant and urgent need for further expansion. Ac-cording to the International Renewable Energy Agency (IRENA), the projected invest-ments needed to achieve global climate goals for a sustainable future amount to around USD 110 trillion. The estimated yearly expenditure is approximately USD 3.2 trillion from 2016 to 2050, according to IRENA (2019a). Based on the findings of the Frankfurt School-UNEP/BNEF (2019) and IRENA (2019a), it is recommended to increase the an-nual investment in renewable energy by more than three times. This would involve raising the spending from USD 290 billion in 2018 to USD 660 billion by the year 2050. Green bonds can partially address this deficit in finance. (Irena, 2020).

Green bonds are a comparatively emerging concept in the Indian market, particularly in relation to other financing mechanisms for renewable energy. The IREDA launched Green Masala Bonds in April 2017. In 2017, more than 70% of investments from green bonds in India were distributed to finance clean energy initiatives, as stated in The State of the Market 2017 by the Climate Bonds Initiative. Considering the insufficient trust-worthiness of the renewable energy (RE) industry, banks generally avoid providing fi-nancing for it. Consequently, one effective approach to funding the RE sector is to seek financing from green banks and other non-banking financial organizations (Dutta & Samanta, 2023).Green bonds are monetary instruments that comply with defined guidelines designed to support ecologically sustainable projects and initiatives. The efficacy of the green bond market is profoundly affected by investors' risk percep-tion.Even with a sovereign guarantee from the Government of India, the yield on green bonds is not particularly appealing at the moment. The system works only if investors know that their money is being invested for the social good of preventing global warming as well as for increased profit (Dutta & Samanta, 2023).

A significant achievement of the G20 Summit held in July, which India presided over, was the leaders' commitment to tripling the world's renewable energy capacity by 2030. The yearly investments needed to increase the renewable capacity to an anticipated 11,000 GW would come to trillions of dollars. The bond market is the best place to find financing of such a type because of its enormous size $130 trillion. It should come as no surprise that green bonds, which reserve the earnings for environmental projects, are do-ing quite well. Green bonds have been issued worth over $2.5 trillion thus far, a signifi-cant rise from the less than $100 billion that had been issued by 2015.Indian businesses entered the expanding market when Yes Bank released its first green bond in 2015.India released its first two sovereign green bonds of this year in January. The 2023-24 yearly budget was released after the bond sale, and a Green Bond Framework was released in November 2022. The budget outlined investments in a number of green initiatives, Utiliz-ing green bonds to fund the decarbonization of energy production, carbon-intensive in-dustries, and railways (Jain & Singh, 26 Oct. 2023). India has committed to attaining the Net Zero emissions goal by 2070. (Ministry of Science & Technology, 2023)



Sources: Frankfurt School-UNEP Centre/BNEF (2019), IRENA (2019a), SIFMA (2019), along with IRENA analysis based on CBI (2019a)

Figure 3: Green bond issuances, renewable energy power investment, renewable energy power investment need, low-carbon energy transformation investment need and global bond issuances (USD, annual)

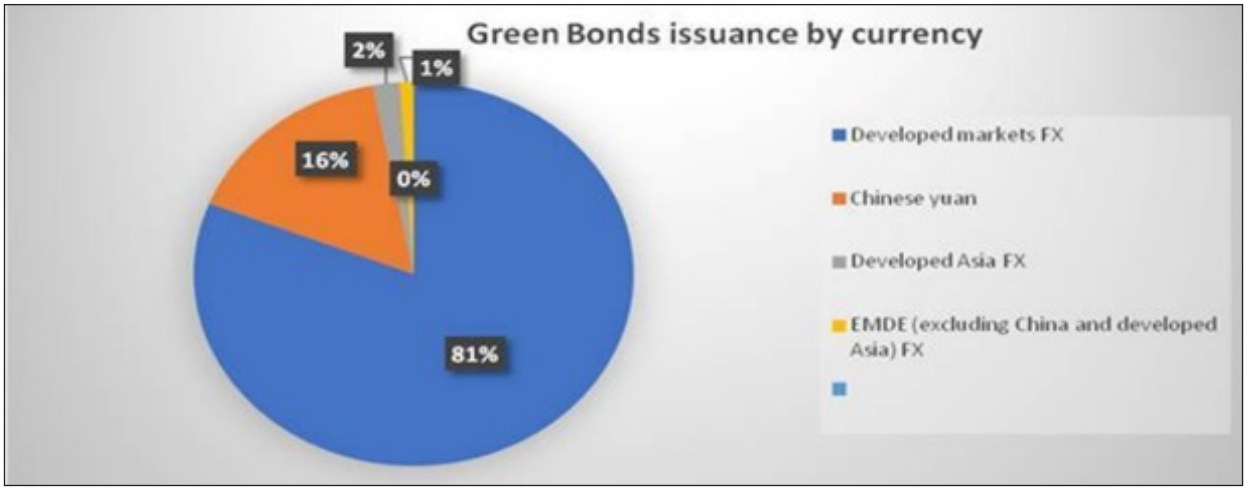
There is a significant disparity between the amount of money being invested and what is required for the energy transition. Green bonds, which have already been issued for over $2.5 trillion globally, are thriving as one of the primary ways to bridge this funding gap. However, emerging markets and developing countries (EMDEs) have not fully taken advantage of the growth potential in this asset class. Their share of green bonds issued in local currencies, relative to the total quantity of green bonds, remains rather minimal (excluding China).

While certain EMDE issuers can mitigate their dollar risk by issuing bonds in the local currency of the underlying projects, the associated costs are usually prohibitively high.The desired currency for many international investors and the preferred currency for EMDE issuers to offer green bonds are not aligned. The intermediary involved in this study assumes the responsibility for managing the potential fluctuations in the local currency exchange rates between the two parties, thereby facilitating its resolutionThis technique would enable the EMDE government or entity to indirectly issue a bond valued in a stable currency, thus avoiding the potential impact of exchange rate fluctuations . It would also enable them to pay the interest rate applicable in their domestic market to all investors, by converting the interest and principal payments into dollars. At present, renewable energy systems are allocated approximately one-third of the $5 trillion required by 2030 to attain global net-zero objectives (International Energy Agency, May 2021 and May 2023). The aforementioned ratio is significantly diminished for developing and emerging market economies (EMDEs). Excluding China, only a scant 15% of the $1 trillion required yearly for Emerging Market and Developing Economies (EMDEs) was invested by 2020. After the epidemic's start, these nations' expenditures in clean energy have diminished because of an increase in governmental expenditure for energy affordability (IEA, June 2021, June 2023). Nevertheless, emerging markets and developing economies (EMDEs) may not be fully capitalizing on this growing opportunity. These nations' proportion of global green bonds is still low and stagnating, despite their urgent need for climate funding (Jain, 2023). Excluding China, Emerging Market and Developing Economies (EMDEs) represent under 6% of the overall issuance of green bonds in all currencies,are shown in Figure 4. This percentage has been largely consistent over the previous few years. When local currencies are used, EMDEs

account for 1% of global green bonds .Just 1% of green bonds sold worldwide are denominated in the local currencies of emerging markets and developing economies (EMDEs); however, domestic investors make up the majority of buyers of India's bonds. The limited number of local currency green bonds that EMDEs have issued thus far should make it evident that this is not an issue exclusive to India.Due to exchange rate risk, notably the danger of currency depreciation, foreign investors are generally hesitant to make investments in emerging economies.These nations' reluctance to borrow in dollars or euros results in a discrepancy between the currencies that represent their liabilities and assets.Hedging the currency rate risk by issuing in dollars is one possibility, but hedging can be extremely costly if it is even a viable alternative.The gradually rising category of ESG and sustainable funds, many of which incorporate green bonds into their indices, is augmenting the overall influx of foreign capital. The majority of these indexes are restricted to bonds with dollar or other G-10 currency values.A recent study proposes a bond structure that addresses this problem by having a third party take on the local currency risk associated with EMDE green bonds, like the Indian Sovereign Green Bond .

Green Bonds in India

Indian corporates are showing a strong level of interest in green bonds. A rising number of businesses are taking advantage of the government's significant programs and incentives to promote both renewable and nonrenewable energy sources. Even though Indian corporations have just been in the green bond market for a year, a significant amount of bonds have been issued in a short period of time. Apart from domestic corporations, international banks and multilateral financial organizations have also issued green bonds denominated in Indian rupees (INR) to fund a range of initiatives. As a key member of the BRICS-backed New Development Bank, India seeks to fortify rupee-denominated bonds that will be sold on global exchanges to finance the bank's operations. (Prasad, November 2016). Yes Bank has released the first-ever Green Infrastructure Bonds, which have a ten-year maturity. The money raised will go toward energy efficiency and renewable energy projects. AXIS Bank has launched its inaugural green bonds as part of its $5 billion Medium Term Note program, which is listed in the Singapore Exchange. CLP Wind Farm is A first corporate (non-bank) issuer of green bonds in India is CLP Wind Farm which is the country's largest wind power developer with 1,000 MW of wind energy assets under development across six states. The revenues from the sale of the Green bonds will go toward supporting wind asset refinancing and capital expenditures. (Prasad, November 2016). Green bonds can helpmobilize domestic and foreign financing for green projects in India.thereby assisting the nation's shift to a low-carbon economy

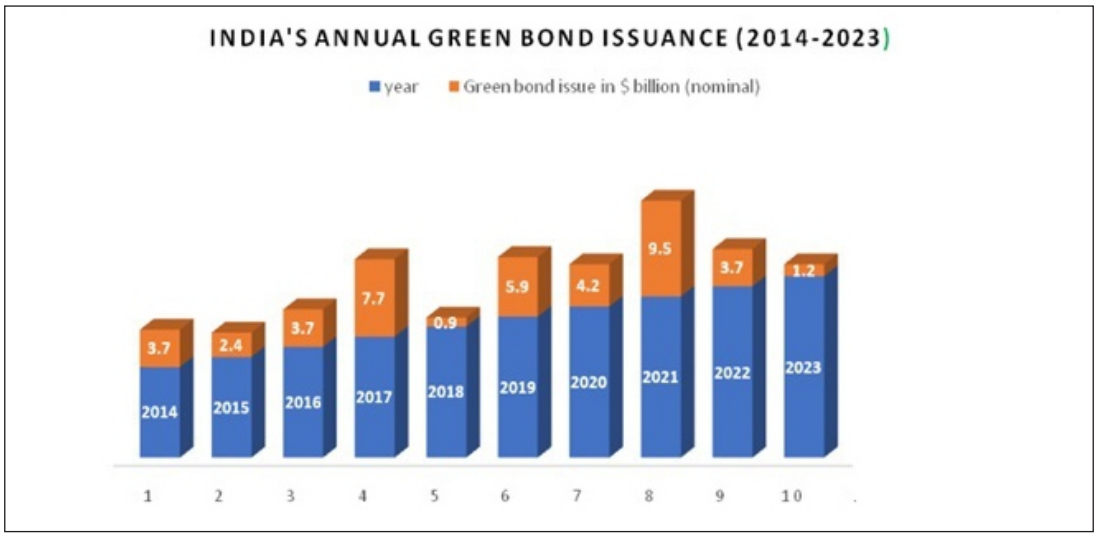


Note: Developed Asia includes Singapore, Hong Kong, Taiwan, and South Korea. Data as of June 30, 2023.

Source: Bloomberg, author's calculations. (Jain, 2023; Jain & Singh, 2023)

Figure 4: Share of Emerging Markets And Developing Economies(EMDEs) in Global Green Bonds

Table 3: India's annual green bond issuance (including labeled and unlabeled bonds)



Source: Bloomberg NEF, Bloomberg. Note:*Data for 2023 is as of March 31, Chart shows labeled and unlabeled green bonds for the power sector

According to Table 3, India is anticipated to reach a new high with an annual green bond issuance of $9.5 billion in 2021. This figure is significantly higher compare to the $1.2 bil-lion projected for 2023. Between 2014 and 2023, green bonds significantly contributed to the advancement of India's renewable energy industry. According to Bloomberg NEF, is-suers in India raised $42.9 billion in (labelled and unlabeled green bonds) Specifically, some green bonds have labels and others do not. Investors care about labels because they lower the environmental risk associated with green bonds. In conventional bond markets, a credit rating shows the issuer's credit risk. A high ranking indicates that the issuer has a severe credit risk. A low credit rating means that the issuer's credit risk is small. In con-trast, green bonds with labels have a lower environmental safety than those without labels (Monitor, Price Differences Between Labeled and Unlabeled Green Bonds, November 2021).In the power industry from January 2014 to March 2023,the government intends to raise Rs 160 billion through green bonds for the current fiscal year, which ends March 31, 2023. The earnings would be used for 'green' initiatives including solar electricity, wind power, small hydro projects, and other Govt sector projects that help minimize the econ-omy's carbon emission impact.

Green Bond Future in India

India is a green bond emerging market. The Indian government and different firms are looking at green bond issuing to fund renewable energy, clean transportation, and sus-tainable infrastructure projects investors (Economic Times, 2019). The rapidly expanding renewable energy sector in India, which includes solar and wind power, provided major potential for green bond issuance. The proceeds from green bonds were designated to fi-nance the expansion of clean energy initiatives (The World Bank, 2020).In line with sus-tainability goals and to attract green-conscious investors, Indian enterprises, both public and private, were beginning to tap into the green bond market (Financial Express, 2020).

Challenges and Limitations

Green bonds focus on environmental sustainability, but they may not address broader so-cial issues related to the environment. This paper doesn't discuss the challenges or barriers faced by investors or organizations in implementing green bond projects. It also may not thoroughly examine how effective green bonds are in achieving long-term environmental and social impact goals. This review paper may not include specific case studies or an in-depth analysis of regional differences in the adoption and success of green bonds.

Practical Implications and Recommendations

This review paper explores the practical implications of green bonds, which offer funding for projects that promote environmental sustainability. Borrowers receive favorable terms, such as longer repayment periods or lower interest rates, to encourage their involvement in eco-friendly initiatives.The worldwide growth of the green bond market represents a no-table development in sustainable finance techniques, facilitating extensive environmental preservation efforts. By promoting eco-friendly financing, green bonds encourage busi-nesses and governments to prioritize sustainability, resulting in the development of more environmentally conscious projects and initiatives. Investors can support green bonds to directly

contribute to environmental benefits. The increasing use of green bonds as finan-cial tools shows a movement towards eco-friendly financing. This can have a positive im-pact on communities by supporting projects focused on environmental sustainability.

