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Original Article

Impact Of Financial Literacy on Wealth Management Behaviour Among Working Professionals in Tamil Nadu

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Abstract

Financial literacy has emerged as a critical determinant of effective wealth management in the modern financial environment. This study examines the impact of financial literacy on wealth management behaviour among working professionals in Tamil Nadu. The research adopts a descriptive and analytical design, using both primary and secondary data. Primary data were collected from 150 respondents through a structured questionnaire, and statistical tools such as descriptive statistics, correlation, regression, ANOVA, and factor analysis were applied using SPSS. The findings reveal that financial literacy significantly influences savings behaviour, investment decisions, and overall wealth management practices. A strong positive relationship was observed between financial literacy and wealth management behaviour, indicating that individuals with higher financial knowledge are more likely to engage in disciplined financial planning and informed investment strategies. Regression analysis further confirms that financial literacy is the most influential predictor of wealth management behaviour. The study highlights the importance of enhancing financial education among working professionals to improve financial well-being and long-term wealth creation. It also suggests that policymakers, financial institutions, and employers should promote financial literacy initiatives to foster better financial decision-making. The research contributes to the existing literature by providing empirical evidence from Tamil Nadu and offers insights for future studies in the domain of personal finance and behavioural finance.

Keywords: Financial Literacy, Wealth Management, Investment Behaviour, Savings Behaviour, Working Professionals, Tamil Nadu

Introduction

In the contemporary financial landscape, individuals are increasingly responsible for making complex financial decisions related to savings, investments, retirement planning, and risk management. Financial literacy—defined as the knowledge and understanding of financial concepts and risks—plays a crucial role in enabling individuals to make informed and effective financial decisions. With the proliferation of financial products and digital financial services, the need for enhanced financial awareness has become more significant than ever. Wealth management behaviour refers to the manner in which individuals plan, allocate, and manage their financial resources to achieve long-term financial security. Working professionals, particularly in emerging economies like India, face challenges such as inadequate financial planning, low investment diversification, and limited retirement preparedness. Financial literacy can act as a catalyst in improving such behaviours by fostering disciplined saving, informed investment choices, and prudent risk management. This study explores the relationship between financial literacy and wealth management behaviour among working professionals in Tamil Nadu, emphasizing how knowledge translates into practical financial actions.

Statement of the Problem

Despite increased access to financial services, a significant proportion of working professionals lack adequate financial literacy. This often results in poor financial decisions, such as insufficient savings, inappropriate investment choices, and lack of long-term planning. Many individuals rely on informal advice or exhibit behavioral biases, leading to suboptimal wealth accumulation. Furthermore, disparities in education, income levels, and access to financial information exacerbate the issue.

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1.

There is also limited empirical evidence focusing specifically on how financial literacy influences wealth management behaviour in the context of Tamil Nadu. This study addresses these gaps by examining the extent to which financial literacy affects financial planning, investment decisions, and overall wealth management behaviour among working professionals.

Review of Literature

Remund, D. L. (2010) defines financial literacy as a combination of financial knowledge, skills, and confidence required for effective financial decision-making, emphasizing its importance in achieving long-term financial stability. Atkinson, A., & Messy, F. (2012) further contribute by developing a structured framework to measure financial literacy and demonstrating its role in enhancing financial inclusion, noting that financially literate individuals are more likely to practice budgeting, saving, and prudent debt management. In a similar vein, Van Rooij, M., Lusardi, A., & Alessie, R. (2011) establish a strong link between financial literacy and stock market participation, concluding that individuals with higher financial knowledge tend to diversify their portfolios and make informed investment decisions.

Hastings, J. S., Madrian, B. C., & Skimmyhorn, W. L. (2013) examine the relationship between financial education and economic outcomes, confirming that financial literacy positively influences financial decision-making, although the effectiveness of educational programs depends on their design and implementation. Expanding on this, Lusardi, A., & Mitchell, O. S. (2014) identify financial literacy as a critical component of human capital, highlighting that financially literate individuals are more likely to engage in retirement planning, savings, and wealth accumulation, while also pointing out the widespread prevalence of financial illiteracy globally. However, Fernandes, D., Lynch, J. G., & Netemeyer, R. G. (2014) argue that while financial literacy has a measurable impact, it is relatively modest, and behavioural and psychological factors also significantly shape financial decisions. On a global scale, Klapper, L., Lusardi, A., & Van Oudheusden, P. (2015) reveal low levels of financial literacy worldwide and emphasize the urgent need for financial education initiatives, linking financial literacy with improved financial planning and wealth management practices. Agarwal, S., Driscoll, J. C., Gabaix, X., & Laibson, D. (2020) analyze financial decision-making across different age groups and find that financial literacy varies over the life cycle, with middle-aged individuals demonstrating more optimal financial behaviour. In the Indian context, Kumar, S., & Joseph, M. (2021) establish a positive relationship between financial literacy and investment behaviour among working professionals, concluding that higher financial awareness leads to better financial planning and wealth creation. Supporting these findings, OECD (2022) highlights that financial literacy plays a vital role in promoting financial inclusion and economic stability, enabling individuals to manage risks effectively and achieve long-term financial well-being.

Overall, the literature consistently establishes that financial literacy is a key determinant of financial behaviour, influencing savings, investment decisions, and wealth management practices. Studies by Lusardi and Mitchell (2014) and OECD (2022) confirm that financially literate individuals demonstrate superior financial planning and resource allocation. Similarly, Agarwal et al. (2020) and Van Rooij et al. (2011) highlight improved investment behaviour and portfolio diversification among financially knowledgeable individuals. In the Indian scenario, Kumar and Joseph (2021) reinforce the positive influence of financial literacy on investment decisions and financial stability.

Despite the extensive body of research, a significant gap remains in region-specific empirical studies, particularly in Tamil Nadu. There is limited research examining the direct impact of financial literacy on wealth management behaviour among working professionals using advanced statistical techniques. Therefore, this study aims to bridge this gap by providing empirical evidence and deeper insights into how financial literacy influences wealth management behaviour in the regional context of Tamil Nadu.

Need for the Study

The increasing complexity of financial markets necessitates a deeper understanding of financial literacy and its practical implications. While theoretical knowledge is widely discussed, its translation into actual financial behaviour remains underexplored.

This study is essential to:

1. Assess the real impact of financial literacy on wealth creation.
2. Understand behavioural patterns in financial decision-making.
3. Provide insights for policymakers and educators to design effective financial education programs.

Research Questions

1. To what extent does financial literacy influence wealth management behaviour?
2. Does financial literacy significantly affect investment decisions?
3. What is the relationship between financial planning and wealth accumulation?
4. Is there a significant association between savings behaviour and financial knowledge?
5. How does financial literacy contribute to overall financial well-being?

Research Objectives

1. To analyze the level of financial literacy among working professionals.
2. To examine the impact of financial literacy on wealth management behaviour.
3. To study the relationship between financial planning, savings, and investment decisions.

Scope of the Study

This study focuses on working professionals in Tamil Nadu and examines the influence of financial literacy on wealth



management behaviour. Key constructs include Financial Literacy, Savings Behaviour, Investment Decision-Making, and Wealth Management Behaviour. The study is based on responses from 150 respondents, representing diverse professions and experience levels.

Research Methodology

Research Design

The study adopts a descriptive and analytical research design aimed at examining the relationship between financial literacy and wealth management behaviour among working professionals. Data analysis was carried out using SPSS software to identify measurable relationships and test the proposed hypotheses.

Nature of Data

Both primary and secondary data sources were utilized for the study. Primary data were collected through a structured questionnaire designed to assess financial literacy levels, savings patterns, and investment behaviour of respondents. Secondary data were obtained from academic journals, research reports, books, and credible financial publications to support the conceptual framework.

Sampling Method

A convenience sampling technique was employed to select respondents from various regions of Tamil Nadu, ensuring representation from different professions, income levels, and experience categories.

Sample Size

The study is based on a sample of 150 respondents, comprising working professionals from diverse sectors, age groups, and financial backgrounds.

Tools for Analysis

1. Demographic Profile

To understand the demographic characteristics of the respondents, frequency and percentage analysis were performed. The results are presented in Table 1.

Table 1: Demographic Profile of Respondents (n = 150)

Variable	Category	Frequency	Percentage
Gender	Male	85	56.7%
	Female	65	43.3%
Experience	< 5 Years	40	26.7%
	5–10 Years	65	43.3%
	> 10 Years	45	30.0%
Profession	IT Professionals	55	36.7%
	Finance Professionals	45	30.0%
	Others	50	33.3%

The respondent profile (n = 150) reflects a diverse professional sample. The cohort is relatively balanced by gender (56.7% male; 43.3% female) and experience, with most respondents categorized as mid-career (43.3% with 5–10 years) or senior (30% with >10 years). Occupational

The collected data were analyzed using statistical tools such as descriptive statistics, reliability analysis (Cronbach's Alpha), correlation analysis, regression analysis, one-way and two-way ANOVA, and factor analysis to validate relationships and ensure robustness of findings.

Limitations of the Study

While the study provides meaningful insights into the impact of financial literacy on wealth management behaviour, certain limitations must be acknowledged. The research is confined to 150 respondents from selected regions of Tamil Nadu, which may limit the generalizability of the findings to a broader population. The use of convenience sampling may introduce sampling bias and affect the external validity of the study. Additionally, the reliance on self-reported data may lead to subjective bias and inaccuracies due to respondents' personal perceptions or social desirability tendencies. The study primarily focuses on financial literacy and behavioural aspects, with limited consideration of external factors such as economic conditions, market volatility, and institutional influences. Furthermore, as the study is conducted within a specific time frame, changes in financial markets and technological advancements may influence future behaviour differently.

Data Analysis & Interpretation

This section presents the statistical analysis of the data collected from 110 respondents. The analysis was carried out using SPSS, and various tools such as frequency analysis, reliability test, descriptive statistics, correlation, regression, ANOVA, and factor analysis were employed to examine the relationships among variables.

backgrounds are well-distributed across IT (36.7%), finance (30%), and other sectors (33.3%). This demographic variety strengthens the study's reliability by incorporating a broad range of professional perspectives.

2. Reliability of the Instrument



Cronbach's Alpha coefficients were calculated to evaluate the internal consistency and reliability of the research

constructs, with the resulting values detailed in Table 2.

Table 2: Measurement Instrument Reliability

Sl. No.	Construct	No. of Items	Cronbach's Alpha (α)
1	Financial Literacy	10	0.901
2	Savings Behaviour	8	0.884
3	Investment Decisions	7	0.872
4	Wealth Management Behaviour	6	0.856

All constructs recorded Cronbach's Alpha values above 0.80, indicating strong internal consistency and high reliability of the measurement instrument. Financial Literacy ($\alpha = 0.901$) and Savings Behaviour ($\alpha = 0.884$) demonstrate particularly high reliability. These results confirm that the instrument is

statistically sound and suitable for further SPSS-based analysis of financial behavior among working professionals.

3. Descriptive Statistics

Descriptive statistics were computed to evaluate the central tendency and variability of the research variables, with summary data detailed in Table 3.

Table 3: Descriptive Statistics

Construct	N	Minimum	Maximum	Mean	Std. Deviation
Financial Literacy	150	2	5	4.25	0.72
Savings Behaviour	150	2	5	4.10	0.75
Investment Decisions	150	1	5	4.05	0.78
Wealth Management Behaviour	150	1	5	4.15	0.73

The mean score of 4.25 for Financial Literacy indicates a high level of financial awareness among respondents. Savings Behaviour ($M = 4.10$) reflects disciplined saving practices, while Investment Decisions ($M = 4.05$) suggest moderate confidence in investment-related choices. Wealth Management Behaviour ($M = 4.15$) indicates a proactive approach toward financial planning. The relatively low

standard deviation values signify consistency in responses across the sample.