Discussion

In recent years, extensive academic research has been conducted on the issue of green bonds.

Following a comprehensive evaluation of many research publications and studies, we have concluded that substantial advancements have occurred in the domain of green bonds in recent years. Numerous future opportunities will arise to invest in ecologically sustainable initiatives through green bonds. The primary aim of a climate-friendly initia-tive is to diminish carbon emissions to attain long-term sustainable development. Green bonds are financial securities that provide investors with stable or fixed-income payments while financing ecologically sustainable projects.Over the past 14 years, green bonds have emerged as an important tool for tackling climate change and associated challenges. Green bonds are an effective method for allocating funds towards sustainable develop-ment.

Conclusion

Green Bonds represent a notable progression in fostering environmental sustainability via ecologically responsible financial practices. Investors are presented with a unique chance to support environmental sustainability initiatives while concurrently generating a return on their investment. In 2010, the World Bank launched the concept of Green Bonds (GB) to combat climate change and alleviate the detrimental impacts of excessive carbon emis-sions. Governments started to shift their focus to ecologically friendly and sustainable growth when the SDG and the Paris Agreement on Climate Change were ratified in 2015 and 2016. The International Energy Agency predicts that $55 trillion will be required by 2035 to fund environmentally friendly initiatives aimed at restricting temperature rises from reaching more than 2°C (IEA, 2014). Green bonds have attained considerable ap-peal globally, particularly in India. In 2021, the aggregate value of green bonds issued in India, encompassing both labeled and unmarked bonds, is anticipated to attain a historic high of $9.5 billion. Green bonds were essential in promoting the expansion of India's re-newable energy sector from 2014 to 2023. Environmentally sustainable projects are fund-ed through Green Bonds. Green bonds promote a low-carbon, climate-resilient economy and help to mitigate climate change. For Green Bonds to be effective, fund allocation transparency must be improved. With robust regulatory frameworks and investor aware-ness, green bonds can improve environmental sustainability and contribute to the transi-tion to an eco-friendly economy.

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Impact of Credibility in Social Media Influencing: A Study on Consumer Engagement Patterns

*Astik Upadhyay

Abstract

The article examines Influencer marketing through Instagram, a new type of social media advertising that has grown in popularity because of its capacity to engage and amuse audiences. This marketing approach is now a useful tool for businesses looking to increase the attractiveness and visibility of their products and services. Brands may create incredibly engaging and relevant marketing campaigns by working with influencers on Instagram. The purpose of the study is to investigate how consumer engagement is affected by influencer marketing campaigns. The study included 130 Indian social media users with active Instagram accounts who were aware of influencer marketing on the platform. Structural Equation Modeling (SEM) study was performed using the AMOS program. The results showed that influencer marketing campaigns directly and dramatically increase consumer engagement. It also demonstrates that engagement is directly and significantly improved by influence and credibility. While attraction does not affect engagement through influencer marketing. Marketing managers, agencies, and businesses who connect consumers with trends and engage in influencer marketing might benefit from the study's conclusions.

Keywords: *: Influencer Marketing, Instagram, Consumer Engagement, Credibility, Attraction.*

Introduction

Influencer marketing is an effective approach in which companies work with people who are well-known online to market their products and services. By utilizing trust and genuineness influencers develop with their followers, this strategy makes brand messaging seem more real and intimate. Influencers produce interesting material like sponsored posts, product reviews, and freebies on platforms like Instagram, YouTube, TikTok, and others, making influencer marketing successful. By raising brand awareness, influencing purchasing decisions, and cultivating brand loyalty, it has a big influence on customer behavior. Brands evaluate the success of influencer campaigns using key metrics including engagement rates, reach, and conversions. Influencer marketing is described as "a non-promotional strategy to marketing in which businesses focus their efforts on opinion leaders, rather than direct target marketing touch points." Hall (2016).

Differentiating between sponsored content and promotional ads is becoming increasingly important as the use of digital media becomes more commonplace. Facebook, Instagram, YouTube, and Twitter are some of the most popular and extensively utilized social networking sites available today, according to Lin et al. (2019). More than ever, consumers are seeking advice from other consumers to guide their purchasing decisions. Nowadays, influencer marketing is typically run from the console of a single digital device owned by an online individual. Advertisers seeking to reach large, specialized audiences with exceptional quality are increasingly turning to influencer marketing (Instagram, 2018). For a broad spectrum of users, including newsrooms, musicians, celebrities, children, and everyone else with an interest in the arts, Instagram provides a platform for visual storytelling. By developing close relationships with their followers and providing a unique visual aesthetic for their posts, some users amass a substantial following over time.

Customers now buy goods and services that influencers promote as well as the brand narratives that these individuals develop because "Influence equals action" is a reality. The interests of marketers, influencers, advertisers, and consumers

*Research Scholar, Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore. E-mail: astikupadhyay7@gmail.com

are thereby safeguarded by these regulations. Therefore, by informing consumers of the material that brands have paid for, the rules seek to provide transparency to influencer marketing.

The Advertising Standards Council of India published clear guidelines for influencer advertising on digital platforms in 2021 (ASCI, 2021).

Influencer marketing on social media is comparable to traditional mass media celebrity endorsements, however influencer marketing interactions are more content-driven (Lou and Kim, 2019). The conventional strategy is mostly predicated on one-way broadcast communication, where fans are usually unable to reply to the messages that superstars convey. As a result, influencer marketing modestly increases audience engagement compared to typical celebrity endorsements (Arora et al., 2019). Because of their fan base among Instagram users, social media influencers have the ability to change the way information flows and play a significant role in promoting brands and social issues.

Review of Literature

The landscape of digital marketing is rapidly evolving, with social media influencers gaining prominence over traditional celebrities due to their perceived sociability (Jin et al., 2019). This shift is transforming the concepts. Digital marketers prioritize key performance indicators (KPIs) such as followers, like/comment ratios, and audience reachability (Primasiwi et al., 2021). While product source credibility is often considered a crucial factor in marketing, Niloy et al. (2023) found it to be irrelevant in shaping audience attitudes towards influencers. Instead, source attractiveness, product match-up, and source familiarity are more influential, with familiarity being the most significant. Hudders et al. (2021) further revealed that defensive responses to negative feedback harm influencer credibility more than accommodating ones. This results in decreased trustworthiness, leading to a lower perception of product quality and a more negative brand perception. Furthermore, the commercial bias of influencer-created content diminishes followers' trust and the content's perceived credibility, reducing their willingness to seek additional information about the promoted product (Gamage et al., 2023). Instagram influencers with large followings are often perceived as more likable due to their popularity, which can lead to perceptions of opinion leadership (Veirman et al., 2017). Consumers generally view Instagram influencer posts as more trustworthy than traditional advertisements, provided they believe the influencer authentically uses or believes in the products they promote (Viessi, 2017). In contrast to typical celebrity endorsements, Jin et al. (2019) discovered that consumers who are exposed to Instagram celebrity brand posts feel more present on social media, have a more positive perception of the endorsed product, and regard the source as more trustworthy. Furthermore, disclosure types, influencer credibility, and brand credibility all have a positive impact on message credibility, attitude toward the advertisement, purchase intention, and electronic word-of-mouth (eWOM) intention, all of which in turn influence how effective Instagram influencer promotional posts are (Lee & Kim, 2020).

Afifah et al. (2022) emphasized the positive influence of eWOM and Instagram influencers on the brand image of cosmetic brands like Wardah and Maybelline. Marketers are thus advised to consider consumer and influencer feedback when designing campaigns. Primasiwi et al. (2021) identified key KPIs for selecting influencers, including the influencer's community, interaction experiences, rate card, and intrinsic value. For food brands initiating influencer marketing strategies, Niloy et al. (2023) stressed the importance of ensuring influencers are attractive, compatible, and familiar to the target audience, with familiarity being the most critical factor. According to Casalo, Flavian, and Ibáñez-Sánchez (2020), the main factors influencing an Instagram account's recognition as a thought leader are perceived uniqueness and originality of posts rather than perceived quality or quantity. Vinzenz, Schorn, and According to Wirth (2021), highlighting human rewards over environmental advantages increases influencer credibility, even while disclosures and benefit appeals do not directly affect consumers' desire for additional product knowledge. Riedl et al. (2019) noted that Instagram posts are less impactful than traditional print advertisements, but influencer marketing is more effective when consumers already follow the influencer, as follower status positively affects purchase intention. When constructing an influencer index, no social media platform holds greater prominence than another (Arora et al., 2019). However, language indicating a "Paid Ad" increases ad recognition, moderating the effect of disclosure language on brand opinion and sharing intention (Evans, Phua, Lim, & Jun, 2017). Personality traits also influence how audiences engage with Instagram influencer advertisements. Extroverted users are more likely to respond positively to lifestyle and brand influencer advertisements compared to introverts, while gender differences in attitudes and attention towards advertisements are negligible (Hazari et al., 2023). This suggests that personality-based audience segmentation is more effective than gender-based segmentation. As social media continues to grow in popularity, Instagram remains a leading platform for influencer marketing, particularly among younger audiences. The transition from traditional word-of-mouth to eWOM has increased the value and trust placed in social media influencers. However, numerous factors, including authenticity, familiarity, and perceived credibility, impact an influencer's image and

popularity. Future research is needed to explore these dynamics further, especially within the Indian context, where Instagram influencer marketing is increasingly significant.

Hypotheses

This study's main goal is to investigate how the factors of Influencer marketing (Influence, Credibility and Attraction) affect consumer engagement. As a result, the following hypotheses were developed after a thorough literature assessment.

H1: Influence has a direct impact on Engagement.

H2: Credibility has a direct impact on Engagement.

H3: Attraction has a direct impact on Engagement.

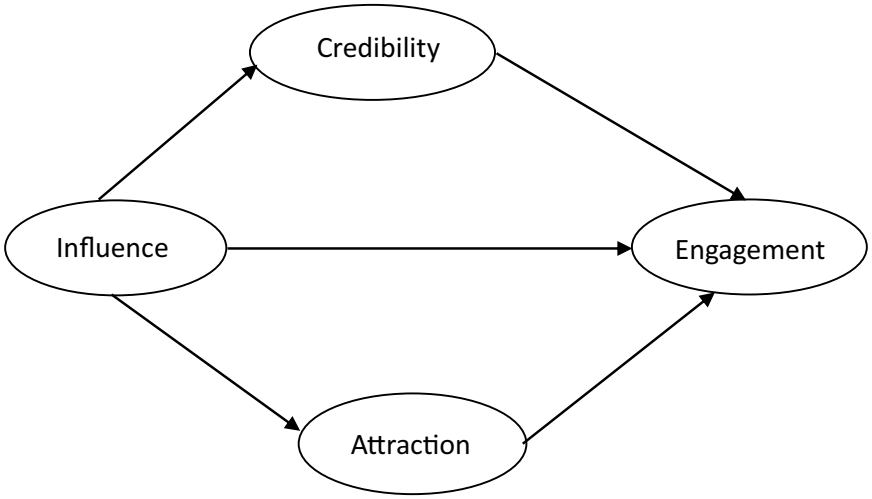

Figure 1. Conceptual Model

Research Method

Examining the components of influencer marketing and their impact on consumer engagement, the study is exploratory in nature. To develop the survey to assess the components of 45 criteria were selected for influencer marketing in accordance with the objectives and relevant literature. The study used a self-designed questionnaire to collect primary data. Respondents were questioned about to use a five-point Likert scale to indicate how much they agree, where 1 means "strongly disagree" and 5 means "strongly agree." The sample universe consists of Instagram users. Purposive sampling was the technique used. For the study, a sample of 130 respondents was chosen. Consumers who met specific criteria were taken into account, including age, gender, family income, and occupation. The item-total correlations for the statements were computed using SPSS. Each statement was shown to have a substantial correlation with the overall score at the 0.01 level. The Statistical Package for Social Science (SPSS) was used to analyze the data that was gathered. First, the factors were clustered using exploratory factor analysis. To investigate the elements of influencer marketing, the raw data was put through a factor analysis using the Principal Component approach with Varimax Rotation.

According to the Cronbach Alpha value of 0.973, reliability was deemed to be strong. Since each statement was deemed pertinent, factor analysis was used to examine the data. Hair et al. (1989) state that a KMO score of 0.50 or above plus a significant Bartlett's test show that the data are appropriate for factor analysis. The KMO values for the study came out at 0.931, indicating that there was enough data for factor analysis. Eight factors in all were identified as a consequence of the factor analysis. Only 4 factors were taken for the further analysis which were having factor load greater than 0.6 and those which included more than 2 items. Which are shown below:

Table 1: Showing KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.931
Bartlett's Test of Sphericity	Approx. Chi-Square	4941.659
	df	990
	Sig.	.000

Table 2: Showing Rotated Component Matrix

	Rotated Component Matrixa							
	Component							
	1	2	3	4	5	6	7	8
VAR00044	.817							
VAR00041	.814							
VAR00043	.786							
VAR00035	.783							
VAR00040	.746							
VAR00042	.732							
VAR00036	.685							
VAR00038	.672							
VAR00019	.640							
VAR00034	.636							
VAR00022	.632							
VAR00025	.615							
VAR00045								
VAR00039								
VAR00037								
VAR00020								
VAR00031								
VAR00023								
VAR00024								
VAR00013		.689						
VAR00012		.668						
VAR00011		.663						
VAR00010								
VAR00014								
VAR00015								
VAR00030			.681					
VAR00033			.615					
VAR00032			.610					
VAR00021								
VAR00028								
VAR00029								
VAR00005				.739				
VAR00007				.713				
VAR00008				.683				
VAR00009				.664				
VAR00006								
VAR00016					.656			
VAR00017					.611			
VAR00018								
VAR00026						.772		
VAR00027						.610		
VAR00004								
VAR00001								
VAR00002								.799
VAR00003								

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

a. Rotation converged in 10 iterations.