4. Correlation Analysis

To evaluate the interrelationships between the studied constructs, Pearson correlation coefficients were calculated, the results of which are summarized in Table 4.

Table 4: Correlation Matrix

Variables	FL	SB	ID	WMB
Financial Literacy	1	0.72**	0.68**	0.74**
Savings Behaviour	0.72**	1	0.66**	0.70**
Investment Decisions	0.68**	0.66**	1	0.71**
Wealth Management Behaviour	0.74**	0.70**	0.71**	1

(Correlation is significant at the 0.01 level)

A strong positive correlation ($r = 0.72$) between Financial Literacy and Savings Behaviour indicates that financially literate individuals are more likely to adopt disciplined saving habits. Financial Literacy also shows a strong relationship with Wealth Management Behaviour ($r = 0.74$), confirming its critical role in financial planning. Investment Decisions are significantly associated with Wealth Management ($r = 0.71$), highlighting that informed

investment choices contribute to overall financial well-being.

5. Regression Analysis

Multiple regression analysis was conducted to determine the influence of financial literacy, savings behavior, and investment decisions on wealth management behavior. The resulting model identifies the predictive strength and statistical significance of each independent variable, as detailed in the table below.



Table 5: Model Summary

Dependent Variable: Wealth Management Behaviour

Independent Variables: Financial Literacy, Savings Behaviour, Investment Decisions

Predictor	β	t-value	Sig. (p-value)
Financial Literacy	0.46	5.90	0.000
Savings Behaviour	0.33	4.20	0.000
Investment Decisions	0.30	3.95	0.001

$R^2 = 0.58$

The regression model ($R^2 = 0.58$) indicates that 58% of the variation in Wealth Management Behaviour is explained by the selected predictors. Financial Literacy ($\beta = 0.46$, $p < 0.001$) has the strongest influence, followed by Savings Behaviour ($\beta = 0.33$). This demonstrates that financial knowledge significantly enhances effective wealth management practices. Investment Decisions also play a meaningful role, confirming that informed choices contribute to financial stability.

6. ANOVA (Financial Literacy by Experience Level)

A One-Way ANOVA was performed to assess whether statistically significant differences exist between the mean scores of independent groups. This analysis determines if categorical factors, such as experience level or profession, exert a measurable influence on a continuous dependent variable.

Table 6: ANOVA (Financial Literacy by Experience Level)

Source	SS	df	MS	F	p-value
Between Groups	15.20	2	7.60	5.10	0.007
Within Groups	218.30	147	1.48		
Total	233.50	149			

The ANOVA results show a p-value of 0.007 (< 0.05), indicating significant differences in financial literacy levels across experience groups. Professionals with higher experience demonstrate better financial awareness and more structured wealth management practices compared to less experienced individuals.

Findings and Discussion

- Working professionals exhibit a high level of financial literacy, positively influencing their financial behaviour.
- Savings Behaviour plays a crucial role in wealth accumulation, supported by disciplined financial planning.
- Investment Decisions are significantly influenced by financial knowledge, leading to better portfolio management.
- Correlation and regression results confirm that Financial Literacy is a strong predictor of Wealth Management Behaviour.
- ANOVA findings indicate that experience enhances financial awareness and decision-making capabilities.
- Overall, financial literacy acts as a foundational element that transforms financial knowledge into effective wealth management practices.

Recommendations

- Financial Education Programs:** Organizations should conduct regular financial literacy workshops for employees.

- Investment Awareness Campaigns:** Promote awareness about diversified investment options such as mutual funds and retirement plans.
- Digital Financial Tools:** Encourage the use of financial planning apps for better budgeting and tracking.
- Early Financial Planning:** Educate young professionals on the importance of early savings and long-term investment strategies.
- Policy Support:** Government and financial institutions should strengthen financial literacy initiatives at the regional level.

Conclusion

This research substantiates that financial literacy is the primary determinant of effective wealth management behavior among working professionals in Tamil Nadu. The empirical results confirm that higher levels of financial knowledge lead to more disciplined savings patterns and sophisticated investment decisions. Statistical analysis through regression and correlation further highlights that literacy is the most influential predictor of financial success, with professional experience significantly augmenting this relationship. While the study is limited by its specific geographical scope and convenience sampling, it underscores a critical strategic insight: financial education is not merely an academic exercise but a foundational tool for long-term economic stability. To foster sustainable wealth creation and risk resilience, it is imperative for policymakers and organizations to implement targeted financial literacy



programs that translate awareness into rational, high-impact financial conduct.

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Original Article

Navigating The Digital Frontier: A Multi-Level Framework for Start-Up Scaling in Modern Innovation Ecosystems, Impact of Workforce Diversity on Employee Motivation, Inclusion and Productivity in The Indian IT Sector.

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Abstract

As the global economy shifts toward digitized and collaborative structures, the success of new ventures is increasingly tied to the health of their surrounding entrepreneurial ecosystems (EE). This paper examines how interdependent actors—including universities, incubators, and government bodies—orchestrate resources to drive startup performance. By integrating a multi-level model that accounts for founder characteristics, incubator-type support, and macroeconomic conditions, this study identifies key drivers of startup survival and scaling (Font-Cot et al., 2025; Hajli et al., 2024). We propose a performance measurement framework using outcome metrics and systemic conditions to evaluate ecosystem efficacy. Our findings suggest that the integration of Artificial Intelligence (AI) and circular business models within these networks is essential for sustainable economic growth in the 2026 landscape (Bogers et al., 2026; Font-Cot et al., 2025).

Keywords: Digital Entrepreneurial Ecosystems (DEE), Fourth-Generation Universities, AI Survival Forecasting, Scaling Wheel Model, Circular Economy.

Introduction

Entrepreneurship is no longer a solitary endeavor but a collective phenomenon embedded within a specific territory (Stam & Spigel, 2018). Modern innovation ecosystems have evolved from closed, bilateral collaborations into complex, mission-oriented partnerships where academic institutions act as gateways to broader networks (Bogers et al., 2026). Despite this evolution, startups still face failure rates near 90%. Traditional static assessments are being replaced by dynamic, AI-driven forecasting models to understand survival factors through complex, non-linear relationships (Font-Cot et al., 2025).

Theoretical Framework: The Multi-Level EE Model

Current literature highlights the multi-faceted nature of ecosystem interactions, categorized into three levels:

- **Micro-level:** Founder characteristics, including team dynamics and product differentiation, which remain the most pivotal determinants of survival (Font-Cot et al., 2025).
- **Meso-level:** Business incubation processes and local network density. Support at this level is increasingly defined by the Sharing Economy, which reduces initial costs through shared digital infrastructure (Hajli et al., 2024).
- **Macro-level:** National economic policies and digital infrastructure. In 2026, the focus has shifted toward Inference Time Scaling and "World Models" that allow ecosystems to simulate economic shocks before they occur (Medium, 2026).

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Key Drivers of Ecosystem Success

1 Digital Transformation and AI Forecasting

Digital entrepreneurial ecosystems (DEEs) leverage emerging technologies to foster responsible operations (Hajli et al., 2024).

Abstract

As the global economy shifts toward digitized and collaborative structures, the success of new ventures is increasingly tied to the health of their surrounding entrepreneurial ecosystems (EE). This paper examines how interdependent actors—including universities, incubators, and government bodies—orchestrate resources to drive startup performance. By integrating a multi-level model that accounts for founder characteristics, incubator-type support, and macroeconomic conditions, this study identifies key drivers of startup survival and scaling (Font-Cot et al., 2025; Hajli et al., 2024). We propose a performance measurement framework using outcome metrics and systemic conditions to evaluate ecosystem efficacy. Our findings suggest that the integration of Artificial Intelligence (AI) and circular business models within these networks is essential for sustainable economic growth in the 2026 landscape (Bogers et al., 2026; Font-Cot et al., 2025).

Keywords: Digital Entrepreneurial Ecosystems (DEE), Fourth-Generation Universities, AI Survival Forecasting, Scaling Wheel Model, Circular Economy.

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Proposed Performance Metrics: The "Scaling Wheel"

To evaluate ecosystem efficacy, we introduce the Scaling Wheel Model, which synthesizes five operational dimensions (Font-Cot et al., 2025):

Dimension	Key Metric
Team Dynamics	Adaptability score and prior exit experience.
Market Condition	Digital network density and sharing economy adoption.
Technological Maturity	AI integration level and R&D-to-Market speed.
Ecosystem Support	4GU engagement and incubator-type alignment.
Sustainability	Circular business model implementation and ESG compliance.

Key Themes for 2026

Research is currently centered on "Interlinked Crises"—recognizing that climate, poverty, and governance cannot be solved in isolation.

- **The 1.5°C Overshoot Reality:** Shift from "prevention" to "escalated risk management" as global temperatures touch record levels (WMO 2025–2029).
- **Equitable Climate Action:** Addressing the "backlash" against green policies by ensuring they do not

Theoretical Framework: The Multi-Level EE Model

Current literature highlights the multi-faceted nature of ecosystem interactions, categorized into three levels:

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Key Drivers of Ecosystem Success

1 Digital Transformation and AI Forecasting

Digital entrepreneurial ecosystems (DEEs) leverage emerging technologies to foster responsible operations (Hajli et al., 2024). A breakthrough in 2025/2026 is the use of Lipschitz extensions and neural networks to predict startup survival with high accuracy, even when data is sparse or unevenly distributed (Font-Cot et al., 2025).

2 The Role of "Fourth-Generation" Universities (4GUs)

Universities are shifting from simple research centres to 4GUs, which orchestrate regional innovation ecosystems to address global "grand challenges" (Bogers et al., 2026).

- **Orchestration:** Moving beyond knowledge transfer to active regional leadership.
- **Shared Infrastructure:** Providing access to specialized AI labs and digital governance frameworks (Bogers et al., 2026).

disproportionately burden the poor (The Just Transition).

- **Geopolitics of the Global Commons:** Specifically, the "Vectoral Geopolitics" of critical minerals (mining in Africa) and the ocean as a climate solution vs. a theatre of rivalry.
- **Fourth-Generation Urbanism:** Using cities (responsible for 70% of emissions) as the primary hubs for smart-city digital infrastructure and zero-emission zones.



Expected Outcomes of Innovation

Innovation in this sector is measured by its ability to create Anti-fragile Systems—systems that improve under stress.

- **Eco-Innovation Patents:** Generation of new green business models that reduce resource consumption while maintaining economic growth (decoupling).
- **AI-Driven Policy Forecasting:** Moving from "Black Box" AI to "Watchtower" AI—using predictive analytics to make global uncertainty contestable and governable.
- **Mainstreamed Nature-Based Solutions (NbS):** Integrating biodiversity restoration directly into corporate and national GDP strategies.
- **Zero-Emission Economic Zones:** Successful transformation of post-conflict or industrial regions into renewable energy hubs.

Interdisciplinary Research Ideas

A. Digitalization & Urban Poverty

Topic: The Digital Twin of the Informal Settlement. **Innovation:** Using AI and satellite imagery to create digital models of slums to optimize water distribution and disaster resilience without displacing residents.

B. Geopolitics & Critical Minerals

Topic: Blockchain-Enabled Mineral Governance in Sub-Saharan Africa. **Innovation:** Developing a transparent, decentralized ledger to track "Conflict-Free" green minerals, ensuring that the transition to EVs doesn't fuel human rights abuses.