Table 3: Showing factors of Influencer Marketing through Instagram

Factor	Name of the factors	Variables	Factor load
F1	Influence	Total- 12	8.55
F2	Credibility	Total- 3	2.02
F3	Attraction	Total- 3	1.90
F4	Engagement	Total- 4	2.79

CFA had been used on the same dataset or 130 respondents using AMOS 21 to verify the factors derived by EFA. The use of CFA aided in the validation of the factors that had been identified. According to its definition, confirmatory factor analysis is "a method of evaluating how well measured variables represent a more limited set of constructs." of Hair et al., 2010). The significance of the link between the observed variables was validated using CFA. Measurement of the factor's discriminant and convergent validity is further aided by confirmatory component analysis. Additionally, the fit indices CMIN/DF, GFI, AGFI, NFI, CFI and RMSEA are considered. The following four constructs are computed for confirmatory factor analysis: Influence, Credibility, Attraction and Engagement.

Table 4: Convergent Validity

Factor	Factor name	Construct Items	Composite reliability	Average variance extracted (AVE)
F1	Influence	TOTAL- 12	0.958	0.657
F2	Credibility	TOTAL- 3	0.870	0.692
F3	Attraction	TOTAL- 3	0.816	0.596
F4	Engagement	TOTAL- 4	0.840	0.573

The assessment of composite reliability and Average Variance Extracted (AVE) is fundamental in determining the reliability and validity of latent constructs. Composite reliability values range from 0 to 1, with higher values signifying better internal consistency. Hair et al. (2014) suggest that a composite reliability score between 0.60 and 0.70 is considered acceptable for ensuring internal consistency. If the composite reliability falls below 0.60, it indicates a lack of internal consistency. The AVE reflects the average proportion of variation explained by the measuring items for a latent construct, with the ideal threshold set at 0.5 (Fornell and Larcker, 1981). This approach guarantees that the constructs are adequately measured, and the relationships between the items and the latent variables are meaningful and reliable.

Table 5: Discriminant Validity

	Credibility	Influence	EngagementAttraction
Credibility	0.832		
Influence	0.683	0.811	
Engagement	0.688	0.669	0.757
Attraction	0.680	0.768	0.5890.772

The discriminant validity of the constructs Credibility, Influence, Engagement and Attraction was assessed using the Fornell-Larcker criterion. The square roots of the average variance extracted (AVE) for each construct (diagonal values: 0.832, 0.811, 0.757, and 0.772) were compared with their correlations.

Model Fit for CFA

The model fit indices suggest a generally satisfactory model fit with some areas for improvement. The CMIN/DF value of 1.852 is just above the ideal threshold of 3, but still acceptable, indicating an adequate fit. The GFI (Goodness of Fit Index) of 0.784 and AGFI (Adjusted Goodness of Fit Index) of 0.731 are both well, indicating acceptable fit. The NFI (Normed Fit Index) of 0.844 and CFI (Comparative Fit Index) of 0.920 fall good of the ideal values and are considered acceptable, signaling room for improvement in the model. The RMSEA (Root Mean Square Error of Approximation) value of 0.08 is slightly above the optimal threshold of 0.05 for a perfect fit, but it remains

acceptable. Overall, while the model exhibits an overall good fit, certain indices, particularly NFI, CFI, and RMSEA, suggest the model could benefit from refinement.

SEM Results

For statistical analysis, the structural equation modeling (SEM) approach was used. Data analysis utilizing SEM was carried out using the Analysis of Moment Structures (AMOS) 21.0 Program.

The linear correlations between observable and unobserved factors are hypothesized in SEM. It uses a number of expressions that are comparable to multiple regression expressions to explain the relationships between numerous variables. In mediation analysis, the study looks at how an intermediary variable also known as the mediator—helps explain how or why an independent variable affects an outcome. In this instance, credibility and attraction work as mediators, and influence is the independent variable that may or may not affect engagement.

SEM ANALYSIS PATH MODEL

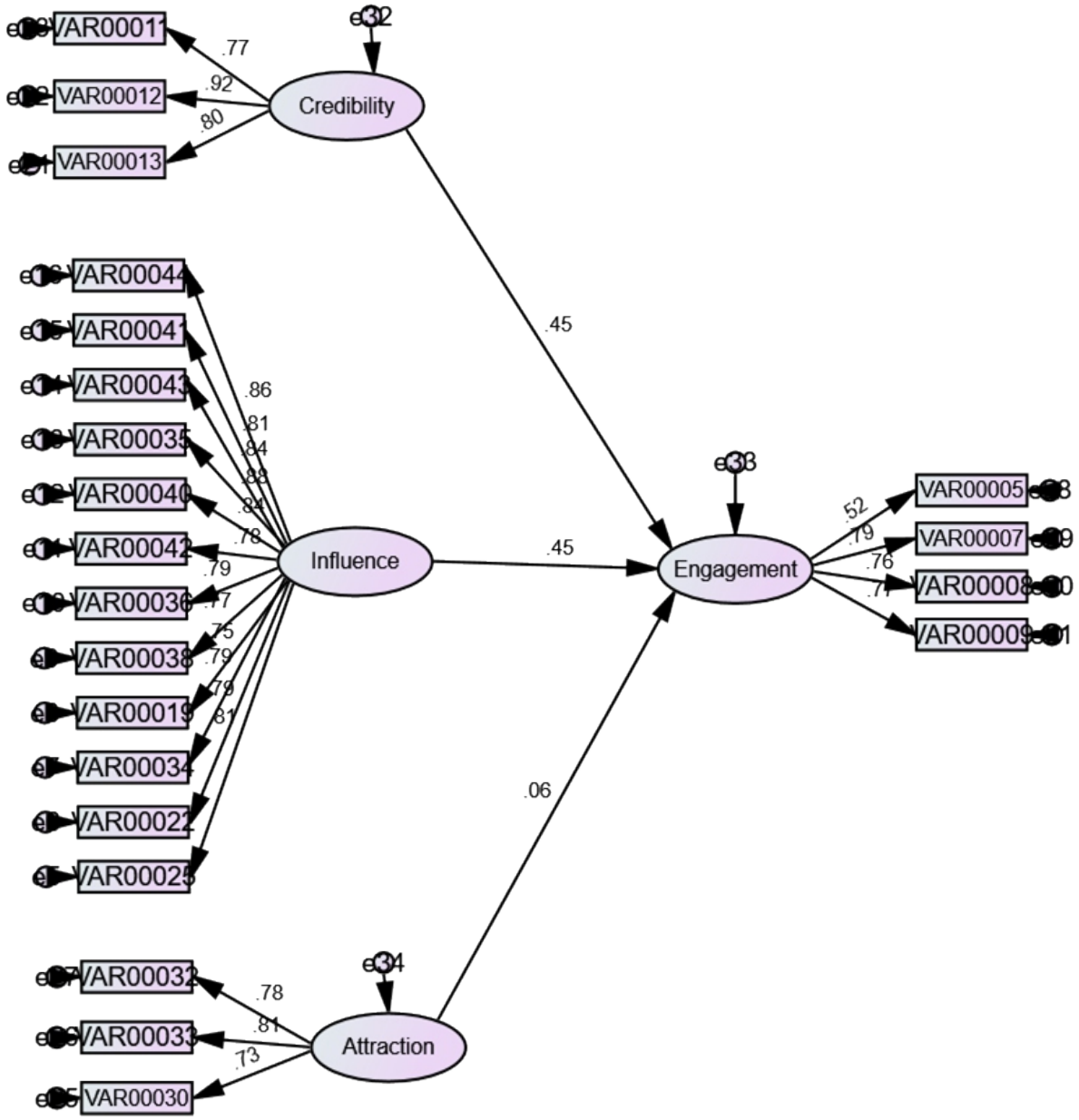

Figure 2: SEM ANALYSIS PATH MODEL FOR A DIRECT RELATIONSHIP

The model fits the degree to which the structural equation model fits the sample data (Hair et al., 2014), was achieved as CMIN/DF = 2.559, GFI = .737, AGFI= 0.677, TLI =.834, CFI = .852, RMSEA = .110.

Table 6. Standardized regression weights for a direct relationship

Relationship	Standard Estimate	S.E.	C.R.	p-value
Engagement <--- Influence	.348	.085	4.076	***
Engagement <--- Credibility	.320	.080	3.980	***
Engagement <--- Attraction	.051	.074	.692	.489

H_1, H_2, and H_3 show differing levels of influence on engagement based on the regression results. H_1 is supported by the analysis, which shows that Influence significantly and favorably affects Engagement. Engagement rises by 0.348 units for every unit increase in Influence. The statistical significance of this association (p <.001) indicates that influence is a key factor in raising customer engagement. Likewise, the data demonstrates that Credibility significantly improves Engagement, supporting H_2. Engagement rises by 0.320 units for every unit increase in Credibility, and this association is statistically significant (p <.001). This finding indicates that Credibility is a strong determinant of consumer engagement, reinforcing its importance in driving audience interaction and trust. H_3 is not supported, nevertheless, because the data shows that attraction has no statistically significant impact on engagement. Although a little positive correlation (β = 0.051) exists, the p-value of 0.489 indicates that this effect is not statistically significant. This suggests that in this approach, attraction by itself has no discernible impact on customer engagement. In summary, Attraction has no discernible effect on customer involvement, whereas Influence and Credibility both have important and beneficial effects. This analysis emphasizes how crucial it is to cultivate credibility and influence to improve customer engagement.

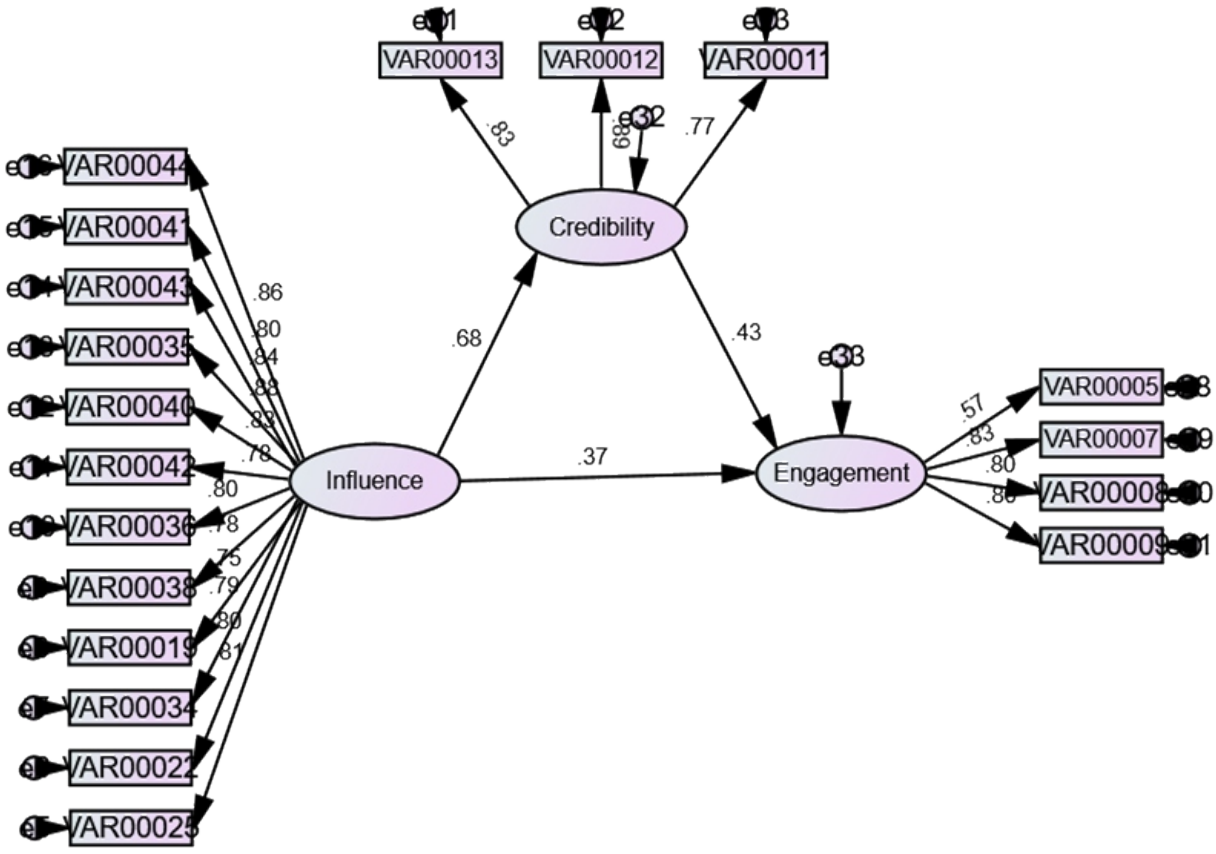

Figure 3. Mediation of Credibility between Influence and Engagement

Table 7. Test for mediation effect of Credibility between Influence and Engagement.

Path	β	Boot S.E	Boot LLCL	Boot ULCI	p-value
Influence → Engagement (Indirect)	.257	.104	.094	.514	.001
Influence → Engagement (Direct)	.323	.124	.109	.624	.006
Total	.579	.108	.376	.801	.000

Note: * Significant at 5% level. Bootstrap samples =2000 and confidence level = 95 %.

Through both direct and indirect impacts, the mediation study investigates the connection between engagement, credibility, and influence. Since zero is not included in the confidence interval (0.094 to 0.514), the indirect effect of Influence on Engagement through Credibility (β = 0.257, p = 0.001) is statistically significant. This suggests that the relationship between Influence and Engagement is partially mediated by Credibility, with Influence increasing Credibility and Engagement consequently. With a confidence interval between 0.109 and 0.624, the direct effect of Influence on Engagement (β = 0.323, p = 0.006) is likewise statistically significant, indicating that Influence directly influences Engagement even after taking Credibility's mediating role into consideration. Influence and engagement have a strong positive association overall, as evidenced by the substantial influence of both direct and indirect effects on engagement (β = 0.579, p = 0.000) with a confidence interval of 0.376 to 0.801. In conclusion, there is a strong overall effect since Influence directly affects Engagement while Credibility plays a large mediating function.

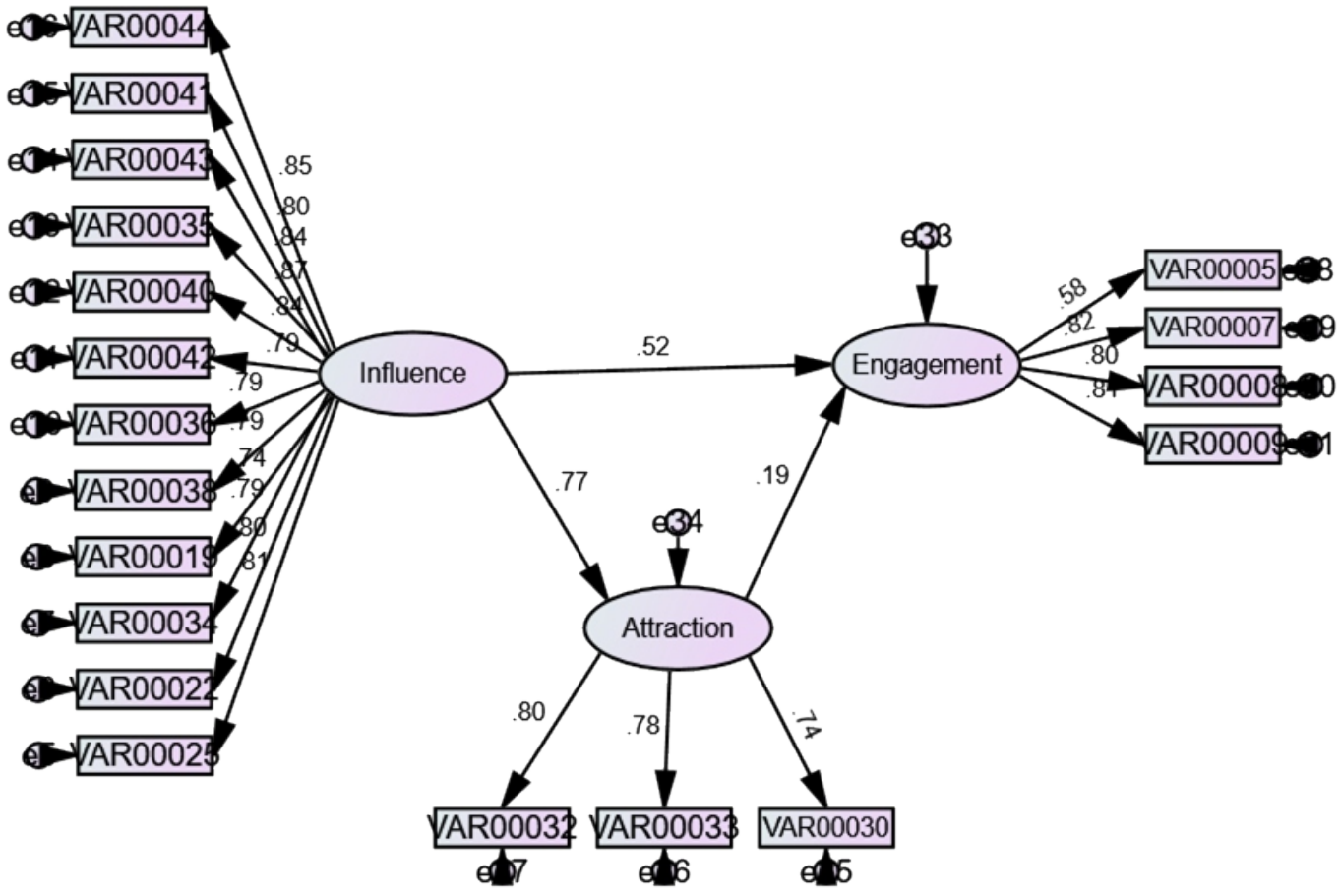

Figure 3. Mediation of Attraction between Influence and Engagement.

Table 8. Test for mediation effect of Attraction between Influence and Engagement.

Path	β	Boot S.E	Boot LLCL	Boot ULCl	p-value
Influence → Engagement (Indirect)	.130	.148	-.080	.399	.284
Influence → Engagement (Direct)	.462	.172	.219	.776	.007
Total	.592	.109	.418	.778	.000

Note: * Significant at 5% level. Bootstrap samples =2000 and confidence level = 95 %.

Through both direct and indirect paths, the mediation study investigates the link among Influence, Attraction, and Engagement. Since zero is included in the confidence interval (-0.080 to 0.399), the indirect effect of Influence on Engagement through Attraction (β = 0.130, p = 0.284) is not statistically significant. This implies that the relationship between Influence and Engagement is not mediated by Attraction. On the other hand, Influence has a statistically significant direct influence on Engagement (β = 0.462, p = 0.007), with a confidence interval between 0.219 and 0.776, suggesting that Influence meaningfully raises Engagement. With a confidence interval ranging from 0.418 to 0.778, the combined effect of Influence on Engagement—which includes both direct and indirect effects—is likewise significant (β = 0.592, p = 0.000), indicating that Influence significantly improves Engagement overall. In conclusion, the analysis does not support the intermediary role of attraction, even while influence strongly drives engagement directly.

Table 9. Summary of the results of all the hypotheses

HYPOTHESIS	CONCLUSION
H_1: Influence has a direct impact on Engagement.	Accepted
H_2: Credibility has a direct impact on Engagement.	Accepted
H_3: Attraction has a direct impact on Engagement.	Rejected
H_4: Credibility has a mediation (full/partial) effect between influence and engagement.	Accepted
H_5: Attraction has a mediation (full/partial) effect between influence and engagement.	Rejected

Discussion

The study's findings reveal that Influence and Credibility are significant drivers of consumer engagement, while Attraction does not have a meaningful impact. Credibility plays a large mediating function, despite the influence directly and significantly drives engagement, but the analysis does not support the intermediary role of attraction. The results of this study support the idea that social media influencers, especially on sites like Instagram, are crucial in influencing consumer behavior. They also complement and build upon earlier research. According to existing research, people prefer social media influencers to traditional superstars because they are seen as approachable and gregarious (Jin et al., 2019). This study backs up that assertion by showing how influencer marketing is becoming more and more effective at influencing consumer behavior and product opinions. According to Hudders et al. (2021), defensive reactions to criticism of a product erode influencer credibility, which in turn lowers customer trust and brand perception. By highlighting how influencer-generated content's commercial slant diminishes its perceived legitimacy and followers' desire to look for further information, this study supports earlier findings (Gamage et al., 2023). Furthermore, the study supports Viessi (2017) in arguing that perceived authenticity is important; audiences are more likely to trust influencers if they believe they are honestly promoting goods they use or believe in. Social media type does not significantly affect how follower characteristics and source credibility influence marketing outcomes. Followers' intrinsic attributes remain stable across platforms, rooted in their cognitive and social frameworks for message evaluation. While tailoring messages to platform features is useful, the core strategy should focus on leveraging follower characteristics (Pan et.al., 2024).

Conclusion & Implications

In summary, the results of the study show that while Attraction does not significantly mediate this relationship, Influence and Credibility are important elements driving customer engagement. Because Influence directly and significantly affects Engagement, the data demonstrate a large overall effect. Credibility also acts as a significant mediator, enhancing the

relationship between engagement and influence. This implies that customer engagement rises when influence boosts credibility. Attraction does not, however, significantly moderate the relationship between Influence and Engagement, according to the data, which refutes its role as an intermediary. Overall, the results highlight how Influence, both directly and indirectly through Credibility, is a potent motivator of customer involvement. These findings demonstrate that while depending only on attraction may not be successful, establishing reputation and gaining influence are crucial for encouraging customer participation. From a strategy perspective, companies should concentrate on enhancing credibility by providing accurate and transparent information and bolstering influence through authoritative communications. Since customers react more favorably to trustworthy and powerful information, marketing initiatives should place a higher priority on establishing trust than on outward beauty. By working with reputable industry leaders and continuously producing top-notch content, brands may improve their positioning. Long-term engagement requires credibility and impact, even though visually appealing information can draw initial attention. Effective customer relationship management can also increase customer loyalty and trust by maintaining open lines of communication and keeping brand commitments. In conclusion, companies that want to boost customer engagement should give top priority to tactics that strengthen their reputation and influence since they understand that appeal by itself is insufficient to encourage long-term customer involvement. Brands may strengthen their relationships with their audience and raise engagement levels by concentrating on these important elements.

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Empowering Tribal Women Through Digital Financial Inclusion: Challenges, Opportunities, and Pathways to Inclusive Growth

*Nazia
**Devesh Kumar

Abstract

The financial inclusion of tribal women is playing a crucial for fostering sustainable and equitable economic growth. This review paper observes the barriers, opportunities, and impacts of financial inclusion on the socioeconomic well-being of tribal women, who often face marginalization due to geographic, cultural, and systemic factors. Key challenges include limited financial literacy, insufficient institutional support, and inadequate infrastructure in tribal regions. The paper explores the roles of government policies, microfinance initiatives, self-help groups, and digital financial services in addressing these challenges and enhancing access to formal financial systems. It also highlights how financial inclusion contributes to economic empowerment, entrepreneurship, and poverty alleviation in tribal communities. Additionally, it emphasizes the importance of culturally sensitive and inclusive approaches to ensure equitable access for tribal women. The help of existing literature and offering policy recommendations, this paper underscores the transformative potential of financial inclusion as a tool for empowering tribal women and promoting inclusive growth.

Keywords: *Financial Empowerment, Tribal Women Entrepreneurs, Sustainable Development, Economic Justice.*

Introduction

The role of women in Indian society is significant. But when it comes to money, they don't have the same rights as males. Tribal In India, women frequently face extreme social discrimination in both their homes and the larger community, which deprives them of their agency (Esmaeilpour Moghadam & Karami, 2023). The goal of microfinance is to increase women's independence so they can significantly impact their families and society. Though they have produced some beneficial results for indigenous women, Dahod research suggests that these programs have had very little effectiveness in that area(Esmaeilpour Moghadam & Karami, 2023). These results imply that microfinance programs and indigenous women's empowerment are positively correlated. Despite occasional side effects, microfinance programs usually empower women with greater economic, social, psychological, and political influence, leading to favourable outcomes (Showkat et al., 2024).

What is financial empowerment

The act of enhancing the capacity of a person or group to make different decisions and convert to those decisions into the actions that are desired is what we mean when we talk about empowerment(Ha & Nguyen, 2024). The process of providing an individual with the ability to make their own financial decisions and achieve independence is referred to as financial empowerment (Parsons, 1991). By making investments, one can transform their financial situation from one of instability to one of stability. It is necessary for individuals to have sufficient financial empowerment and the ability to evaluate their level of empowerment in order for them to be able to enhance their financial well-being and make prudent decisions regarding their finances(Adeleke, 2024). Empowerment on a smaller scale can be achieved through activities such as self-help, education, support, social action organizations, and the formation of networks that connect individuals with others who are going through experiences that are like to their own. When we talk to larger-scale empowerment, community organization, campaigning, legislative lobbying, social planning, and policy formation are all powerful tools(Mothobi & Kebotsamang, 2024) that can be utilized. definition provided by the Consumer Financial Protection Bureau in 2020 It is important to note that financial empowerment covers both financial education and

*Research Scholar, HPKV Business School, Central University of Himachal Pradesh Dharamshala India
**Associate Professor, HPKV Business School, Central University of Himachal Pradesh Dharamshala India. E-mail: deveshkumarsharma@hpcu.ac.in

financial literacy. However, its 0prime focus is on enhancing individuals' capacity to manage their finances(Anwarul Islam &][Khan, 2024) and make use of financial services, as well as on providing them with access to products that are personalized to their needs. The persons who are financially empowered are knowledgeable and skilled they are aware of the resources that can assist them with their financial difficulties(Utama & Harianto, 2021). This feeling of empowerment can help individuals develop the confidence that they are able to make good use of their financial knowledge, skills, and resources in order to achieve their objectives(Subramaniam et al., 2024). The process of becoming stronger and more confident, managing one's own income and saving money, gaining access to banking services, accumulating assets and achieving financial independence, leveraging money, planning and budgeting one's income, having control over how one uses money, and developing one's financial knowledge are the primary characteristics of financial empowerment(Shaikh et al., 2023). It is more vital to have the ability to save and spend money, as well as a positive perspective around finances, in order to be financially empowered and maximize life choices(Zhu, 2024).

A Financial Empowerment Component

Learning about finance is the first phase of achieving financial well-being. People need to have a thorough understanding of financial topics in order to manage their money properly (Gunawan et al., 2023). This includes creating a budget, using banking services effectively, paying off debts on time, and managing credit responsibly(Demirgu and Kiapper, 2012). Understanding the potential effects of an increase in assets or income on benefits may be essential. The hallmarks of financial competency include using your knowledge and abilities and making wise financial decisions(Anwarul Islam & Khan, 2024). It is a logical step after financial education in the context for financial empowerment. The foundation of overall financial health is made up of personal financial security indicators and financial aspirations. Its help financial stress to financial bliss, there is a variety of financial well-being(Dhal et al., 2021). People's general quality of life and many parts of it are greatly influenced by how they view their finances. Stress related to money might make it more difficult to lead a healthy lifestyle, succeed in other endeavours, and work efficiently(Utama & Harianto, 2021).