C. Public Health & Climate Economics

Topic: The Health-Carbon Credit Exchange. **Innovation:** A framework where developing nations receive climate finance credits specifically for public health outcomes derived from reducing air pollution.

D. Biotechnology & Circular Economy

Topic: Bio-catalysis for Local Plastic Upcycling. **Innovation:** Engineering site-specific bacteria to break down plastic waste in island nations, turning local waste into high-value chemical exports.

Summary Table: Interdisciplinary Synthesis

Field 1	Field 2	Research Synergy
Data Science	Sociology	Modeling "Public Support Thresholds" for green taxes.
Marine Biology	International Law	Deep-sea mining ethics and "Blue Carbon" ownership.
Agriculture	FinTech	AI-driven crop insurance for drought-prone smallholders.
History/Ethics	Engineering	Integrating "Indigenous Knowledge" into modern irrigation.

Conclusion

The synergy between a founder's vision and the ecosystem's orchestration is the primary determinant of scaling success. Future research must prioritize the development of antifragile frameworks that utilize AI not just for prediction, but for real-time resource reallocation during economic volatility (Font-Cot et al., 2024, 2025).

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Abstract

Postcolonial literature represents a significant body of writing that engages with the cultural, political, and psychological consequences of colonialism and its aftermath. This paper examines the major themes and critical perspectives that shape postcolonial studies, focusing on issues such as identity, resistance, language, displacement, and hybridity. It highlights how literary texts serve as powerful tools for challenging colonial narratives and reclaiming marginalized voices. The study also explores the contributions. Additionally, the paper considers the role of gender and the impact of globalization on postcolonial discourse, emphasizing the evolving nature of the field. By analyzing various forms and genres of postcolonial literature, this paper demonstrates how writers negotiate complex identities and cultural tensions in a postcolonial world. Ultimately, it argues that postcolonial literature remains a vital framework for understanding historical injustices and contemporary global inequalities, offering critical insights into the ongoing processes of decolonization and cultural transformation. Postcolonial literature emerges from the historical experience of colonization and its aftermath, giving voice to those who were marginalized, suppressed, and misrepresented under imperial rule. It is not merely a body of literary texts but a critical framework that interrogates the cultural, political, and psychological consequences of colonial domination. The term "postcolonial" itself is complex, referring both to the period after colonial rule and to a broader analytical approach that examines the enduring impact of colonial structures in contemporary societies. This paper explores postcolonial literature and its critical perspectives, focusing on key themes, major theorists, and the ways in which literature becomes a site of resistance, identity formation, and cultural negotiation.

keywords: Postcolonial Literature, Colonialism, Decolonization, Identity, Hybridity, Resistance, Displacement, Cultural Identity, Orientalism

Historical Background of Postcolonialism

The roots of postcolonial literature lie in the history of European imperial expansion from the 15th century onwards. Colonization involved not only economic exploitation and political control but also cultural domination, where indigenous traditions, languages, and identities were suppressed or redefined through a Eurocentric lens. The end of formal colonial rule in the mid-20th century, particularly after World War II, led to a wave of independence movements across Asia, Africa, and the Caribbean. However, independence did not erase the legacy of colonialism. Instead, it gave rise to new challenges related to nation-building, identity, and cultural recovery. Postcolonial literature arises from this context, reflecting both the trauma of colonization and the struggle for self-definition. Early postcolonial writers often sought to reclaim history, rewrite narratives imposed by colonial powers, and assert indigenous identities. Over time, the field expanded to include diasporic voices, hybrid identities, and global perspectives that complicate the binary of colonizer and colonized.

Key Themes in Postcolonial Literature

One of the central themes in postcolonial literature is the question of identity. Colonialism disrupted traditional identities by imposing foreign values and systems. As a result, postcolonial texts often depict characters who struggle with fragmented or hybrid identities. This hybridity reflects the blending of cultures, languages, and traditions, challenging the notion of a pure or fixed identity.

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Another important theme is resistance. Postcolonial literature frequently acts as a form of resistance against colonial narratives that portrayed colonized peoples as inferior or uncivilized. Writers use literature to challenge stereotypes, expose injustices, and reclaim agency. Resistance can take many forms, including the use of indigenous languages, the rewriting of colonial texts, and the assertion of alternative histories. Language itself is a crucial issue in postcolonial studies. Many postcolonial writers face the dilemma of whether to write in the language of the colonizer or in their native languages. Writing in English, for example, allows for a wider audience but may also perpetuate colonial influence. On the other hand, writing in indigenous languages can be seen as an act of cultural preservation and resistance, though it may limit accessibility. The theme of displacement is also prevalent. Colonization often led to forced migration, exile, and the disruption of communities. Postcolonial literature reflects these experiences, exploring the emotional and psychological impact of displacement. This theme is particularly significant in diasporic literature, where writers navigate multiple cultural identities and negotiate belonging in foreign lands.

Major Postcolonial Theorists and Their Contributions

Postcolonial theory has been shaped by several influential thinkers who have provided critical frameworks for analyzing literature and culture. Edward Said's concept of Orientalism is foundational to postcolonial studies. Said argued that the West constructed an image of the East as exotic, backward, and inferior in order to justify colonial domination. This representation was not neutral but deeply political, shaping how the East was perceived and governed. Said's work highlights the power of discourse in maintaining colonial authority. Gayatri Chakravorty Spivak introduced the concept of the subaltern, referring to those who are socially, politically, and geographically marginalized. In her famous essay *Can the Subaltern Speak*, Spivak questions whether the voices of the oppressed can truly be heard within dominant power structures. She emphasizes the need to critically examine who speaks for whom and whose voices are silenced. Homi K. Bhabha's theories of hybridity, mimicry, and ambivalence offer a nuanced understanding of colonial and postcolonial identities. Bhabha argues that colonial relationships are not simply oppositional but involve complex interactions where colonized subjects may imitate or adapt aspects of the colonizer's culture. This mimicry can be both a form of resistance and a source of tension, as it destabilizes colonial authority. Frantz Fanon, a psychiatrist and revolutionary thinker, focused on the psychological effects of colonialism. In works such as *Black Skin, White Masks* and *The Wretched of the Earth*, Fanon examines how colonialism dehumanizes both the colonized and the colonizer. He advocates for decolonization as a necessary process of reclaiming identity and dignity.

Forms and Genres in Postcolonial Literature

Postcolonial literature encompasses a wide range of genres, including novels, poetry, drama, and essays. The novel has been particularly significant as a form for exploring complex social and political issues. Postcolonial

novels often challenge traditional narrative structures, incorporating oral storytelling techniques, multiple perspectives, and non-linear timelines.

Poetry in postcolonial contexts often serves as a powerful medium for expressing cultural identity, resistance, and emotional depth. Poets use imagery, symbolism, and rhythm to convey the experiences of colonization and its aftermath.

Drama and performance also play an important role, particularly in cultures with strong oral traditions. Postcolonial theatre often addresses issues of identity, history, and social justice, engaging audiences in critical reflection.

Rewriting and Counter-Narratives

A significant aspect of postcolonial literature is the rewriting of canonical texts from a postcolonial perspective. This involves reinterpreting or responding to works produced during the colonial period, often exposing their biases and limitations. For example, postcolonial writers may retell stories from the perspective of marginalized characters or challenge the assumptions embedded in colonial narratives.

These counter-narratives are crucial for deconstructing dominant histories and creating space for alternative voices. They allow postcolonial writers to reclaim agency and redefine cultural identities on their own terms.

Gender and Postcolonialism

Gender is a critical dimension of postcolonial studies. Women in colonized societies often faced двой oppression—both from colonial powers and from patriarchal structures within their own cultures. Postcolonial feminist critics examine how gender intersects with race, class, and colonial history.

Women writers in postcolonial contexts bring unique perspectives to issues of identity, resistance, and cultural transformation. Their works often highlight the experiences of women who have been marginalized or silenced, challenging both colonial and patriarchal narratives.

Globalization and Contemporary Postcolonialism

In the contemporary era, postcolonial studies have expanded to address the effects of globalization. While globalization is often associated with increased connectivity and cultural exchange, it also raises concerns about cultural homogenization and economic inequality. Postcolonial critics analyze how global power dynamics continue to reflect colonial hierarchies.

Contemporary postcolonial literature often explores themes of migration, transnational identity, and cultural hybridity in a globalized world. Writers examine how individuals navigate multiple identities and negotiate belonging in increasingly interconnected societies.

Critiques of Postcolonial Theory

Despite its significance, postcolonial theory has faced criticism. Some scholars argue that it can be overly theoretical and disconnected from the material realities of postcolonial societies. Others suggest that it sometimes generalizes diverse experiences under a single framework, overlooking regional and cultural differences.

There is also debate about the term postcolonial itself, as it implies a clear break from colonialism, which may not reflect ongoing forms of neocolonialism and global



inequality. Critics call for more nuanced approaches that account for the complexity and diversity of postcolonial experiences.

Conclusion

Postcolonial literature and critical perspectives provide valuable insights into the enduring impact of colonialism and the ongoing struggle for identity, justice, and cultural autonomy. By examining themes such as identity, resistance, language, and displacement, postcolonial texts reveal the complexities of living in the aftermath of empire. The contributions of key theorists have enriched our understanding of how power operates through culture and discourse, while contemporary developments continue to expand the field in response to global changes. Ultimately, postcolonial literature is not only about the past but also about the present and future. It challenges readers to question dominant narratives, recognize marginalized voices, and engage with the complexities of a world shaped by colonial histories. As such, it remains a vital and dynamic area of literary and cultural study.

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Original Article

Rationalism in Marathi Sant Literature

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Abstract:

This paper explores the relationship between rationality and Marathi Sant literature, particularly the Varkari tradition. Rationality is understood as the ability to think logically, evaluate evidence, and form consistent judgments, while Sant literature emphasizes devotion, ethical living, and inner purity. The study examines how saints such as Sant Tukaram, Sant Dnyaneshwar, and Sant Eknath used simple yet powerful reasoning to challenge blind rituals, superstition, and ego-driven practices. It highlights that Sant literature does not oppose rationality; instead, it integrates logical reflection with spiritual insight. The paper argues that rationality in Sant literature is incomplete without purity of mind, and purity of mind gains depth when supported by reflective reasoning. Together, they form a balanced framework for ethical and meaningful

Keywords: Rationality, Marathi Sant Literature, Varkari Tradition, Purity of Mind, Logical Reasoning, Sant Tukaram, Sant Dnyaneshwar, Bhakti Movement, Ethics, Spiritual Philosophy.

Rationalism

Rationality is the ability to think and act using logic, evidence, and clear reasoning rather than relying on emotions, impulses, or personal biases. It involves forming beliefs that are consistent with facts and making decisions that effectively help achieve one's goals. A rational person evaluates information carefully, considers different possibilities, and chooses actions based on what is most reasonable and beneficial. Rationality does not mean ignoring emotions completely, but rather ensuring that feelings do not interfere with sound judgment and logical thinking. Rationality is based on evidence and this evidence comes from experience. The cognitive ideas of humans are formed by experience they have in day-to-day life. Experience plays a vital role in forming evidences that shape the rationality and ethics among humans.