Since 2005, when the United Nations declared that year to be International Microcredit Year, the perception of "Financial inclusion" has emerged as a tool for achieving inclusive growth(Shetty & Hans, 2018). Individuals and families, particularly women and the rural area, are given the ability to participate in the formal financial system through the process of financial inclusion(Esmaeilpour Moghadam & Karami, 2023). Furthermore, countries that have well-functioning financial systems are enriched. The broad view is that financial inclusion has the possible to contribute to the attainment of economic growth and poverty reduction goals in all country (Thathsarani et al., 2023). Through participation in the official financial system, it will make it possible for millions of people with modest incomes to better their economic and social position (Muchandigona & Kalema, 2023). Every nation's economic strategy has underlined the significance of an inclusive financial system, and this trend is expected to continue. It is difficult to overstate the benefits that come with having a financial system that is inclusive. The first and most important benefit is that it facilitates the effective distribution of productive resources by integrating underrepresented groups into the mainstream of the process of economic development(Al-Baity, 2023). Furthermore, having access to proper financial services has the potential to dramatically improve the financial discipline that exists within a society as well as the administration of finances in an effective manner(Thetlek et al., 2024). It is also possible for an inclusive financial system to help to the reduction of financial distress, which is frequently experienced by those working in the informal sector(Shetty & Hans, 2018). This can be accomplished by minimizing the lending practices that are utilized by local money lenders. As a result, an inclusive financial system has the potential to unquestionably contribute to increased levels of efficiency and welfare by ensuring the financial stability of the general public and motivating them to form money-saving behaviours (Suri & Jack, 2016). The rural and underprivileged, especially rural women, can’ot afford the financial services providing by formal financial services due to increased costs and other limitations, like the need for collateral (Ediagbonya & Tioluwani, 2023). They are thereby shut out of the financial system, which hinders a nation's ability to prosper economically. Policymakers worldwide concentrated on measures that would guarantee financial inclusion in order to include people who were previously excluded in a country's development process (Mmari et al., 2024).

Objective

- To know the gender gap in financial inclusion
- To identify FI barriers for women.
- To study about the govt schemes for FI
- To analyse the role of financial inclusion in advancing Sustainable Development Goals
- Use a systematic literature analysis to determine possible future paths for research on Empowering Tribal Women Through Financial Inclusion

Methodology

The main objective of this research is to conduct a comprehensive analysis of literature on Empowering Tribal Women Through Financial Inclusion. To achieve this, the study focuses on papers published in Scopus between 2014 and 2025. Included only English-language articles from the fields of

business, social sciences, and economics. Various terms such as mobile banking, internet banking, and online banking are used to refer to digital banking. Data for this review was collected from the Scopus database using a systematic approach. At first stage, the search engine was employed to obtain articles from the Scopus database that contained the terms "women empowerment" and "financial inclusion" in their titles, abstracts, and keywords. The selection process followed the PRISMA framework, as illustrated in Table 1. Using the specified search strategy, 119 documents were initially retrieved. In the first level of screening, the documents were categorized based on topic relevance, key publications, and duplicate entries. The analysis focused completely on papers related to business management, accounting, and environmental topics, cover the period from 2014 to 2025 due to the important growth observed in the last 10 years. After filtering by keywords, source type, and language, 81 documents were selected. Journal articles written in English and from the fields of business, social sciences, and economics were included, non-English articles, review papers, book chapters, conference proceedings, and studies conducted in developed and underdeveloped countries were excluded.

Table 1, Bibliographic Data Retrieval Process

Stage	Filtering Criteria	Eliminated	Accepted
1	Initial search outcome (on search term)		119
2	Year filter (2014–2025)	9	110
3	Filter by subject (economics, econometrics, finance, business, management and accounting, and multidisciplinary)	10	100
4	Language filter (English)	8	92
5	Document type (article, review)	2	90
6	Scimago Journal ranking (Q1, Q2, Q3) & citation	9	81

Source: Author Compilation

Data Analysis Techniques

To accomplish the goals of the study, data analysis was done. A number of factors, such as journal distribution, regional distribution, annual publishing patterns, and the research methodologies used in the studies, were used to analyse the general features of the chosen articles. Citation analysis was used to examine the importance of the retrieved publications and their impact on subsequent studies. To show how the main keywords relate to one another, a keyword co-occurrence map was also made. VOS viewer software was used to create the bibliographic map and the citation analysis.

Findings

The implementation of digital financial inclusion was the subject of 81 peer-reviewed journal papers published between 2014 and 2025, according to this comprehensive literature evaluation. Every article that was retrieved is shown in reference. This section shows the overall analysis of the retrieved articles. Figure 1 illustrates the trend of papers related to financial inclusion from 2014 to 2025. It was observed that there was a slight increase in the number of papers between 2014 and 2018, followed by a significant increase in studies from 2019 to 2024.

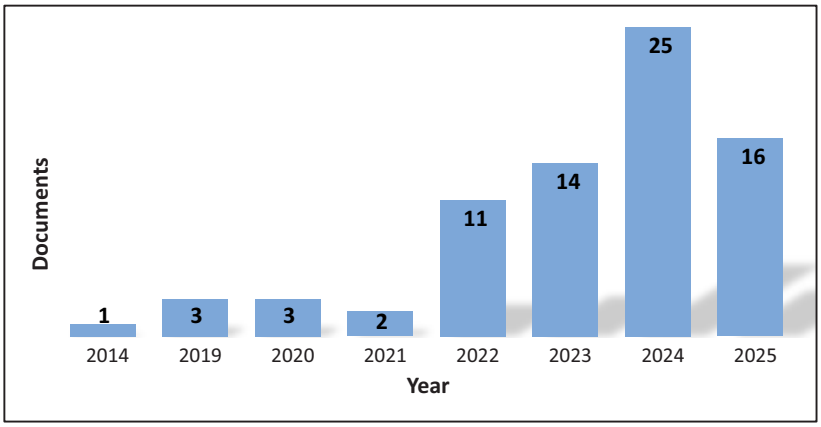

Figure 1, Yearly distribution of articles
Source: Author Compilation

Citation analysis

Citation analysis displays the number of citations an author, document, or journal has received over a specific time period. Citations by documents, by nation, and by journals are included in this study. Citation analysis on the basis of Documents publication, most relevant Sources, authors and their affiliations finally the countries and institutional types. Based on systematic literature review the most relevant sources which includes Journal's name are presented in Figure 2, Further Authors with the greatest number of documents and citation are presented in Fig. 3. Countries based documents and citations are presented in Fig. 4.

Most relevant sources

Figure 2 highlights the most relevant sources on financial inclusion. The journal sustainable development goals series has made the largest contribution, while equality, diversity and inclusion, gender in management, international journal of social economics, Journal of Risk and Financial Management have made equal contributions.

Figure 2 Most relevant sources
Source: Author Compilation

Figure 3, highlights the names of the 12 authors who have contribute the most significant contributions to the study of digital financial inclusion. Out of a total of 194 authors working on this topic, only those who have published at least two papers were considered, resulting in the identification of 12 authors. Maren, the author, has the highest number of citations. And Vinay published highest documents.

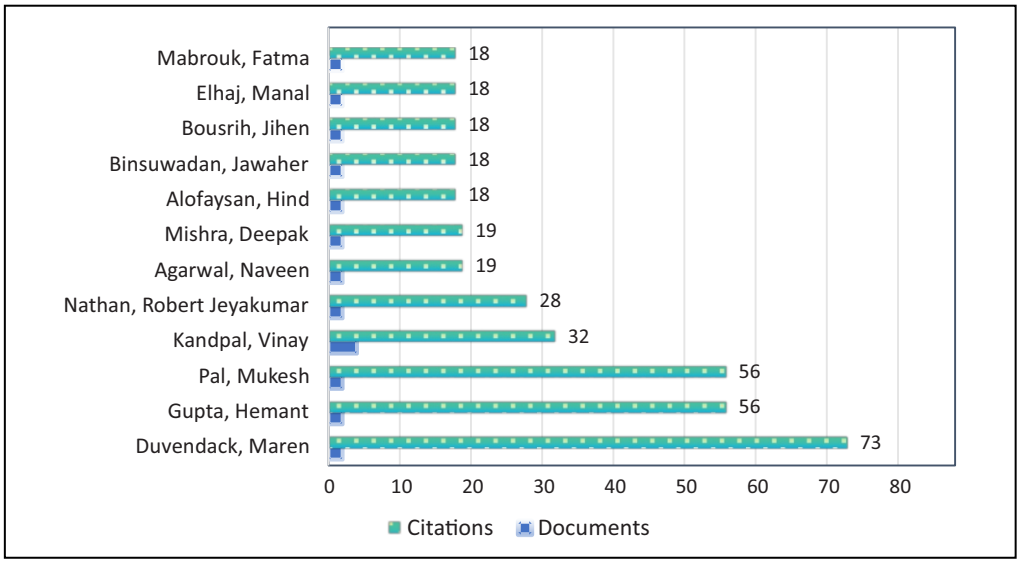

Figure 3 Citations and documents for different authors
Source: Author Compilation

Countries Wise Documents And Citations

Figure 4 illustrates the global scientific output on digital financial inclusion by country. India ranks first with 33 publications and 239 citations, followed by United Kingdom with 7 publications and 174 citations. Although research on this topic spans 37 countries, when the minimum threshold of publications per country is set at three, 10 countries meet this criterion. The significant output from developed nations highlights the increasing trend of research in this area, with the United Kingdom leading in total citations as shown in Figure 4.

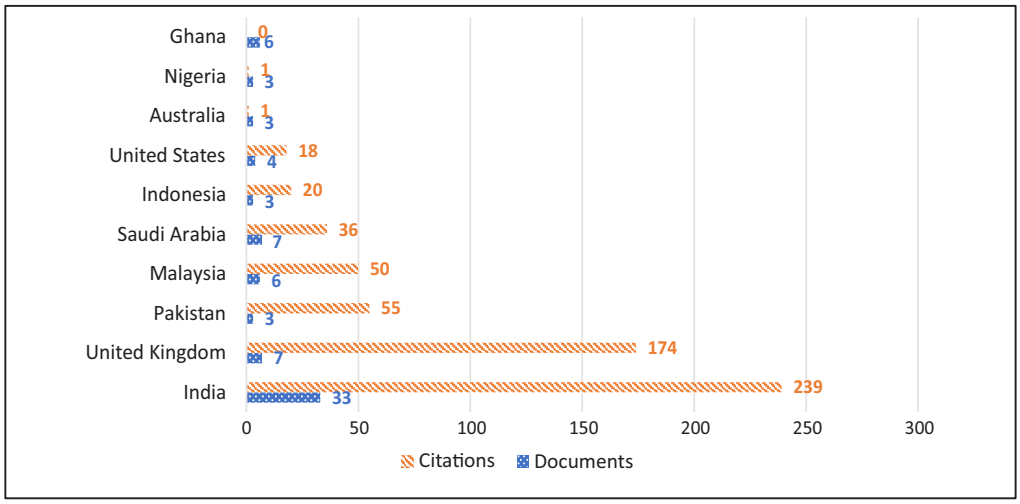

Figure 4 Countries wise documents and citations
Source: Author Compilation

Keyword co-occurrence

The analysis of major keywords related to the Empowering Tribal Women Through Financial Inclusion has been conducted using co-occurrence of keywords. The co-occurrence map of different terms from the chosen articles in this study is shown in Figure 5. Only keywords that occurred at least five times were included in this study. 17 keywords in all satisfied this requirement. The most frequently used keywords were "digital financial inclusion" and "women empowerment" which appeared 51 times and 37 times, respectively digital financial inclusion co-occurred with 90 other keywords, while "women empowerment" co-occurred with 63. Other prominent keywords included financial services and micro finance. This suggests that most studies focus on the empowering of tribal women. Additionally, keywords such as " Sustainable Development" (7 occurrences), "fintech" (6 occurrences), " Poverty Alleviation " (8 occurrences), gender equality (6 occurrences). These key variables are commonly used to explain the Empowering Tribal Women Through Financial inclusion.

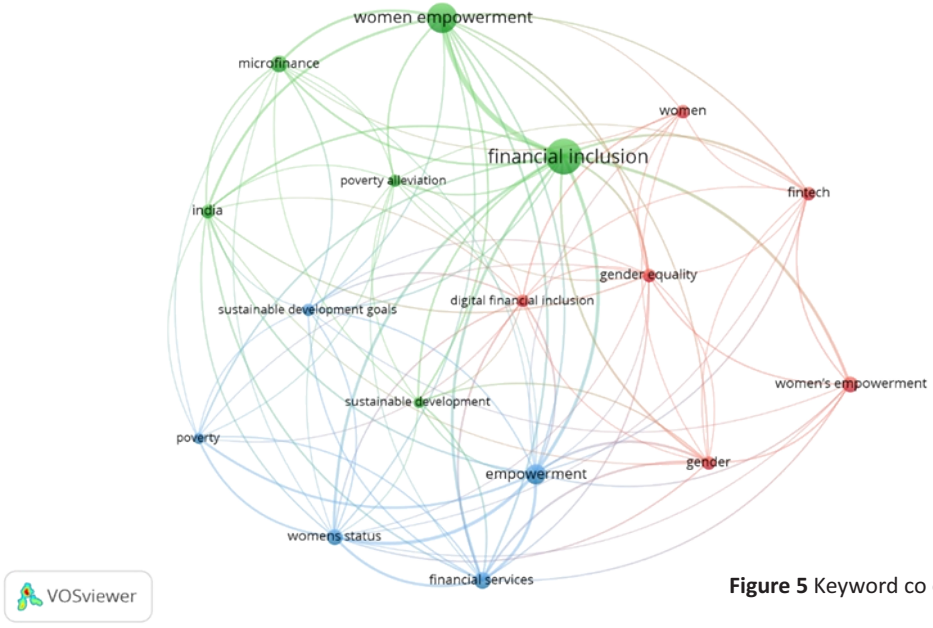

Figure 5 Keyword co occurrences

According to the findings of a complete evaluation of the relevant literature, women confront a number of obstacles when it comes to obtaining digital financial inclusion. In addition to being multifaceted, these obstacles are caused by impediments that are societal, economic, and infrastructure-related. The most significant challenges are as shown in table 2.

Table 2, Challenges to women digital financial inclusion

S. No.	Challenges	Description	Reference
1.	Limited Financial Literacy	Women often lack basic financial knowledge, limiting their ability to use banking services effectively.	(Demirgüç-Kunt et al., 2021; OECD, 2013)
2.	Digital Gender Divide	Limited access to mobile phones and internet prevents women from using digital financial services.	(GSMA, 2020; Demirgüç-Kunt et al., 2018, Tay et al., 2022)
3.	Mobility and Physical Access Barriers	Cultural norms and safety issues restrict women's ability to visit banks or financial service points.	(Sarma & Pais, 2011; World Bank, 2014, Shetty & Hans, 2018)
4.	Lack of Legal Documentation	Many women lack ID documents needed for financial services like bank accounts or loans.	Chakrabarty, 2013; UN Women, 2018
5.	Low and Irregular Incomes	Women's informal employment leads to unstable earnings, limiting their financial service eligibility.	ILO, 2016; (Demirgüç-Kunt et al., 2021)
6.	Socio-Cultural Norms and Gender Discrimination	Patriarchal norms limit women's financial decision-making and autonomy.	Chakrabarty, 2013; (Setiawan et al., 2024)
7.	Financial Products Not Tailored to Women	Financial products often ignore women's unique needs, like irregular income and lack of collateral.	AFI, 2016; World Bank, 2014(Joshi, 2024)
8.	Lack of Gender-Sensitive Outreach and Education	Financial training and schemes often fail to reach women due to location, timing, or male domination of programs.	Sarma & Pais, 2011; AFI, 2016
9.	Gender Bias in Financial Institutions	Women face discrimination, such as being asked for male guarantors or denied credit.	Chakrabarty, 2013; UN Women, 2018
10.	Security and Privacy Concerns in Digital Transactions	Fear of fraud, data misuse, or lack of digital literacy discourages women from using mobile banking and digital finance tools.	GSMA, 2020; ITU, 2019; OECD, 2022

Source: Author Compilation

There are still barriers that prevent women from having access to digital financial services. These barriers include cultural, economic, and institutional barriers. According to (Demirgüç-Kunt et al., 2021) and the Organization for Economic Co-operation and Development (2013), women are unable to use formal banking services and digital financial instruments because they lack the information necessary to understand financial concepts. This is connected to the digital gender divide, which is a phenomenon in which women, particularly those who living in rural or low-income areas, have not easily access to mobile phones, internet connectivity, and digital education, which in turn restricts their ability to participate in matters pertaining to digital money. According to (Sarma and Pais, 2011) and the World Bank (2014), factors such as mobility and physical access limits, which are sometimes influenced by cultural norms and worries about safety, are also factors that prohibit women from attending service sites or financial institutions. There is also a significant problem with the legal paperwork that is required in order to establish bank accounts or obtain loans. Two examples of such documents are identification cards and evidence of residence. According to Chakrabarty (2013) and UN Women (2018), this has a disproportionate impact on women and makes it difficult for them to participate in the official financial system. According to the International Labor Organization (2016) and (Demirguc-Kunt et al. 2018), women's eligibility for formal financial services such as loans and savings accounts is restricted due to low and irregular income, which are mostly a result of informal employment. According to Chakrabarty (2013) and UN Women (2018), patriarchal socio-cultural norms severely restrict the financial freedom of women and frequently make it possible for male family members to exercise control over these matters. Women's needs are not

adequately met by the financial systems as well. Due to the fact that the majority of products are not suitable for women's income patterns or because they do not have collateral, women are not allowed to participate in formal financial schemes (AFI, 2016; World Bank, 2014). Women are not allowed to participate in state-sponsored financial programs. Financial literacy programs and schemes frequently fail to reach women owing to time constraints, geographical constraints, or environments that are dominated by men (Sarma & Pais, 2011; AFI, 2016). Lack of gender-sensitive outreach and education is a common reason for this failure. There is still a persistent gender prejudice in financial institutions. According to Chakrabarty (2013) and UN Women (2018), women are frequently asked to provide male guarantors or are considered to be high-risk candidates. The last reason why women are less likely to use mobile banking and digital platforms is because they are concerned about the privacy and security of digital transactions. 2020; ITU; 2022; OECD; GSMA; 2020; OECD; 2020 Notable among these are the identification of significant psychological and technical impediments, such as the fear of online fraud, problems with digital literacy, and concerns around data protection. Policies need to be all-encompassing, gender-responsive, and encourage equal access, financial education, and digital safety for women in order to achieve inclusive digital financial inclusion. These kinds of policies are required because of the complexity of the issues.

Digital financial inclusion promotes sustainable growth by including tribal women in the financial system. Integration allows indigenous women to access finance, save securely, and invest in livelihood opportunities. They gain economic resilience and are encouraged to start businesses, which boosts household earnings and community growth. It creates a more stable and inclusive economy by reducing financial barriers and encourages equal participation. Long-term, sustainable growth for impoverished groups depends on integration like this. Table 3 shows how using digital financial inclusion to meet the Sustainable Development Goals can help indigenous women grow. Tribal women can participate more in the economy with better banking services. This will boost self-sufficiency, reduce poverty, and improve community development, achieving sustainable development goals.

Table 3, Achieving SDGs through Digital Financial Inclusion for Tribal Women

S. No.	SDG	SDGContribution through Digital Financial Inclusion	In-text Citation
1.	SDG 1: No Poverty	Digital financial inclusion enables women to access savings, credit, and insurance, helping reduce poverty and build financial resilience.	(GSMA, 2020; Demirgüç-Kunt et al., 2021, Hendriks, 2019, Kandpal, 2024)
2.	SDG 5: Gender Equality	Providing access to financial services empowers tribal women, reducing gender disparities in economic participation and decision-making.	(UN Women, 2018; World Bank, 2021,Aziz et al., 2022)
3.	SDG 8: Decent Work & Economic Growth	Financial inclusion through digital platforms supports entrepreneurship and income generation, leading to greater economic growth	(ILO, 2016; OECD, 2022, Setiawan et al., 2024) (Okello Candiya Bongomin & Munene, 2021)
4.	SDG 10: Reduced Inequalities	By enabling access to digital finance, women from marginalized tribal communities can participate more equally in the economy.	(Sarma & Pais, 2011; GSMA, 2020, Esmaeilpour Moghadam & Karami, 2023)
5.	SDG 4: Quality Education	Access to digital finance tools can fund education for women and children, breaking the cycle of poverty and inequality.	(ITU, 2019; OECD, 2022, Gupta et al., 2022)
6.	SDG 2: Zero Hunger	Digital finance aids in agricultural investments and food security initiatives, which benefit women in rural and tribal areas.	(GSMA, 2020; FAO, 2018, Bakhshi et al., 2024, Ghosn et al., 2024)
7.	SDG 3: Good Health and Well-being	Digital financial services enable access to healthcare, helping tribal women manage healthcare expenses and improve family health outcomes.	(WHO, 2020; GSMA, 2020, N. Song & Appiah-Otoo, 2022)
8.	SDG 9: Industry, Innovation, and Infrastructure	Digital financial inclusion enables women to access resources for technological and entrepreneurial innovations in underserved communities.	(OECD, 2022; ILO, 2016, Arner et al., 2017, Kaddumi et al., 2023)

Source: Author Compilation

Financial inclusion and poverty reduction (SDG1)

Financial inclusion and poverty reduction (SDG1)

Socioeconomic growth through financial inclusion reduces poverty over time (Niaz, 2022). Financial inclusion and poverty reduction have been studied using state-level macro-data (Burgess & Pande, 2005; Inoue & Hamori, 2012). (Tay et al., 2022) examined how financial inclusion reduces poverty using rural bank state-level panel data. With state government backing, rural bank branch expansion in India reduced poverty, according to the study. Another research of Indian states by (Ediagbonya & Tioluwani, 2023) evaluated financial inclusion and poverty. This study found the financial inclusion reduces poverty by assessing regional commercial banks' credit and deposit amounts. Cross-country data has been utilized to study money and poverty worldwide (Acheampong & Tetteh, 2024) explored how financial indicators reduce poverty in 162 nations. Financial access adversely correlated with poverty. (Tran & Le, 2021) found similar results in developed European countries, whereas (Park & Mercado, 2015) found the same in underdeveloped Asian countries. Access to financial services improves money security and privacy.

Ending hunger and financial inclusion (SGD2)

This study (Antle & Diagana, 2003), sustainable agriculture development is necessary to stop hunger and eco-friendly damage. An inclusive financial system has just been familiar as a strategy that promotes sustainable farming practices by converting the agricultural sector into representations with high specialty, awareness, and economies of scale. Loan expansion in China has a positive effect on the transformation of smallholder farming practices into larger-scale agricultural output, claim Cai et al. (2021). Similarly, Showkat et al. (2024) found a reciprocal association between agricultural industrialization and financial inclusion, suggesting that the industrialization of agricultural output could be facilitated by an inclusive financial system. By making sure they have only access to the capital they require to update their agricultural output, smallholding farmers can adopt advanced technologies in their sector (Miller & Jones, 2010). Therefore, greater access to financial services may consequence in investments that agree for higher yields.

Well-being, health, and financial inclusion (SGD 3)

Well-being, a component of human expansion, is viewed as a complex spectacle that can be evaluated using a variety of metrics based on both individual and unbiased standards (Demirgüç-Kunt et al., 2021) suggest that financial inclusion, financial growing, and social development might all be positively correlated. According. (Klapper et al. 2016), financial inclusion enhances health by assisting people in resolving medical emergencies while controlling their spending and preserving their resources. Savings allow households to grow wealth, stabilize consumption, improve resilience to external shocks, and invest in the development of human capital, including healthcare and education, according to (Zhuang et al. 2009). Parents can pay for their children's clinic admissions using a savings account. One major factor keeping many people in poverty is the expense of out-of-pocket medical care.

Gender equality and financial inclusion (SGD 5)

According to(Aziz et al., 2022), gender prejudices based on money are the root cause of gender disparity and exacerbate poverty amongst women.(Bui & Luong, 2023) found that financial inclusion significantly reduces gender disparity in the study on sub-Saharan Africa. Women who have access to finance are empowered because it gives them the ability to make decisions, increases their sense of self-worth, and raises their socioeconomic standing overall (Cheston & Kuhn, 2002). However, (Goetz & Gupta, 1996) looked at Bangladesh's special credit institutions and found that, despite the fact that giving women access to acknowledgement would authorize them carefully, financial inclusion has little effect on their economic empowerment because their spouses control the majority of the household's financial resources. However, giving women more access to financial resources and services will change gender norms and provide contemporary women more freedom to engage into society.

Economic growth and financial inclusion (SGD 8)

The change of financial landscape has raised attention in the present relationship between financial inclusion and economic sustainable growth. According to (Muchandigona & Kalema, 2023), the key elements of a strong financial system are production specialization, risk management, savings mobilization, and transaction and information cost reduction. The financial sector delivers debtors with a range of low-risk, high-return financial products in an effort to encourage economic expansion. A study of the financial inclusion index by Van et al. (2021) found that in 152 countries, financial inclusion positively affects economic growth. However, there is a negative correlation between financial inclusion and economic growth (Khan et al., 2021). Whether financial inclusion promotes economic growth will depend on the forms of financial services accessible and how the funds are spent.

Financial inclusion and industry, innovation, and infrastructure (SGD 9)

improved access to financial services allows businesses with limited resources to obtain the funds required to support organizational, business, and technological advances, financial inclusion has a beneficial impact on innovation (Shi et al., 2019). By lowering risk and transaction costs and offering an effective payment system and institutional efficiency, financial inclusion innovates the financial system. The asymmetric relationship between financial inclusion, innovation, development, and remittance inflows in African nations was investigated by (Boachie & Adu-Darko, 2024) using the Granger causality test. Innovation and financial inclusion were found to be bidirectionally causal, meaning that growing the financial sector promotes financial system innovation and vice versa. Green growth and eco-innovations have the potential to change

industrial structures into more sustainable patterns, reduce reliance on conventional energy sources, and open up new economic prospects, according to (Zhang & Posso, 2017). The demand-related aspects of financial inclusion, however, have little bearing on Kenyans' use of mobile money, according to (Suri & Jack, 2016) According to the study, a supportive, regulated environment rather than just latent desire for financial access was the primary driver of the increased adoption of mobile money technologies. Thus, the Kenyan example shows that without a regulatory environment that reduces market uncertainty, the main objective of financial inclusion cannot be achieved. For innovation-led sustainability, a favourable regulatory environment and efficient governance within the framework of financial inclusion are crucial. wiring their credit standards with shorter-term loans.

Inequality and financial inclusion (SGD 10)

The impact of finance on wealth and income distribution has become a contentious topic as growing inequality has gained considerable attention (Omar & Inaba, 2020). While some research suggests that financial inclusion and inequality are positively correlated, the majority of studies have found the reverse. While (Park & Mercado, 2018) observed that, depending on the geographic factors, the degree of access to finance reduces income inequality, (Ghosn et al., 2024) conducted an empirical investigation into whether financial inclusion reduces income distribution disparity when important macroeconomic factors, including fiscal policy and economic development, are under control.

Government initiatives to promote FI in India: The following programs are under the direction of the Indian government. These programs are implemented to help the less fortunate members of society. Table 4 shows the Government Schemes for Financial Inclusion and Women's Empowerment.