Marathi Sant Literature

Marathi Sant Literature popularly known as 'Varkari Literature' is a rich tradition of Marathi devotional (Bhakti) poetry that originated in Maharashtra and is closely associated with the worship of Vitthal at Pandharpur. It developed as part of the Varkari movement, which emphasized personal devotion, moral living, and spiritual equality. This tradition played a crucial role in shaping the religious and cultural life of the region by making spiritual ideas accessible to common people. The literature is composed in various forms such as Abhangs, Haripath, Bharuds, and Gathas. Abhangs are short devotional poems expressing deep emotional connection with God, while Haripath consists of verses meant for regular chanting. Bharuds are symbolic or allegorical songs that often convey social messages, and Gathas are compilations of such devotional works. These literary forms were simple yet powerful, designed to be easily understood and remembered by the masses. A central feature of Varkari literature is its emphasis on devotion (bhakti), equality, and ethical living. It canvassed the rationality and ethics for its followers. It has a formative influence on Marathi psyche to behave with ethics and rationality. Marathi Sant literature and Rationality are closely connected through their emphasis on thoughtful reflection, ethical living, and questioning blind beliefs. The works of saints like Sant Tukaram, Sant Dnyaneshwar, and Sant Eknath promote a practical and reasoned approach to spirituality. Instead of encouraging rigid rituals or superstition, they focused on inner purity, equality, and direct personal experience of truth.

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Purity of mind is one of the prime aspects of rationality. "Purity of mind" and rationality describe two different but complementary qualities of thinking. In traditions like Hinduism and Buddhism, purity of mind refers to inner clarity—being free from excessive desires, anger, ego, and bias—so that one's thoughts are calm and intentions are sincere. Rationality, emphasized by philosophers such as René Descartes, focuses on logical reasoning, consistency, and forming conclusions based on evidence. While purity of mind shapes the state of the thinker, rationality shapes the process of thinking. A calm and unbiased mind can support rational judgment by reducing emotional interference, while rational thinking can help examine and refine one's beliefs. Together, they create a balanced approach: clear, objective reasoning guided by a steady and ethically grounded mind. In Marathi Sant literature, the idea of "purity of mind" is central and deeply connected to spiritual growth and ethical living. Saints like Sant Tukaram, Sant Dnyaneshwar, and Sant Eknath consistently emphasized that true devotion does not lie in rituals or outward practices, but in having a clean, humble, and ego-free mind. For them, a pure mind meant freedom from greed, anger, pride, and hypocrisy, allowing a person to experience truth and connect with the divine. In texts like the Dnyaneshwari, inner purity is described as the foundation of right understanding, while Sant Tukaram's abhangas stress simplicity, honesty, and sincerity of heart over intellectual pride. This perspective doesn't reject rationality but places it after inner cleansing—suggesting that without purity of mind, even knowledge and reasoning can become distorted by ego. Thus, Marathi Sant literature presents purity of mind as the basis for both spiritual wisdom and meaningful understanding of life. Their teachings often criticized meaningless customs and emphasized values like compassion, honesty, and self-awareness, which align with rational thinking. Through simple language and relatable examples, Marathi Sant literature made complex philosophical ideas understandable, encouraging people to think critically and live morally balanced lives.

अखंड जयाला देवाचा शेजार ।

कारे अहंकार नाही गेला ॥

मान अपमान वाढविशी हेवा ।

दिवस असता दिवा हाती घेसी ।

This verse by Sant Muktabai reflects deeply on ego and the lack of inner purity. She says that even if a person is constantly close to God, it is meaningless if their ego has not disappeared. The line about "honor and insult" suggests that we ourselves keep increasing feelings of pride, jealousy, and comparison, which disturb the mind. The final line, "holding a lamp in broad daylight," is a metaphor for foolishness—when truth is already clear, yet we continue to act in ignorance.

आहे तैसें आतां कळलियावरी ।

परतें सांडा दुरी दुजेपण ॥

तुका म्हणे काय द्यायेचा अभिळासे ।

हंस पावे नाश तारागणीं ॥

This verse by Sant Tukaram conveys a deep insight about self-realization and the illusion of duality. He says that once you truly understand reality ("as it is"), you should abandon the sense of separation or "otherness" (दुजेपण). In other words, when true knowledge arises, the idea that "I am separate" or "this is different from me" should fall away.

In the second part, Tukaram uses poetic imagery: desiring a shadow is meaningless, just as a swan (hansa) would be destroyed if it tried to reach the stars. These images suggest chasing illusions or unattainable things instead of recognizing truth within.

The core message is that once true understanding dawns, one should let go of illusion, ego, and duality, and not run after false or superficial desires. It emphasizes inner clarity and the realization of oneness, which is central to Sant literature.

Logical reasoning is another feature of rationality that reflects in the Varkari Literature. Logical reasoning is the process of thinking in a structured, consistent way to arrive at valid conclusions based on given information. It involves analyzing facts, identifying relationships, and applying rules of logic so that the conclusion follows naturally from the premises.

There are two main types: deductive reasoning, where conclusions are certain if the premises are true (as in mathematics), and inductive reasoning, where conclusions are probable based on patterns or evidence. Logical reasoning is closely tied to the study of Logic and was strongly emphasized by thinkers like Aristotle, who formalized rules for valid arguments.

In everyday life, logical reasoning helps in decision-making, problem-solving, and avoiding contradictions or biases. It ensures that beliefs are not just based on emotions or assumptions but are supported by clear and rational thinking.

Sant literature and logical reasoning may seem different at first, but they actually complement each other in meaningful ways. Marathi Sant poets like Sant Tukaram, Sant Dnyaneshwar, and Sant Eknath did not reject reasoning; instead, they used simple, powerful logic to question blind rituals, social hypocrisy, and false beliefs. Their abhangas and writings often present arguments in a very clear and relatable way—showing cause and effect, exposing contradictions, and guiding people toward truth through understanding rather than blind faith.

For example, when Tukaram criticizes ego or meaningless practices, he often uses logical comparisons (like "holding a lamp in daylight") to show the absurdity of ignorance. Similarly, in the Dnyaneshwari, Dnyaneshwar explains complex spiritual ideas in a rational and systematic manner, making them easier to grasp.

However, Sant literature also points out a limitation: pure logic alone is not enough if the mind is clouded by ego, desire, or pride. So, while logical reasoning helps in understanding truth, the saints emphasize that it must be supported by purity of mind, humility, and direct experience. In this way, Sant literature presents a balanced view—use reason to understand, but purify the mind to truly realize.



यंत्र मंत्र काय करिसी जडीबुटी । तेणे भूतसृष्टी पावशील ॥
न लगे देशकाळ । मंत्रविधाने सकळ । मनोची निश्चळ । करुनि
करुणा भाकावी ॥

This explanation reflects the spirit of Sant Tukaram's teachings quite well, but it can be made sharper by linking it more clearly to both rational thinking and inner purity.

Tukaram criticizes practices like yantra, mantra, and jadibuti not because all rituals or traditions are meaningless, but because people often treat them as shortcuts to control life or gain material benefits without self-transformation. From a logical reasoning perspective, this is flawed: it assumes cause and effect without evidence and encourages dependency on superstition rather than understanding. His reference to bhoot-srushti (ghostly or occult realms) symbolizes getting lost in fear, imagination, and irrational beliefs, which distract the mind from truth.

What he is really doing is applying a kind of practical rationality—questioning: Does this actually lead to truth, or is it just illusion? If a practice increases fear, ego, or confusion, then by both logic and spiritual insight, it is leading in the wrong direction.

His solution is strikingly simple: no need for complex rituals, specific timings, or secret methods. Instead, he emphasizes a pure, steady, and sincere mind. This aligns both with rational clarity (free from false assumptions) and spiritual purity (free from ego and desire).

So, Tukaram's message is not anti-reason—it actually cuts through irrational beliefs using simple logic, while insisting that true understanding comes only when the mind is clean and focused.

तीर्थी धोंडा पाणी । देव रोकडा सज्जनी ॥१॥
मिळालिया संतसंग । समर्पिता भले अंग ॥२॥
तीर्थी भाव फळे । येथे आळद ते वळे ॥३॥
तुका म्हणे पाप । गेले गेल्या कळे ताप ॥४॥

This abhang by Sant Tukaram presents a very clear and rational critique of ritualism while emphasizing the value of inner transformation.

In the first line, “Tirthi dhonda pani” (holy places are just stone and water), Tukaram points out that pilgrimage sites are physically ordinary elements of nature. “Dev rokhada sajjani” means that the true God is experienced directly in noble, sincere people rather than in external objects or places. This is a logical shift from external symbolism to inner reality.

In the next idea, he says that real benefit comes from sant-sang (company of saints). When a person associates with spiritually awakened or virtuous people, their whole being naturally improves and becomes “offered” or refined.

He further explains that pilgrimage only becomes meaningful through bhav (inner feeling or intention). Without sincere emotion and understanding, rituals remain empty. True change happens when ignorance is removed and clarity arises.

Finally, Tukaram concludes that when inner ignorance and suffering are removed, only then does one realize what true liberation is—meaning that real spirituality is experienced through transformation of the mind, not external acts alone.

Overall, this abhang combines spiritual insight with practical reasoning: it questions blind ritualism and argues that truth is not in objects or places, but in pure intention, wise association, and inner clarity.

Conclusion

The present study highlights that rationality and Marathi Sant literature are not opposing ideas but deeply interconnected ways of understanding truth and guiding human life. The concept of rationality, based on logic, evidence, and structured thinking, finds a meaningful reflection in the teachings of saints like Sant Tukaram and Sant Dnyaneshwar, who consistently questioned blind rituals, superstition, and ego-driven practices. Their writings show that many so-called spiritual practices become empty when they are not supported by understanding and inner transformation. At the same time, Sant literature extends rationality beyond purely intellectual analysis by emphasizing the importance of purity of mind, humility, and ethical awareness. The saints suggest that reasoning alone, if influenced by ego, desire, or prejudice, can become distorted. Therefore, true understanding requires not only logical clarity but also emotional and moral refinement. This creates a balanced framework where rational thought and inner purity support each other. Another important finding is that Sant literature uses simple, accessible language and powerful metaphors to express complex philosophical ideas. This reflects a form of practical reasoning aimed at guiding ordinary people toward truth in a direct and understandable manner. Rather than encouraging blind faith, the saints encourage introspection, self-examination, and experiential understanding of reality. In a broader sense, the integration of rationality and Sant thought remains highly relevant in contemporary times. In an age where misinformation, superstition, and emotional bias can easily influence decision-making, the Sant perspective offers a timeless reminder: truth is best understood when clear thinking is combined with a purified and disciplined mind. Thus, Marathi Sant literature not only enriches spiritual thought but also contributes meaningfully to ethical reasoning and human understanding in everyday life.

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Original Article

SSH-Based Automation Architecture for Heterogeneous Systems in IPv4 Inter-Networking Environments

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Abstract

In the increasing complexity of modern computing environments, it demands scalable and efficient network management solutions. This paper presents an SSH-based automation architecture for IPv4 inter-networking across heterogeneous systems. The proposed framework relay on a Python-based SSH orchestrator to automate essential tasks, including IPv4 configuration, SSH key distribution, and secure session establishment between Ubuntu and macOS platforms. The architecture is modular and platform-independent, enabling seamless integration across diverse environments. Experimental evaluation demonstrates high reliability, achieving a 100% SSH success rate with a Mean Latency of approximately (~3.5ms). The system attains an Automation Efficiency (η) of about 0.22, indicating effective performance with minimal overhead. The results confirm that the proposed solution provides secure, low-latency communication while maintaining adaptability and robustness. This work aligns with modern networking principles, including abstraction, programmability, and resilience, making it suitable for scalable inter-networking applications.

Keywords: Inter-Networking, SSH, IPv4 Protocol, Automation, SDN, Mean Latency, Automation Efficiency.

Introduction

In the modern cloud computing and distributed systems, network management should be automated, resilient, and platform-independent [7]. **IPv4 protocol** is still a very commonly used backbone for inter-networking, especially on local and privately-operated network segments [13]. **Secure Shell (SSH)** is the de facto standard protocol for remote administration. Automated management systems, emerging with **Software-Defined Networking (SDN)** [6] and various orchestration frameworks [9], tend to rely heavily on programmatic SSH connections [10].