Table 4, Government Schemes for Financial Inclusion and Women's Empowerment

Initiative	Objective	Key Features	Women's Role & Impact	Reference (Report/Paper)
Bank Branch Expansion in Rural Areas	Improve access to banking	Physical branches in remote areas	Facilitated savings & credit for women	RBI (2022). Trends and Progress of Banking in India
Kisan Credit Card (KCC)	Provide farm credit	Low-interest, flexible crop loans	Improved access for women farmers	NABARD (2023).
ATMs & Micro-ATMs	Cash access in rural areas	White-label ATMs, micro-ATMs	Convenient cash access for SHGs	RBI (2021). Payment Systems Report
Online Transactions	Promote cashless economy	UPI, BHIM, AEPS	Enabled secure transactions for women	MeitY (2023). Digital India Progress Report
Financial Literacy Campaigns	Raise financial awareness	Workshops, targeted content for women	Helped women make informed decisions	RBI (2022). NSFE 2020–2025
JAM Trinity	Enable digital identity & DBT	Jan Dhan + Aadhaar + Mobile	23+ crore women beneficiaries	Economic Survey (2016–17)
Atal Pension Yojana (APY)	Pension for informal sector	Govt co-contribution, ₹1k–₹5k pension	43% women subscribers	MoF (2023). APY Progress Report
PMSBY	Accident insurance	₹12/year premium for ₹2 lakh cover	Women covered via SHGs, banks	MoF (2022). PMSBY Annual Summary
PMJJBY	Life insurance	₹330/year for ₹2 lakh cover	40.7% of enrollees are women	MoF (2023). PMJJBY Annual Report
MUDRA Yojana	Support micro-entrepreneurs	Loans: Shishu, Kishore, Tarun	68% of borrowers are women	MUDRA (2022). Annual Report

Source: Author Compilation

Gender-wise, women's engagement in significant financial inclusion projects shows a progressive but uneven financial ecosystem for women in India. Women are 68% and 82% of MUDRA Yojana and Stand-Up India participants, respectively. This shows that women dominate these programs. These organizations provide microcredit and entrepreneurship help to empower women. The most important proportion of women in these programs shows their growing role in small company and self-employment. Under the Pradhan Mantri Jan Dhan Yojana (PMJDY), 55% of account holders are women, representative successful cover and the importance direct benefit transfers play in women's financial inclusion. However, insurance and pension plans like the Atal Pension Yojana (APY), PMJJBY, and PMSBY have a higher participation percentage among men, with women comprising about 35–43% of beneficiaries. Long-term financial security awareness, access, and prioritization remain low among women, particularly in rural and informal sectors. Women's increased contribution in insurance programs, particularly through Self-Help Groups (SHGs), is worth considering. results show that insurance and pension awareness and inclusion are important. significant advances in encouraging women to take charge of their finances through financial programs.

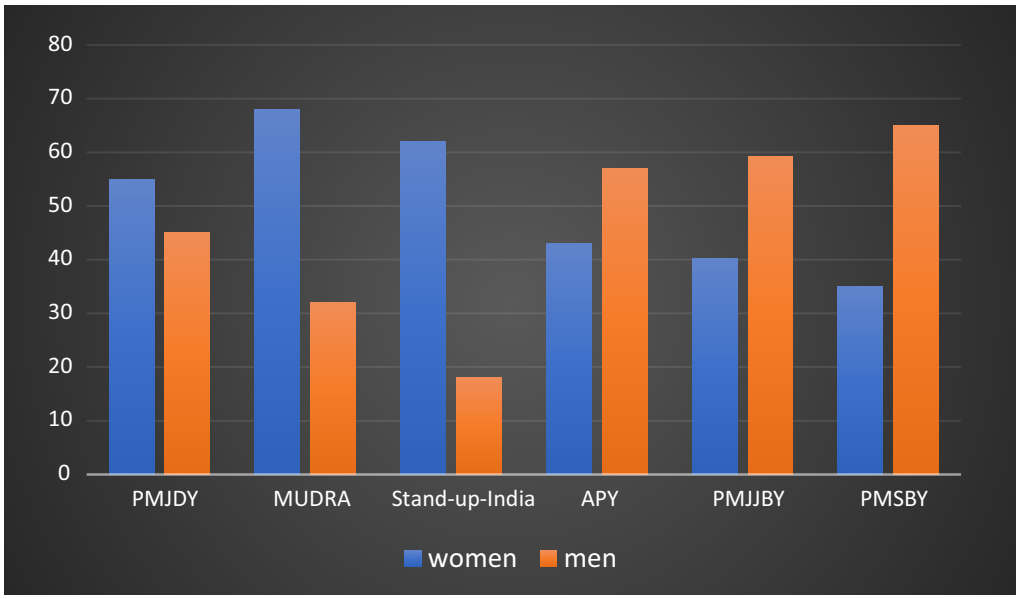

Fig 6 Gender wise participation in financial Inclusion schemes
Source: Author Compilation

Findings

- The study unequivocally demonstrates that one of the causes of women's involuntary financial exclusion is gender bias.
- The issue of women's financial exclusion is exacerbated by sociocultural obstacles and a lack of financial awareness.
- The procedures and regulations of FI schemes are time consuming and complex.
- There are numerous government programs to encourage women's financial inclusion (FI) in India.
- Women in India are still not aware of the importance of insurance coverage
- There is mounting evidence that FI has a multiplier effect on enhancing women's empowerment.
- FI schemes' procedures and regulations are laborious and intricate.

Suggestions

The following recommendations are suggested,

- Gender equality is crucial for the overall development of the family, society, and country.
- Women should participate in extensive financial literacy programs to raise their awareness of the various financial inclusion (FI) programs, particularly those related to work and insurance.
- It is necessary to simplify the laws pertaining to FI schemes. In nations like India, mobile banking and finance could be a promising strategy that lowers transaction costs and travel time.
- Knowledge of the recently developed 100% digital banking systems and BNPL (buy now pay later) services.
- Digital financial inclusion on household consumption can be more considerable for rural community than the urban community.

Conclusion

In conclusion, considering the various obstacles that Indian tribal women confront, research on their financial empowerment becomes crucial. The investigation of economic justice programs and inclusive development avenues validates the intricate interactions between cultural, economic, and societal elements that influence rural women's financial circumstances.

Using needy women from rural areas as respondents, the current study evaluated how social and economic empowerment factors affected women's total financial inclusion and empowerment. Women's total degree of financial inclusion and empowerment has been measured using the requirement that they have a bank account. Although according to Srinivasan (2007) have challenged the notion that financial inclusion requires a bank account, policymakers must start somewhere to boost women's participation in the formal financial system or social welfare schemes.

The current study has determined that factors pertaining to women's social and economic empowerment have a direct and significant impact on women's total financial inclusion and empowerment. For women in rural India, a bank account is more than just a financial account; it is a status symbol of self-assurance, independence, financial maturity, and responsibility that she may draw upon when needed. The Indian government is working to empower women socially and economically through financial inclusion through a number of social welfare programs, particularly the Pradhan Mantri Jan Dhan Yojana, Ayushman Bharat Yojana, and Pradhan Mantri Ujjwala Yojana.

The need for focused interventions is highlighted by the challenges that have been found, including cultural biases, low educational attainment, low wage income, male dominance, and poor financial literacy. Destroying patriarchal systems, improving educational chances, addressing income inequality, advancing financial literacy, and combating biased cultural viewpoints are all critical.

The suggested interventions, which include direct cash transfers, microfinance programs, community savings and lending strategies, and government initiatives designed especially for female entrepreneurs, present encouraging paths for promoting financial empowerment. These interventions acknowledge the importance of social and economic tactics in developing a holistic framework for the economic advancement of indigenous women.

The study emphasizes the value of coordinated efforts by governmental, non-governmental, and community partners as we look to these communities for a future characterized by resilience and economic equality. We can create a more equitable society that empowers indigenous women on all levels—economically, socially, mentally, and politically—by coordinating social interventions and economic policies.

Essentially, the path to indigenous women's financial empowerment necessitates a comprehensive strategy that recognizes the interdependence of numerous elements affecting their financial security. We can help ensure that tribal women are actively involved in determining their financial futures and, consequently, the success of their communities by putting forth consistent effort and resolutely tackling the obstacles that have been identified.

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Personalizing Digital Banking: A UX/UI and Customer Analytics Approach to SBI's YONO Platform

*Shareef AP
**MA Shakila Banu

Abstract

This study is regarding customer analytics of distinct factors pertaining to user experience and user interface design in the context of mobile banking. The attempt of the paper is to delve into the details of how various factors viz. how user-friendly is the app, how much Safety and Security the app offers to transactions, how diversifications are added to the app, how does time saving impacts users experience, how does economy of transactions and Updates of the app affect user gratification and further add to the strategic effectiveness that is offered by SBI's YONO application. As a research tool, the study makes use of a well - structured questionnaire with different dimensions in order to collect primary data. Secondary data which are relevant are collected from the various sources available. Kerala, the South Indian state was selected for the study because of its high rates of financial literacy, robust digital infrastructure, and diverse population that well engages with mobile banking platforms like State Bank of India's YONO platform. Kerala's blend of urban and rural users and its tech-savvy demographic features make it a very ideal context to investigate M-Banking user analytics and the impact of UX/UI design factors in enriching mobile banking experiences. 500 samples of the users is selected using Stratified Proportionate Random Sampling from the whole population. The test of internal consistency was done on structured questionnaire using Cronbach's Alpha. The results of the test revealed consistency on all factors. Additionally, after testing using Shapiro-Wilk test, the data were found following a non-normal pattern. Structural Equation Modelling was employed for testing the validity of the hypothetical model. Researcher has leveraged R, Python and relevant libraries and packages associated with them for these analyses. The findings of the study will be greatly useful for UX/UI design process so of financial apps to customize them according to user preferences.

Keywords: *Mobile Banking, UX/UI Design, SBI YONO*

Introduction

The landscape of digital banking has undergone a dramatic transformation in recent years, driven by the proliferation of mobile applications that provide fast, accessible, and multi-functional financial services. The YONO app (You Only Need One) by the State Bank of India exemplifies this shift by offering a hybrid platform that combines core banking services with lifestyle solutions. In this increasingly competitive environment, refining the User Experience (UX) and User Interface (UI) design becomes essential for maintaining user engagement and satisfaction.

This study explores how key dimensions of UX/UI—such as ease of use, transaction security, speed, functional diversity, cost-related factors, and update responsiveness—shape the user experience of SBI's YONO application. Additionally, it examines how this experience translates into strategic outcomes, such as continued use, user satisfaction, and app effectiveness. By focusing on a sample drawn from Kerala, a region characterized by high digital literacy and financial inclusivity, the research offers context-rich insights into the role of user analytics in improving digital banking platforms.

Methodology

This study employed a mixed-methods research design centered on primary data collection using a structured, multi-dimensional questionnaire. The instrument was carefully designed to evaluate users' perceptions across various facets of user experience (UX) and user interface (UI) design in SBI's YONO mobile application. To ensure robust coverage of the user

*Research scholar, PG & Research Dept. of Management Studies, Jamal Mohamed College (Affiliated to Bharathidasan University) - Tiruchirappalli, Tamil Nadu.
E-mail: drapshareef@gmail.com
**Research supervisor and Associate Professor, PG & Research Dept. of Management Studies, Jamal Mohamed College (Affiliated to Bharathidasan University) - Tiruchirappalli, Tamil Nadu.
E-mail: rspazila@gmail.com

base, a stratified proportionate random sampling method was utilized, targeting a diverse set of respondents from across Kerala—a state known for its high financial literacy, extensive smartphone penetration, and heterogeneous banking behaviors. A total of 500 valid responses were obtained and included in the final analysis.

To assess the internal consistency of the constructs, Cronbach's Alpha was applied. All constructs surpassed the acceptable threshold (>0.70), confirming the reliability of the measurement scale. Furthermore, Shapiro-Wilk tests were performed to evaluate data normality, and the results indicated significant deviations from a normal distribution ($p < .001$ across most variables). Due to this non-normal nature, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed as the primary analytical approach, which is more tolerant to non-normal data and suitable for complex, exploratory models.

PLS-SEM was implemented using the seminr package in R, where latent variables were modeled as composites based on observed indicators. The measurement model (outer model) was validated for construct reliability and convergent validity. The structural model (inner model) tested hypothesized paths among latent constructs such as User Friendliness, Security, Economy, and their influence on user experience and perceived app effectiveness. The analysis part of the research is supported extensively by R programming for PLS SEM, Python for Test of consistency and Test of Normality. Data cleaning and preparation was done with the help of Microsoft Excel.

Literature Review

User Friendliness

User interface intuitiveness and design clarity play a pivotal role in shaping digital banking experiences. Park and Kim (2021) argue that streamlined layouts minimize cognitive overload, boosting both satisfaction and retention. Similarly, Kang and Lee (2020) highlight the importance of inclusive design features for diverse Indian demographics. These studies reinforce that user-friendly designs are not just functional elements but also strategic tools for digital engagement.

Safety of Transactions

Security remains one of the most critical predictors of trust in digital financial services. Li et al. (2018) found that perceived security, encompassing features like encryption and biometric authentication, directly influences continued usage. Gai et al. (2021) corroborate this by demonstrating the centrality of secure environments in driving digital banking loyalty in Asia.

Time-Saving Capabilities

Efficiency is a strong motivator for mobile banking adoption. Research by Jung and Lee (2020) confirms that real-time feedback and optimized workflows improve satisfaction and app stickiness. Sharma and Das (2021) echo this, showing that fast, low-friction interfaces increase usage rates and user retention in Indian digital banking contexts.

Diversification of Services

The inclusion of non-traditional services (e.g., e-commerce, insurance, budgeting tools) enhances perceived value but may introduce complexity. Smith and Chen (2020) warn of feature fatigue, where excessive functionalities dilute user satisfaction. This paradox suggests the need for strategic curation rather than indiscriminate expansion.

Economic Considerations

Cost remains a concern for many users. Zhou et al. (2022) found that fee transparency significantly influences user trust. Gupta and Bansal (2021) note that even when users seek cost efficiency, they will not compromise on functionality or service reliability, emphasizing a balanced value proposition.

Updates and Enhancements

Frequent updates that align with user feedback are key to user retention. Smith and Brown (2019) show that iterative enhancements—especially those adding AI features or customization—improve app ratings. However, this must be aligned with usability rather than simply introducing novelty.

Results and Analysis

Table 1 Cronbach's Alpha values

Variables	Cronbach's Alpha
User_Friendliness	0.87
Safety_and_Security	0.82
Time_Saving	0.85
Diversifications	0.85
Economy	0.91
Updates	0.82
User_Gratification	0.88
Effectiveness	0.86

The values indicate a good consistency. Shapiro Wilk test was employed to check the normality of data. The values were obtained as follows.

Table 2. Shapiro Wilk Test of Normality

Variables		Shapiro Wilk Values (n=500)	
		W	P
User Friendliness	UEF_UF1	0.835	<.001
	UEF_UF2	0.747	<.001
	UEF_UF3	0.825	<.001
	UEF_UF4	0.802	<.001
	UEF_UF5	0.808	<.001
	UEF_UF6	0.844	<.001
	UEF_UF7	0.802	<.001
	UEF_UF8	0.835	<.001
Safety	UEF_ST1	0.819	<.001
	UEF_ST2	0.777	<.001
	UEF_ST3	0.859	<.001
	UEF_ST4	0.830	<.001
Time Saving	UEF_TS1	0.798	<.001
	UEF_TS2	0.817	<.001
	UEF_TS3	0.859	<.001
	UEF_TS4	0.831	<.001
	UEF_TS5	0.809	<.001
	UEF_TS6	0.801	<.001
Diversification	UEF_D1	0.857	<.001
	UEF_D2	0.840	<.001
	UEF_D3	0.847	<.001
Economy	UEF_E1	0.906	<.001
	UEF_E2	0.888	<.001
	UEF_E3	0.905	<.001
	UEF_E4	0.906	<.001
	UEF_E5	0.890	<.001
Updates	UEF_U1	0.857	<.001
	UEF_U2	0.859	<.001
User Satisfaction	US_1	0.810	<.001
	US_2	0.819	<.001
	US_3	0.779	<.001
	US_4	0.843	<.001
	US_5	0.821	<.001
	US_6	0.792	<.001
	US_7	0.805	<.001
	US_8	0.843	<.001
Customized Effectiveness	EU1	0.868	<.001
	EU2	0.863	<.001
	EU3	0.260	<.001
	EU4	0.844	<.001
	EU5	0.856	<.001

Shapiro Wilk Test of normality clearly exhibits that the variables don't follow normality. Since it shows a non-normal pattern, the methods of analysis shows an integrated approach by using advanced statistical methods, including **Partial Least Square Structural Equation Modeling (SEM)**. These statistical tools help to go with a robust framework for measuring the relationships between different key factors of user experience, user gratification, and strategic effectiveness subsequently achieved through the technology (SBI's YONO).

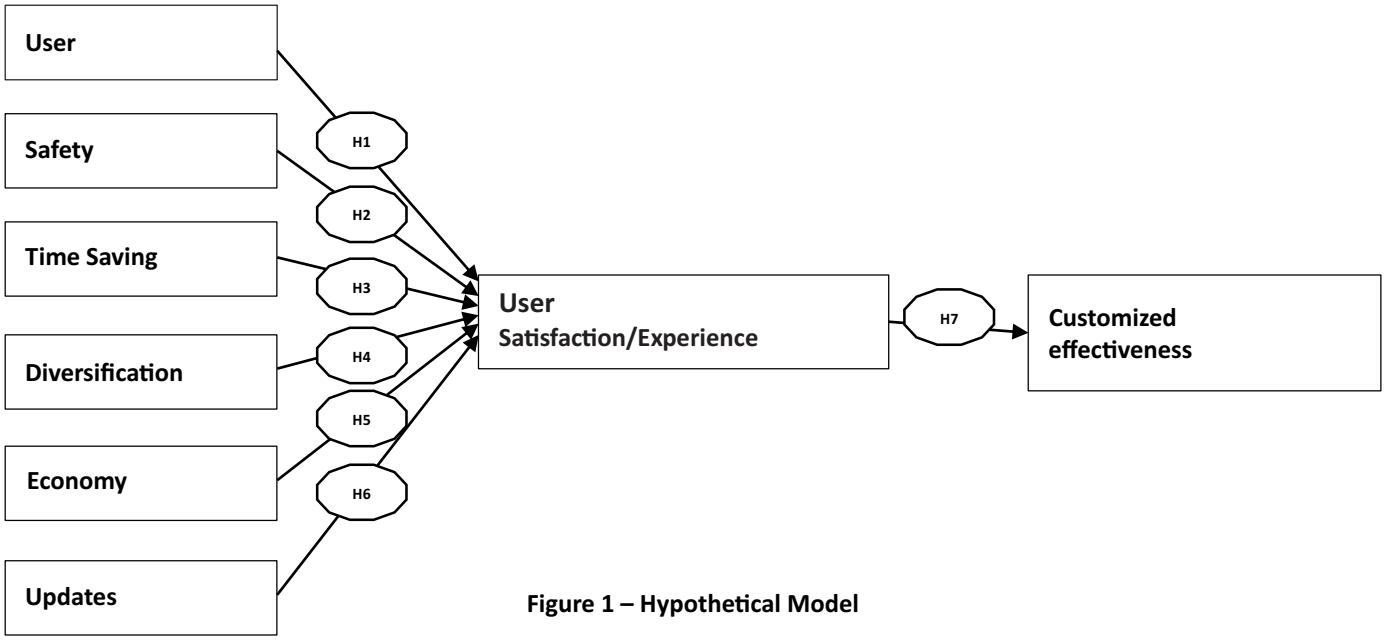

Figure 1 – Hypothetical Model

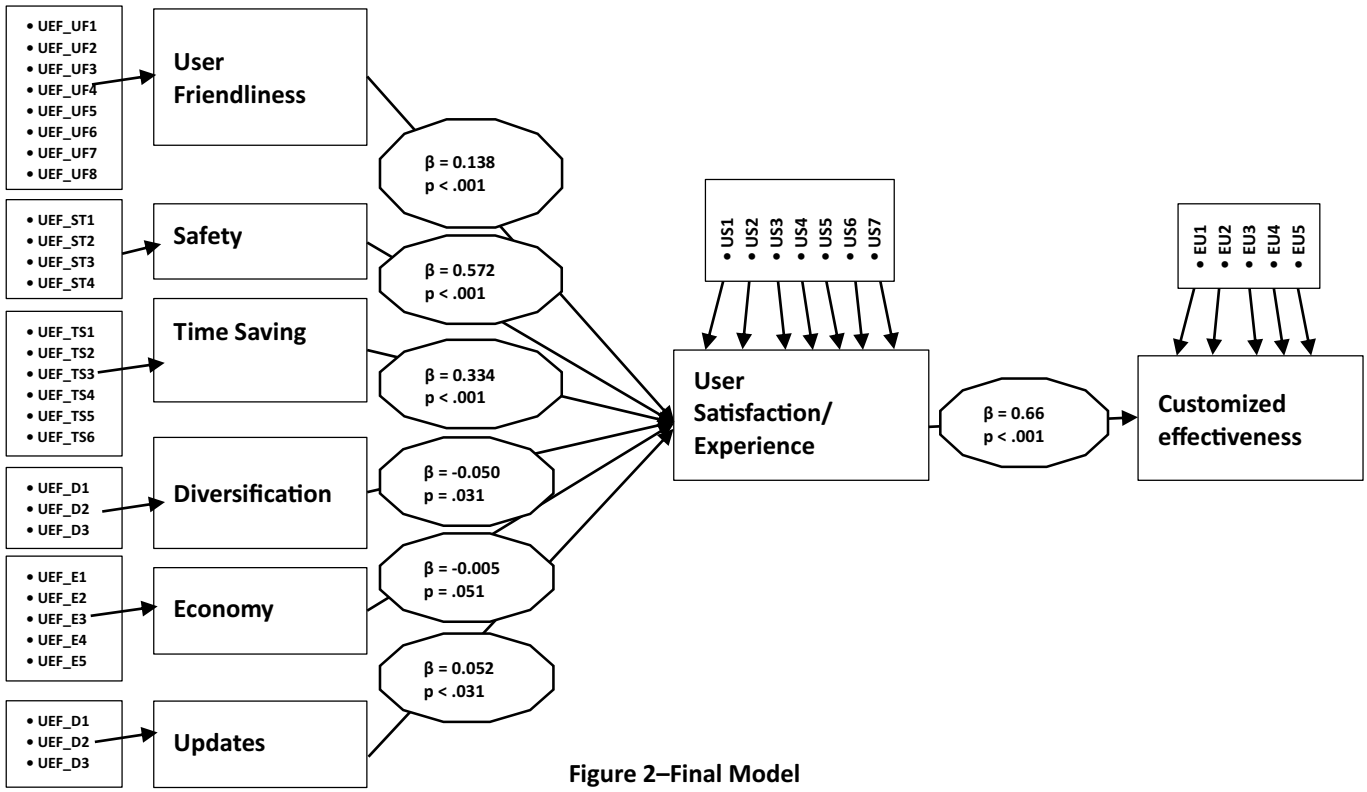

Figure 2–Final Model

The Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis reveals critical relationships between six UX/UI design constructs and their influence on user experience and overall strategic effectiveness within the SBI YONO mobile banking application.

Among the antecedents of **User Experience**, **Safety of Transactions** demonstrates the most substantial positive effect (**β** = 0.572, **p** < .001), highlighting the essential role of transaction security and user trust in the digital banking context. This is followed by **Time Saving** (**β** = 0.334, **p** < .001) and **User Friendliness** (**β** = 0.138, **p** < .001), both of which significantly enhance user experience. These findings suggest that intuitive navigation and efficient task execution are pivotal in shaping favorable app experiences.

Notably, **Diversification** presents a weak but statistically significant **negative** association with user experience (**β** = –0.050, **p** = .031), implying that an overabundance of features may dilute usability and potentially distract users from core functionalities. Meanwhile, **Economy** (**β** = –0.005, **n.s.**) and **Updates** (**β** = 0.052, **n.s.**) do not exhibit statistically significant impacts, indicating that perceived cost and update frequency may not substantially influence users' immediate app satisfaction.

The model explains a substantial **84.1%** of the variance in **User Experience** (R^2 = 0.841), showcasing strong predictive accuracy. In turn, **User Experience** has a **highly significant and strong effect** on **Effectiveness** (**β** = 0.660, **p**< .001), explaining **43.6%** of its variance (R^2 = 0.436). This finding confirms that a positive, seamless user experience directly contributes to the perceived strategic effectiveness of the mobile application.

From a practical standpoint, these results emphasize the importance of prioritizing secure transactions, user-centric design, and performance efficiency in mobile banking applications. Developers and UX designers are advised to streamline features rather than over-diversify them, ensuring clarity and accessibility. Strategic refinement of these aspects can significantly enhance user engagement, satisfaction, and ultimately, the functional success of digital banking platforms such as SBI's YONO.

Findings of the study intend to contribute to the ongoing renovation of User eXperince /User Interface design processes, helping State Bank of India to customize the application to user preferences and advance its functionality and usability. The results of the study are expected to offer real and action oriented insights for financial institutions as a whole and banks in particular who are seeking to customize or optimize their mobile application platforms for improved customer experience, better retention and competitiveness in the industry.

Practical Implications

1. Prioritize Security in Design Strategy

The findings underscore the dominant role of transaction safety in driving user experience. Banks must continuously invest in advanced security protocols such as two-factor authentication, biometric login, and proactive fraud detection systems to bolster trust and digital confidence among users.

2. Focus on UI Efficiency

UX designers should minimize workflow steps, simplify screens, and incorporate intuitive navigation paths. The strong impact of time-saving features implies that digital banking apps should allow users to perform essential actions—like fund transfers or bill payments—within minimal taps or clicks.

3. Streamline Offerings Thoughtfully

Although diversification was included as a UX factor, its slightly negative influence suggests that users may prefer focused rather than cluttered digital environments. Overloaded interfaces with too many services may lead to decision fatigue. Strategic segmentation and customizable dashboards could provide an optimal middle ground.

4. Reconsider the Role of Cost and Updates

The low significance of economy and updates suggests users are more concerned with value and consistency than low cost or frequent technical revisions. Enhancements should be guided by usability testing and user-centered design principles, rather than frequency alone.

5. Use UX as a Strategic Lever

The strong predictive link between user experience and customized effectiveness signals that UX is not merely a usability component—it's a strategic business differentiator. Financial institutions must embed UX research into product planning, digital transformation, and customer relationship strategies.

6. Design for Diversity

Given the study's focus on Kerala, with its mix of rural and urban, young and elderly, and tech-savvy and novice users, inclusive design is non-negotiable. Features such as language options, accessibility tools, and personalized content delivery are key to reaching underserved populations.

Conclusion

The analysis underscores the pivotal role of UX/UI factors in shaping users' perceptions and continued use of mobile banking applications like SBI's YONO. Features related to transaction safety, time-saving functionalities, and user-friendliness emerged as the most influential in enhancing user experience. Conversely, factors such as service diversification and update frequency showed either weak or statistically insignificant effects.

Most notably, the user experience itself had a significant and positive effect on the strategic perception of the app's effectiveness—demonstrating that usability is not just an operational concern but a strategic asset. These insights validate the inclusion of UX/UI research in digital banking innovation strategies, particularly for institutions aiming to expand user retention and satisfaction.

By aligning UX/UI design with actual user preferences and behavior patterns, financial institutions can build not only functional but also emotionally resonant digital platforms. This study thus offers a blueprint for data-driven customization of mobile banking services, emphasizing user trust, intuitive navigation, and streamlined digital interaction.

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- The authors should provide a declaration along with the manuscripts, stating that the article is an original work of author(s) and the same has not been published earlier in any other publication.

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To become a Fully Integrated, Socially Responsible, Contextually relevant, and Value-Based Management Institute of National Reckoning by meeting the growing and emerging needs of industry and business through contemporary innovative management Teaching, Training, Research and Consulting.

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We intend to provide and develop the capabilities of the young managers by raising their level of competence and intellect to face various challenges in the global environment. In pursuit of excellence, we provide training and development services, foster research and disseminate knowledge through publication of books, journals and magazines for the development of society at large.

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Block A, Gate No 2, Shakti Khand IV, Indirapuram,
Ghaziabad - 201014
Ph: 0120-4550100
www.jaipuriamba.edu.in

About Jaipuria Institute of Management, Ghaziabad

Jaipuria Institute of Management is a premier management institute in Ghaziabad set up by Seth Anandram Jaipuria Education Society under the able guidance of the chairman Shri Shishir Jaipuria. JIM offers 2 years state government university master degree courses in business Administration (MBA), MBA Business Analytics and MBA (Banking and Financial Services). All these programs are affiliated with Dr. APJ Abdul Kalam Technical University, Lucknow, UP and approved from AICTE. The institution provides quality management education to transform individuals into Business Leaders, skilled managers and entrepreneurs.

Jaipuria Institute of Management intends to provide and develop the capabilities of the young managers by raising their level of competence and intellect to face various challenges in the global environment. In pursuit of excellence, the institute provides training and development services, fosters research and disseminates knowledge through publication of books, journals and magazines for the development of society at large. Jaipuria Institute of Management has established itself as a leading management institute in northern India.