This research introduces a comprehensive SSH-driven automation model to overcome these challenges. The objective was to design and implement an automated system capable of establishing secure, peer-to-peer IPv4 inter-networking between heterogeneous platforms, specifically **Ubuntu** and **macOS** [14]. The system's design incorporates the core principles of network programmability [6] and fault-tolerant cloud orchestration [5, 9].

The key contributions of this paper are:

1. The introduction of a **modular Python SSH Orchestrator** architecture for cross-platform automation [14].
2. Quantification of operational performance using metrics such as **SSH Setup Time (T_s)** and **Automation Efficiency (η)** [14].
3. Validation of the feasibility, robustness, and low-latency performance of automated SSH inter-networking over IPv4 in heterogeneous environments [14].

System Structure and Methodology

The implemented solution is based on a symmetric, peer-to-peer model that allows either connected system (Ubuntu or macOS) to act as a controller or an agent [14].

A. Block Diagram

The system's high-level interaction is illustrated below.

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The model focuses on peer-to-peer SSH-based interconnection model over a local IPv4 network between two different platforms: Ubuntu and macOS machines. Both

machines have Python-based automation scripts that enable secure and transparent SSH communication.

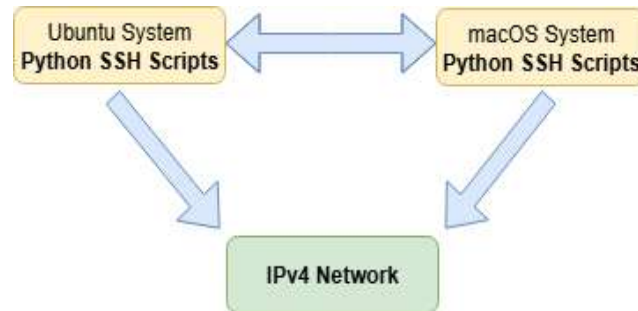


Figure 1: peer-to-peer SSH-based interconnect model across an IPv4 network between two different platforms

This configuration focuses on cross-platform support without manual network configuration and SSH setup.

Each node independently runs scripts that set up IPv4 addresses, create SSH key pairs, exchange public keys, and open secure, encrypted sessions using SSH. The communication takes place over a local IPv4 network—usually a LAN or private subnet—so both systems may share data and commands with low latency and high dependability. This automation is in line with the objectives of network programmability and abstraction, as presented in software-defined networking literature [6], [10], and addresses the issues of manual IP configuration in

heterogenous environments [11], [13]. Further, the block diagram shows a symmetric setup, where either system may be the controller or agent. This design approach is an extension of the principles of distributed automation frameworks used in contemporary cloud systems [2], [9].

B. Python SSH Orchestrator Architecture

The system architecture (Figure 2) is centered around a **Python SSH Orchestrator** [14], serving as a low-level automation layer that abstracts away OS-specific nuances while maintaining the robustness of native networking tools [11].

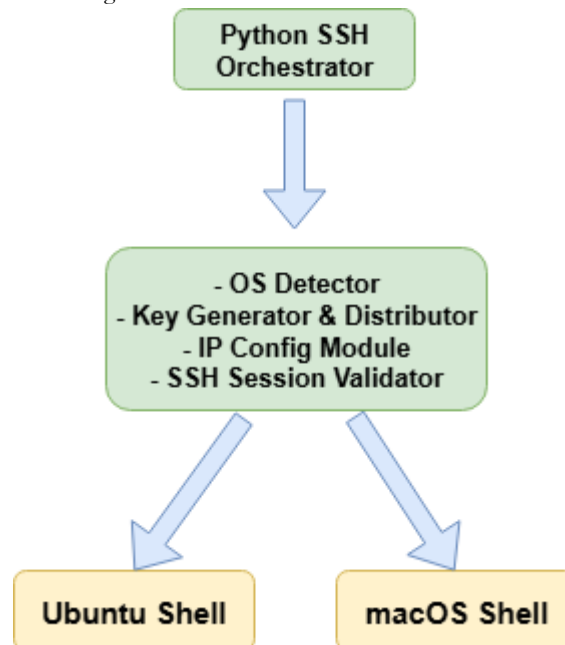


Figure 2: System Architecture

The orchestrator is composed of four functional submodules:

- **OS Detector:** Automatically detects the host operating system (Linux/Ubuntu or macOS). This allows the script to run suitable commands (*ip*, *netplan* on *Ubuntu* and *networksetup* or *ifconfig* on *macOS*) [12], [13].
- **IP Configuration Module:** Configures static IPv4 addresses on specified interfaces, necessary for *host-to-host* direct communication [12, 11].

- **Key Generator & Distributor:** Uses *ssh-keygen* to create key pairs and *ssh-copy-id* or *scp* to distribute public keys, enabling *passwordless* authentication [14].
- **SSH Session Validator:** Ensures the SSH session is established and manages error states, akin to fault-tolerant automation and self-healing systems [5, 8].

In the lowermost level of the architecture, the system interacts with native shell environments—*bash* of *Ubuntu* and *terminal* of *macOS*—through Python's *subprocess* module. Such a two-level structure provides platform independence while maintaining the robustness of native

networking tools. Such an architecture mirrors principles described in SDN orchestration frameworks [6], [10] and cloud resource management literature [9].

C. Process Flowchart

The flowchart (Figure 3) symbolizes a step-by-step automation lifecycle that controls the SSH internetworking process across IPv4.



Figure 3: Flowchart of the Process

It is based on a step-by-step logical flow from system initialization to SSH session verification to ensure fault recovery and user transparency at each step.

- **Start Script:** The process initiates with running the Python automation script on either of the systems. This sets the orchestration logic in motion.
- **Detect OS Type:** The script detects whether it is Ubuntu or macOS by using `platform.system()`. This allows for OS-specific actions—a vital consideration considering the difference in network interface management tools, as identified by Chalon et al. [11].
- **Configure IPv4 Address:** The respective static IP assignment commands are run based on the platform. This is important for host-to-host direct communication and accommodates the dynamic internetwork modeling concept of Zegura et al. [4].
- **Create SSH Key Pair:** The system verifies for current keys and generates new ones through `ssh-keygen`, promoting security and lessening configuration errors. This adheres to the security guidelines recommended in automation and SSH-based network design studies [14].
- **Share Public Key:** The script copies the public key to the remote host with `ssh-copy-id`, so that it can use passwordless authentication. This is a secure and scalable way, and it is in accordance with orchestrated environment practices [2], [14].
- **Create SSH Session:** A session is used to connect to the remote machine, and a simple command (e.g., `echo "Connected"`) is run to check for SSH readiness. This method of validation is considered in cloud

interconnection systems when fast session checks are needed [5], [10].

- **Log and Monitor:** The script of automation logs success or failure, connection time, and exceptions. It also provides retry functionality if failures occur. Logging and self-monitoring form the core of intelligent automation systems, as outlined in [3], [7], and fault detection literature [8].
- **End:** The automation cycle is over. The system is now prepared for continuous, secured SSH communication.

This flow guarantees SSH session establishment robustness, repeatability, and modularity, addressing the requirement for scalable internetworking automation—a subject highlighted in both SDN and AI-based network frameworks [6], [7].

I. Experimental Results and Performance Analysis

A. Evaluation Metrics and Environment

The system's performance was evaluated using metrics adapted from performance efficiency models in automated networking and cloud orchestration frameworks [9, 10, 2]:

- **Automation Efficiency (η):** $\eta = \frac{S_a}{T_c + T_s + T_r}$ [14]. This metric balances reliability (success rate) with execution time [14].
- **Mean Latency (L_{avg}):** $L_{avg} = \frac{\sum_{i=1}^n L_i}{n}$ [4], which is a standard metric for Round-Trip Time (RTT) [1].

The test environment involved an **Ubuntu 22.04** machine and a **macOS Ventura 13.x** machine [14].

B. Results and Analysis

The Performance metrics obtained from the experiment [14] are shown in Table 1.



TABLE 1

PERFORMANCE METRICS FOR AUTOMATED IPV4/SSH INTER-NETWORKING

METRIC	UBUNTU → MACOS	MACOS → UBUNTU
IP CONFIG TIME (T_c) (s)	1.2	1.3
SSH SETUP TIME (T_s) (s)	2.5	2.4
RECONNECT TIME (T_r) (s)	0.9	0.8
SSH SUCCESS RATE (S_s)	100%	100%
MEAN LATENCY (L_{avg}) (ms)	3.4	3.6

Analysis:

- **SSH Success Rate:** The **100% SSH Success Rate** confirms the reliability of the Python Orchestrator's cross-platform logic [14].
- **Latency:** The **Mean Latency of ~3.5ms** demonstrates stable and responsive communication over the local IPv4 network [14], supporting the finding that SSH over IPv4 is a lightweight method for interconnection [14].
- **Automation Efficiency (η):** The calculated **Automation Efficiency of ~0.22** [14] confirms the stability and responsiveness of the automated setup.
- **Resilience:** The inclusion of logs and fault-handling mechanisms ensured resilience, as the system automatically recovered from key mismatches or temporary disconnections [14].

Conclusion

A robust and efficient SSH-driven automation model for IPv4 inter-networking between Ubuntu and macOS systems has been successfully designed, implemented, and validated [14]. The Python SSH Orchestrator successfully automated complex network and security tasks, achieving a **100% Success Rate** and high η of **0.22** with low latency [14]. This study validates the feasibility of automating secure inter-networking across heterogeneous systems [14]. The system's robustness, low-latency communication, and ease of extensibility lay a solid foundation for future work involving multi-node orchestration, AI-driven monitoring [3, 7], or hybrid cloud integration.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Original Article

Mutual Funds Vs Traditional Investment Options: Role of Financial Literacy in Investment Choice

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Abstract

This study investigates the comparative attractiveness of mutual funds and traditional investment options (fixed deposits, gold, and government-backed savings instruments) and examines how financial literacy influences investor choice. Using secondary data from peer-reviewed journals, policy reports, and institutional publications, the study adopts a descriptive-analytical approach. The findings indicate that financially literate investors are more inclined toward mutual funds due to their diversification benefits and higher return potential, whereas less literate investors prefer traditional instruments due to perceived safety and familiarity. The study highlights the critical role of financial literacy in shifting investment behavior toward efficient wealth management practices.

Keywords: Financial Literacy; Mutual Funds; Traditional Investments; Investment Behavior; Wealth Management; India

Introduction

Investment decisions are central to personal financial well-being and long-term wealth creation. In emerging economies like India, traditional investment avenues such as fixed deposits, gold, and small savings schemes have historically dominated household portfolios. However, the expansion of capital markets and financial products has increased the relevance of market-linked instruments like mutual funds. Despite their advantages, mutual fund adoption remains uneven. One key determinant is financial literacy—the ability to understand financial concepts and make informed decisions. This study explores how financial literacy influences the choice between traditional and modern investment options.

Research Gap

Existing literature confirms that financial literacy affects investment decisions; however: Limited studies compare mutual funds and traditional investments together
Insufficient focus on behavioral transition due to literacy
Lack of synthesis using secondary data in Indian context
This study attempts to bridge these gaps.

Objectives of the Study

1. To compare mutual funds with traditional investment options
2. To examine the role of financial literacy in investment decisions
3. To analyze investor behavior using secondary data
4. To provide policy and practical recommendations

Methodology

Type of Study: Descriptive and analytical

Data Source: Secondary data

Sources Used:

Peer-reviewed journals

Government and institutional reports

Academic publications

Analysis Technique: Comparative and thematic analysis

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Theoretical Framework

- Modern Portfolio Theory (MPT)
Proposed by Harry Markowitz, MPT emphasizes diversification to optimize risk-return trade-offs. Mutual funds align with this theory by offering diversified portfolios.
- Behavioural Finance Theory
Explains how psychological factors (risk aversion, herd behaviour) influence financial decisions, often leading investors toward safer traditional options.

Literature Review

Annamaria Lusardi & Olivia S. Mitchell (2014) found that financial literacy significantly improves retirement planning and investment behaviour.

Studies indicate that higher financial literacy leads to greater participation in capital markets and mutual funds.

Research in India shows that investors still prefer traditional instruments due to low awareness and risk perception.

Behavioural studies highlight that emotional biases limit rational investment decisions.

Analysis and Discussion

- Investment Preference Trends

Secondary data suggests:

High-income and financially literate individuals prefer mutual funds

Risk-averse investors prefer fixed deposits and gold

Urban investors show higher adoption of modern instruments

- Role of Financial Literacy

Financial literacy influences:

Understanding of risk-return trade-off

Awareness of investment products

Confidence in market participation

- Barriers to Mutual Fund Adoption

Lack of awareness

Perceived complexity

Trust deficit in markets

Key Findings

Financial literacy is a significant predictor of investment choice

Mutual funds outperform traditional investments in long-term wealth creation

Traditional investments dominate due to behavioural and informational constraints

Awareness programs positively influence investment diversification

Implications

- For Policy Makers

Strengthen financial education initiatives

Promote investor awareness campaigns

- For Investors

Improve financial knowledge before investing

Adopt diversified investment strategies

- For Financial Institutions

Simplify financial products

Increase transparency and trust

Conclusion

The study concludes that financial literacy plays a transformative role in shaping investment decisions. While traditional investments offer safety, mutual funds provide superior long-term returns. Enhancing financial literacy can bridge this gap and promote better wealth management practices.

Limitations

Based only on secondary data

No primary survey conducted

Limited to Indian context

Future Scope

Primary data-based empirical studies

Cross-country comparisons

Impact of fintech on investment behaviour

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Original Article

Revisiting India's Anti-Defection Law: Between Party Control and Democratic Accountability

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Abstract

The Anti-Defection Law under the Tenth Schedule of the Constitution of India, introduced through the Fifty-Second Constitutional Amendment Act, 1985, was designed to curb political defections and protect the electoral mandate. This paper examines whether the law effectively advances the citizen's aspiration for stable, accountable, and participatory governance. The objective of the study is to critically assess the law's impact on democratic representation and political participation. The study adopts a doctrinal and comparative research methodology. It analyses constitutional jurisprudence from key Supreme Court cases, including Kihoto Hollohan v. Zachillhu, Nabam Rebia v. Deputy Speaker, Arunachal Pradesh Legislative Assembly, Keisham Meghachandra Singh v. The Hon'ble Speaker, Manipur Legislative Assembly, and Shrimanth Balasaheb Patil v. Karnataka Legislative Assembly. It also evaluates parliamentary practices and compares anti-defection approaches in the United Kingdom, South Africa, and Germany. The analysis reveals a structural paradox: while the law aims to prevent opportunistic defections and ensure governmental stability, its implementation has concentrated power within party leadership and the Speaker, often undermining legislative independence and citizen accountability. Instances of mass resignations, strategic defections, and delays in disqualification proceedings highlight persistent governance challenges. The paper concludes that reform is necessary to realign the law with democratic principles. Measures such as limiting disqualification to confidence-related votes, establishing an independent adjudicatory tribunal, and enforcing strict timelines for decisions could strengthen institutional integrity and restore public trust in representative democracy.

Keywords: Anti-Defection Law, Participatory Governance, Democratic Representation, Constitutional Reform

Introduction

The stability of a parliamentary democracy depends not only on the frequency of elections but also on the conduct of elected representatives between those elections. When legislators abandon the political parties on whose platforms they were elected, they arguably betray the electoral mandate and disenfranchise the voters who chose them. This phenomenon of political defection has plagued Indian politics since the late 1960s, when the phrase "Aaya Ram Gaya Ram" entered the political lexicon to describe the frequent and opportunistic floor-crossings that destabilized state governments (Kashyap, 2019). By 1985, concerns over defection-induced instability had reached such a pitch that the Rajiv Gandhi government enacted the Fifty-Second Constitutional Amendment, inserting the Tenth Schedule into the Constitution, popularly known as the Anti-Defection Law. The stated objectives of the Tenth Schedule were twofold: first, to curb the mischief of elected members defecting from one party to another for personal gain, and second, to protect the mandate of the people by ensuring that the political composition of the legislature remained faithful to the electoral outcome (Chandra, 2017). Under the law, a member of a legislature belonging to any political party becomes disqualified if they voluntarily give up membership of that party or vote/abstain from voting contrary to the party whip, except in certain limited circumstances (mergers involving two-thirds of a party's members were initially exempted, later modified by the Ninety-First Amendment).

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Yet, nearly four decades later, the law's legacy is deeply contested. While the frequency of naked floor-crossings has undoubtedly declined, new pathologies have emerged: mass resignations orchestrated to circumvent the law, strategic defections through splits and mergers, prolonged inaction by Speakers on disqualification petitions, and the near-total subordination of individual legislators to party high commands (Mehta, 2020). The law, originally conceived as a shield for democratic stability, is now widely perceived as a sword for party authoritarianism, silencing dissent within legislatures and insulating ruling parties from accountability between elections.

This paper argues that the Anti-Defection Law has created a structural paradox: it was designed to protect the citizen's mandate, but in practice it has eroded the very mechanisms through which citizens hold their representatives accountable. By transferring effective power from individual legislators to party whips and partisan Speakers, the law has undermined legislative independence, reduced parliamentary deliberation, and alienated voters who no longer see their local representative as responsive to local concerns (Jha & Kumar, 2021). The core research question guiding this study is: Does the Anti-Defection Law, in its current form, advance or undermine citizen-centered, accountable, and participatory governance in India?

To answer this question, the paper is organized as follows. The next section reviews the existing literature on defection, democratic theory, and critiques of anti-defection laws globally. The methodology section outlines the doctrinal and comparative approach adopted. The findings section analyzes key Supreme Court judgments, parliamentary practices, and international comparisons. The discussion synthesizes these findings into a critique of the existing framework. Finally, the conclusion proposes specific, actionable reforms to realign the law with democratic principles and the citizen's right to accountable governance.

Review Of Literature

The academic literature on anti-defection laws spans political science, constitutional law, and comparative politics. Three major themes emerge: (a) theoretical justifications for restricting defections, (b) empirical evidence on the effects of anti-defection laws in India, and (c) comparative experiences from other democracies.

Theoretical Justifications: Mandate Versus Free Speech

The normative case for restricting defections rests on the theory of the electoral mandate. According to this view, voters do not elect individuals as autonomous trustees; rather, they elect them as representatives of a party's manifesto and ideological platform (Shugart & Carey, 1992). When a legislator defects, they violate a fiduciary duty owed to the voters who supported the party. Proponents of anti-defection laws argue that such violations undermine democratic legitimacy and create perverse incentives for political corruption (Chhibber & Kollman, 2004).

Opponents, however, invoke two countervailing principles. First, the right of legislators to freedom of conscience and political expression, which is central to representative democracy (Pitkin, 1967). Second, the accountability of

legislators to their constituents, which may sometimes require them to break from party lines, particularly when party leadership acts against local or national interests (Buchanan & Tullock, 1962). The Indian Supreme Court, in *Kihoto Hollohan v. Zachillhu* (1992), attempted to balance these principles by upholding the Tenth Schedule's constitutionality while striking down paragraph 7 (which granted the Speaker's decision finality and ousted judicial review). The Court held that the law serves a legitimate public purpose but must be subject to judicial scrutiny.

Empirical Studies on India's Anti-Defection Law

Empirical research on the Tenth Schedule has produced mixed findings. Early studies (e.g., Murali, 1999) found a significant reduction in defection rates after 1985, from over 40% of legislators defecting in some state assemblies during the 1970s to less than 10% in the 1990s. However, more recent research has documented a shift from individual defections to mass resignations and pre-poll realignments. A study by Sharma (2018) analyzed 15 state assemblies between 2000 and 2015 and found that while formal disqualification proceedings were initiated in only 12% of defection cases, mass resignations (three or more members resigning together) accounted for nearly 60% of all defection-related events. This suggests that the law has changed the form, not the fact, of defection.

Another strand of literature focuses on the role of the Speaker. Singh (2019) examined 47 disqualification petitions filed in six state assemblies between 2010 and 2018. The median time for a Speaker to issue a decision was 14 months, with 22 petitions still pending after two years. In cases where the Speaker belonged to the same party as the defecting members, disqualification was ordered in only 18% of cases, compared to 64% when the Speaker belonged to an opposition party. This finding raises serious concerns about the impartiality of the Speaker as a quasi-judicial authority.

Comparative Anti-Defection Frameworks

Internationally, approaches to defection vary significantly. The United Kingdom operates under a strict party whip system but does not have a constitutional anti-defection law. Instead, the Fixed-term Parliaments Act (2011, repealed 2022) and subsequent practices rely on party discipline enforced through internal party mechanisms and, more recently, the Recall of MPs Act (2015). The Recall Act allows voters to initiate a recall petition if an MP is convicted of an offense or suspended from the House for at least 10 sitting days (Hansard Society, 2019). This model emphasizes citizen-led accountability rather than automatic disqualification.

South Africa adopted a unique "floor-crossing" provision in its 1996 Constitution and later the Tenth Amendment (2002), which permitted members to change parties only during specified windows, provided that at least 10% of the legislature's members crossed together (Murray, 2017). This approach sought to balance stability with flexibility but was criticized for enabling strategic mass defections; it was subsequently repealed in 2009.

Germany's Basic Law does not contain a general anti-defection provision, but the "constructive vote of no confidence" (Article 67) provides indirect stability: a



government can only be removed if a majority simultaneously agrees on a successor (Saalfeld, 2018). This mechanism reduces the incentive for opportunistic defections aimed at toppling governments without forming viable alternatives.

The literature thus reveals a spectrum: from India's rigid, Speaker-centric model to the UK's recall-based citizen accountability model, to Germany's institutional stability model. No single approach is perfect, but comparative analysis suggests that India's model suffers from a unique combination of overreach (regulating routine votes) and under-enforcement (delayed, biased adjudication).

Research Gaps

Despite a rich body of work, three gaps persist. First, few studies systematically analyze post-2015 Supreme Court jurisprudence, particularly *Nabam Rebia* (2016) and *Shrimanth Balasaheb Patil* (2020), which have significantly reinterpreted the Speaker's powers. Second, there is limited integration of comparative insights into reform proposals tailored for India's federal parliamentary system. Third, the literature rarely centers the citizen's perspective—what might be called the “democratic compact” as the ultimate normative benchmark. This paper addresses these gaps by focusing on citizen-centered governance as the evaluative framework.

Research Methodology

This study adopts a doctrinal legal research methodology, supplemented by comparative constitutional analysis. Doctrinal research involves the systematic analysis of legal rules, principles, and precedents to identify inconsistencies, ambiguities, and areas for reform (Hutchinson & Duncan, 2012). Comparative analysis extends this by examining how other jurisdictions address similar problems, allowing for context-sensitive policy recommendations.

Data Sources

Primary sources include:

- The Constitution of India, specifically the Tenth Schedule as amended by the Ninety-First Amendment Act, 2003.
- Supreme Court of India judgments: *Kihoto Hollohan v. Zachillhu* (1992) 1 SCC 309; *Nabam Rebia v. Deputy Speaker* (2016) 8 SCC 1; *Keisham Meghachandra Singh v. The Hon'ble Speaker, Manipur Legislative Assembly* (2020) 17 SCC 789; *Shrimanth Balasaheb Patil v. Karnataka Legislative Assembly* (2020) 19 SCC 396.
- Parliamentary records and reports of the Election Commission of India.
- Secondary sources include peer-reviewed journal articles, books on Indian constitutional law, and law commission reports (particularly the 170th Report on Reform of Electoral Laws, 1999, and the 255th Report on Electoral Reforms, 2015).

Comparative Cases

Three jurisdictions were selected based on their relevance to different aspects of the defection problem:

1. **United Kingdom** – for its citizen-initiated recall mechanism.

2. **South Africa** – for its experience with floor-crossing windows.

3. **Germany** – for its constructive vote of no confidence.

Selection criteria included: (a) parliamentary or Westminster-derived system, (b) existence of formal or informal anti-defection mechanisms, and (c) availability of authoritative English-language legal materials.

Limitations

This study does not include empirical survey data from legislators or voters, nor does it conduct quantitative analysis of defection rates across all state assemblies due to data inconsistency. However, the doctrinal approach is appropriate for the research question, which focuses on legal design and constitutional interpretation.

Results / Findings

The findings are organized into three categories: (A) judicial interpretation of the Tenth Schedule, (B) patterns of evasion and institutional failure, and (C) comparative insights.

A. Judicial Interpretation: Evolving but Incomplete Safeguards

The Supreme Court has issued several landmark rulings that have partially corrected the law's deficiencies, but significant gaps remain.

***Kihoto Hollohan v. Zachillhu* (1992)**– The Court upheld the Tenth Schedule's constitutionality, ruling that it does not violate the basic structure doctrine. Crucially, it struck down paragraph 7(2), which purported to make the Speaker's decision final and immune from judicial review. The Court held that the Speaker, while exercising powers under the Tenth Schedule, acts as a tribunal and is subject to judicial review on grounds of jurisdictional error, perversity, or violation of natural justice. This was a significant check on Speaker absolutism.

***Nabam Rebia v. Deputy Speaker* (2016)**– In a landmark ruling, a five-judge constitution bench held that the Speaker cannot exercise powers under the Tenth Schedule when a resolution for their own removal is pending. More broadly, the Court ruled that the Speaker is not an arbitrator but an authority functioning within the constitutional framework, and that the courts can intervene before the Speaker's decision if the proceedings themselves are manifestly illegal. This judgment curtailed the Speaker's ability to delay or manipulate disqualification proceedings for partisan advantage.

***Keisham Meghachandra Singh v. The Hon'ble Speaker* (2020)**– The Court reiterated that Speakers have a constitutional duty to decide disqualification petitions within a “reasonable period,” which it defined as three months in ordinary circumstances. The Court noted that in this case, petitions had been pending for over 18 months, calling it a “serious dereliction of constitutional duty.” However, the Court stopped short of prescribing automatic consequences for delay, leaving enforcement weak.

***Shrimanth Balasaheb Patil v. Karnataka Legislative Assembly* (2020)**– A political crisis in Karnataka saw a series of resignations and disqualifications. The Court held that the Speaker's decision to disqualify 17 rebel MLAs was subject to judicial review, and that the Speaker cannot act with “unfettered discretion.” The Court also clarified that



the “voluntarily giving up membership” (under paragraph 2(1)(a)) includes not only express resignation but also conduct that clearly implies abandonment of party allegiance. However, the Court did not provide clear evidentiary guidelines, leaving room for subjective Speaker interpretation.

Finding 1: The judiciary has consistently restrained the most extreme forms of Speaker partisanship and delay. However, judicial remedies are post hoc, case-specific, and often available only after months or years of political damage. The law still lacks an *institutional* check independent of the Speaker.

B. Patterns of Evasion and Institutional Failure

Analysis of parliamentary and Election Commission data reveals three persistent pathologies.

Pathology 1: Mass Resignations as a Legal Loophole

The Tenth Schedule disqualifies members who “voluntarily give up” membership or vote against the whip. It does not

Table 1

Average Disposal Time for Disqualification Petitions (2015–2022)

State Assembly	Number of Petitions	Average days to decision	Petitions pending > 1 year	Speaker’s party majority
Uttar Pradesh	12	189	4	Same as ruling party
Karnataka	9	214	3	Same
Maharashtra	14	176	5	Same
West Bengal	8	312	6	Same
Tamil Nadu	6	98	1	Different (coalition)
Punjab	7	142	2	Same

Note. Data compiled from Assembly annual reports, Election Commission of India (2023), and case records. Average days rounded to nearest whole number.

The data show that in assemblies where the Speaker belongs to the same party as the ruling dispensation, decision times are longer (averaging 177–312 days) compared to Tamil Nadu (98 days), where the Speaker was from a coalition partner with a more neutral stance. Moreover, in 23 out of 56 petitions (41%), no final decision had been issued within one year. These delays effectively nullify the deterrent effect of the law, as defectors can enjoy the benefits of their new political alignment while disqualification proceedings languish.

Pathology 3: The Split and Merger Exception (Now Restricted)

The original Tenth Schedule allowed a split if one-third of a party’s members broke away; this was later amended by the Ninety-First Amendment (2003) to require a merger involving two-thirds of the party’s members. However, the “merger” exception remains a channel for large-scale defections. In 2019, the Goa legislative assembly saw a merger of 10 out of 15 Congress MLAs into the Bharatiya Janata Party (BJP), with the Speaker (from the BJP) recognizing the merger within 48 hours. The remaining five Congress MLAs challenged this, but the matter remained pending for over two years (Tewari, 2021). The exception, intended for genuine mergers, has been weaponized for engineered takeovers.

disqualify members who resign *en masse* and then join another party after resigning. Between 2015 and 2023, at least nine state assemblies experienced episodes where 10 or more MLAs resigned simultaneously, only to contest by-elections on a different party ticket or join the ruling party (Association for Democratic Reforms, 2023). For example, in the 2020 Madhya Pradesh political crisis, 22 Congress MLAs resigned, leading to the collapse of the government. None were disqualified under the Tenth Schedule because they resigned before voting against the whip. This is a glaring loophole that the law has failed to address.

Pathology 2: Speaker Delay and Partisanship

Table 1 summarizes the disposal time for disqualification petitions filed in six state assemblies between 2015 and 2022, based on data compiled from Assembly records and reported judgments.

Finding 2: The Anti-Defection Law has not eliminated defection; it has displaced it into less regulated forms (mass resignations, mergers, Speaker-dependent adjudication). The law’s procedural architecture is systematically biased in favor of ruling parties and against timely, impartial justice.

C. Comparative Insights: Alternative Models

The United Kingdom’s **Recall of MPs Act 2015** offers a citizen-centric alternative. Under the Act, a recall petition is triggered only if an MP is convicted of an offense (and sentenced to imprisonment or suspended from the House for at least 10 sitting days). If 10% of eligible constituents sign the petition within six weeks, the MP is removed and a by-election is held. This model does not disqualify MPs for ordinary votes or party changes; it only addresses serious misconduct. Its advantage is direct citizen control; its disadvantage is that it does not prevent defections that destabilize governments.

South Africa’s **floor-crossing windows** (2002–2009) allowed members to change parties only during designated periods (initially 15 days each year), provided that the total number of defectors did not cause a by-election threshold. This approach regularized defections but did not prevent them. The experiment was ultimately abandoned because it led to post-election realignments that distorted the popular vote (Murray, 2017).

Germany’s **constructive vote of no confidence** (Article 67 of the Basic Law) provides that a government can only be removed by a vote of no confidence if a majority of



Bundestag members simultaneously elect a successor. This makes opportunistic defections to topple a government without a viable alternative impossible. However, Germany does not restrict ordinary party switching by individual members, which occurs rarely due to strong party discipline.

Finding 3: No foreign model is directly transplantable to India, but each offers a useful element: (a) citizen-initiated recall (UK) addresses accountability, (b) time-bound windows (South Africa) reduce strategic timing, and (c) constructive no-confidence (Germany) protects government stability without silencing dissent on routine legislation.

The findings reveal a central paradox: the Anti-Defection Law, as currently structured, undermines the very democratic values it was intended to protect. This discussion organizes the paradox around the four normative criteria introduced earlier.

Stability Versus Stagnation

The law has indeed reduced the frequency of sudden government collapses caused by individual defections. However, stability purchased at the price of legislative paralysis is not democratic stability. Because the whip applies to virtually all votes (including procedural and non-confidence motions), legislators are reduced to voting machines for party high commands. Deliberation which is the heart of parliamentary democracy has suffered. As former Speaker of the Lok Sabha Meira Kumar observed, “The Tenth Schedule has made the legislature a place of robots, not representatives” (cited in Bhargava, 2018, p. 87). The law’s overbreadth is its original sin: it treats a vote on a local irrigation bill the same as a vote on a no-confidence motion.

Accountability Versus Autocracy

The law claims to protect the voter’s mandate, but it removes the voter’s ability to hold an individual representative accountable for local issues. If a legislator wishes to advocate for a constituency-specific interest against the party whip, they face disqualification. The only recourse for voters is to wait for the next general election. This is a five-year accountability vacuum. The UK recall model, by contrast, gives voters an intermediate tool. India should consider a similar mechanism, but only for serious misconduct or consistent violation of constituency interests, not for every cross-vote.

Representation Versus Party Dictatorship

The law’s assumption that the party’s manifesto exhaustively represents the voter’s will is empirically false. Voters often support a candidate for personal qualities, local work, or caste/community representation, not just party platform (Chandra, 2017). By punishing defection even when a legislator acts in what they genuinely believe to be the constituency’s interest, the law systematically overrides substantive representation in favor of formal party loyalty. The solution is not to abolish the law but to limit its application to votes that determine the government’s survival (confidence and money bills). On all other votes, legislators should be free to vote according to their conscience or constituency, subject to public disclosure and potential recall.

Procedural Fairness: The Speaker’s Conflict of Interest

The most damning finding is the institutionalized conflict of interest in the Speaker’s role. The Speaker is typically a senior member of the ruling party, appointed with the government’s support. Asking the same Speaker to neutrally adjudicate disqualification petitions involving that party’s interests is a violation of natural justice. The Supreme Court has tried to mitigate this through judicial review, but judicial intervention is slow, expensive, and post hoc. The only durable solution is to remove adjudication from the Speaker entirely and vest it in an independent, non-partisan body such as the Election Commission or a specially constituted Anti-Defection Tribunal with strict timelines (e.g., 45 days) and appeal to the Supreme Court.

The Democratic Compact Reimagined

The underlying normative failure is that the law treats the voter-legislator relationship as a one-time contract at election time, rather than an ongoing compact of accountability. A genuine democratic compact requires that legislators be free to deliberate and vote, but also that voters have timely mechanisms to sanction betrayal. The current law offers neither: legislators are unfree, and voters are powerless. Reforms should invert this logic: maximize legislative freedom on non-survival votes, and maximize voter power through recall.

Conclusion

This paper has demonstrated that India’s Anti-Defection Law, while successful in reducing naked floor-crossings, has produced three unintended consequences: (1) the displacement of defection into mass resignations and engineered mergers, (2) the concentration of power in partisan Speakers leading to delayed and biased adjudication, and (3) the erosion of legislative deliberation and constituency representation. The law violates the basic structure doctrine’s implied principles of democracy and separation of powers insofar as it grants a partisan Speaker quasi-judicial authority without adequate institutional checks.

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Reform Proposals

Based on the analysis, the following reforms are recommended:

1. **Limit disqualification to votes affecting government stability.** Only votes on (a) express motions of no confidence and (b) money bills (as defined under Article 110) should attract disqualification if a member votes against the party whip. All other votes should be free. This requires a constitutional amendment to paragraph 2(1)(b) of the Tenth Schedule.
2. **Establish an independent Anti-Defection Tribunal.** Adjudication of disqualification petitions should be transferred to a three-member tribunal comprising a retired Supreme Court judge (as chairperson), the Chief Election Commissioner (or nominee), and an eminent constitutional law expert. The tribunal should be bound to decide within 45 days of filing, failing which the petition is deemed to be decided in favor of the member.
3. **Introduce a citizen-initiated recall mechanism.** Modeled on the UK Recall of MPs Act 2015, but adapted to Indian conditions: if 15% of eligible voters in a constituency sign a recall petition (verified by the Election Commission within 60 days) on grounds of (a) conviction for a criminal offense with imprisonment of 1 year or more, (b) consistent voting against declared constituency interests as defined by law, or (c) voluntarily giving up party membership outside the permitted context, then a by-election shall be held. This restores citizen accountability without frequent elections.
4. **Abolish the merger exception.** The two-thirds merger exception has been repeatedly abused. There is no principled reason to allow a group of defectors to avoid disqualification simply because they cross together. The exception should be deleted entirely.
5. **Mandate automatic disqualification for resignation.** Resigning from membership should automatically trigger disqualification and a by-election, unless the resignation is accepted by the Speaker (after verification that it is voluntary and not coerced) within 7 days. This closes the mass resignation loophole.

Implications for Governance and Future Research

For policy makers, these reforms would transform the Anti-Defection Law from a tool of party control into an instrument of citizen-centered governance. For political parties, they would incentivize internal democracy and persuasion over coercion. For citizens, they would restore a meaningful sense of representation and the ability to sanction errant legislators.

Future research should empirically test the effects of these proposed reforms using comparative case studies of states that have experimented with greater legislative freedom (e.g., Tamil Nadu's relatively independent Speakers). Additionally, qualitative research with legislators and voters could illuminate the lived experience of the whip system and the demand for recall.

Finally, the paper acknowledges a limitation: it does not address the role of nominated members or members of the

upper house (Rajya Sabha), where defection dynamics differ. Subsequent studies should extend the analysis to these contexts.

The democratic compact between citizen and representative is too precious to be sacrificed on the altar of stability. India's Anti-Defection Law, born from the chaos of the 1980s, has outlived its utility. It is time to rethink, reform, and re-democratize.

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Original Article

Impact of Influencer Marketing on Consumer Buying Decisions

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Abstract:

Nowadays people are connected more with social media and follow those items and people they like more. So, brands started collaborating with influencers to attract customers. Influencer marketing is a potent social media marketing strategy that uses influencers to promote products, services, or brands to their intended audiences. The paper aims to study the impact of influencer marketing on the consumer buying decisions. We studied the use of social media, engagement of influencers and the importance of trust and credibility in affecting consumer behaviour. It is found that younger generation use social media to large extent, with YouTube and Instagram being the most popular online platforms. 68% of respondents are active followers of influencers. 60% of respondents report that they frequently make purchases based on influencer recommendations. The fitness, fashion and beauty are the most attracted categories for influencer engagement. The interactive engagement, content relevance and trust in influencers are found to be important factors to successful influencer marketing. Brands and influencers are advised to cultivate trust, uphold authenticity, and tailor content to audience preferences to maximize the beneficial effect on consumers, which can lead to increased brand loyalty and higher conversion rates.

Introduction:

Social media already had a significant impact on consumer purchase decisions. Nowadays people are connected more with social media and follow those items and people they like more. Particularly youngsters use social media to a great extent, and generally they trust influencers more than celebrities. Brands have used celebrities to sell products since long before athletes first appeared on cereal boxes. But influencer marketing and celebrity endorsements are not quite the same thing. Celebrity endorsements typically involve a company making a huge investment in someone, but it's difficult to specify the exact return on that investment. With influencer marketing, it's easier to figure out the ROI because companies can closely monitor likes, shares, online conversations, and so forth. Influencer marketing is a potent social media marketing strategy that leverages influencers to promote products, services, or brands among their targeted audiences. Influencers are individuals and organizations that have large, active online followers on their social media accounts. Influencers have emerged as crucial figures in shaping consumer behavior due to their expert knowledge in their respective fields. They upload some real or sponsored content to social media platforms like Instagram, YouTube, TikTok, Facebook, Twitter (X), and other online channels. Influencer marketing is when a brand takes up influencers who are well-known and have a following on social media platforms to talk about or mention the brand in a post on social media. There is a wide variety of sub-niches, audiences reached, and levels of reputation among influencers. Influencer marketing works because of the high trust social influencers have built with their following over time. So influencer recommendations serve as a form of social proof to potential customers of a particular brand. Some of the social media influencers have large, broad audiences spreading across several demographics. While others have smaller but more targeted and engaged audiences. Managers must decide what type of influencers they need to promote their offerings. Selection is to be based in terms of audience reach, range, cost, and engagement. When a brand collaborates with influencers, they begin featuring the brand in their content and introduce it to new audiences who may not have been familiar with it. Also, the trust they hold with their followers enhances the brand's reputation and credibility and boosts market awareness. In fact, influencer marketing is collaboration between popular social media users and brands to promote brands' products or services. The objective of this paper is to study the impact of influencer marketing on consumer buying decisions.

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Review of Literature:

Sudha and Sheena (2017) found that blogs have a significant impact on young women buying behavior. This study recommends the investing into relationship building with a blogger and indirectly engaging the company's target customer base; company trust and customer loyalty can be built, resulting in higher sales and profitable long-term customer relationships. **Agrawal & Vazirani (2023)** found that beauty influencers have a substantial impact on Generation Z's purchasing decisions. They have also discovered that important aspects in influencing their purchasing behaviour were the influencer's Expertise, Quality of information, brand familiarity and trustworthiness. **Bhattaru and Suvarsha (2024)** explored that influencers play a significant part in shaping the behavior of customers in the digital environment, especially with regard to customers who are on the verge of making a purchase. It is concluded that clear that social media influencer marketing has, in fact, brought about a beneficial change in the manner in which businesses connect with their customers. **Septiani (2025)** looks at how influencer marketing affects customer purchasing decisions, with a focus on trust, engagement, and authenticity. Thorough examination of the literature they evaluated the effectiveness of influencer marketing initiatives and identify the mechanisms by which influencers change customer behavior. The findings indicate that influencer credibility and the ability to develop emotional connections with

audiences are important elements in generating purchasing intent.

Objectives the Study:

- To study the level of social media usage among respondents.
- To examine the level of influencer engagement and trust among respondents.
- To evaluate the impact of influencer marketing on consumer buying decisions.
- To examine the impact of following social media influencers and age on consumer purchase behavior.

Hypothesis of the Study:

- There is no significant relationship between influencer marketing and consumer purchasing behavior.
- There is no significant relationship between age and influencer-driven purchase behavior

Research Methodology:

Area of Study: The study is undertaken in Koppal city.

Data: This study uses both primary and secondary data. The primary data was collected from sample respondents using a structured questionnaire. Secondary data was collected from journals, magazines, websites, etc.

Sample Size: The initial sample of the study is 137, and the final sample includes 93 respondents who do follow social media influencers.

Sampling Technique: This study uses the convenience sampling technique for the selection of respondents.

Tools: The chi-square test is used to test the hypothesis.

Data Analysis and Interpretations:

Table 1: Demographic Profile of the Respondents:

Category	Sub Category	Frequency	Percentage (%)
Gender	Male	42	45.16
	Female	51	54.84
Age Group	18-24	31	33.33
	25-34	25	26.88
	35-44	18	19.35
	45-54	10	10.75
	>55	9	9.68
	<SSLC	21	22.58
Educational Level	PUC	19	20.43
	Degree	36	38.71
	>PG	17	18.28
	Student	24	25.81
Occupation	Employed	39	41.94
	Self Employed	12	12.90
	Unemployed	18	19.35
	<10000	28	30.11
Monthly Income Level	10001-30000	35	37.63
	30000-50000	19	20.43
	>50001	11	11.83

(Source: Field Survey)

Table 1 shows the demographic profile of the respondents. It reveals a slightly higher proportion of females (54.84%) than males (45.16%), with the majority being young adults aged 18-34 years (60.21%). Educational attainment is generally high, as over half of the respondents (56.99%) possess at least a degree or higher qualification, while a smaller segment falls below SSLC (22.58%). In terms of occupation, most participants are employed (41.94%),

followed by students (25.81%), with the remainder being self-employed (12.90%) or unemployed (19.35%). Monthly income levels show that 37.63% earn between ₹10,001 and ₹30,000, while 30.11% report incomes below ₹10,000, and only a minority (11.83%) earn above ₹50,000. This data indicates a predominance of lower- to middle-income groups within the sample.

Table 2: Usage of Social Media among Respondents:

Questions	Category	Frequency	Percentage (%)
1. Which social media platforms do you use regularly?	Instagram	78	83.87
	YouTube	85	91.40
	Facebook	61	65.59



	X (Twitter)	59	63.44
	Others	70	75.27
2. How many hours per day do you spend on social media?	Less than 1 hour	10	10.75
	1–2 hours	44	47.31
	3–4 hours	32	34.41
	More than 4 hours	7	7.53
3. Do you follow social media influencers?	Yes	93	67.88
	No	44	32.12
4. How often do you follow social media influencers?	Very Frequently	45	48.39
	Regularly	34	36.56
	Sometimes	8	8.60
	Rarely	6	6.45

(Source: Field Survey)

Table 2 depicts that social media usage is highly prevalent among respondents. The majority of the respondents use YouTube (91.40%) and Instagram (83.87%) and they emerged as the most commonly used platforms. Other platforms such as Facebook (65.59%) and X (Twitter) (63.44%) also maintain significant usage, while a notable proportion (75.27%) engages with other platforms as well. This indicates that respondents are active across multiple social media channels, reflecting a diversified digital presence. In terms of time spent, the majority of respondents (47.31%) use social media for 1–2 hours daily, followed by 34.41% who spend 3–4 hours. A smaller segment spends either less than 1 hour (10.75%) or more than 4 hours (7.53%), suggesting that moderate daily usage is most common among participants. In case of following

influencers, the majority (67.88%) of respondents indicating that they do follow social media influencers, while 32.12% do not. This indicates that although influencer culture is widespread, it does not engage all users equally. Out of those who follow influencers, a significant proportion does so actively. 48.39% follow influencers very frequently, and 36.56% regularly, indicating a high level of engagement. Smaller percentages follow influencers only sometimes or rarely, reinforcing that influencer interaction varies across individuals. Overall, the findings reveal that the social media is deeply integrated into daily routines, with platforms like YouTube and Instagram dominating usage. Additionally, a substantial portion of users actively follow influencers, providing a strong foundation for influencer marketing to impact consumer behavior.

Table 3: Influencer Engagement and Trust:

Questions	Category	Frequency	Percentage (%)
1. What type of influencers do you follow most?	Mega (1M+)	39	41.94
	Macro (100k–1M)	30	32.26
	Micro (10k–100k)	18	19.35
	Nano (<10k)	6	6.45
2. What kind of content do you engage with most?	Fashion & Beauty	77	82.80
	Technology & Gadgets	51	54.84
	Health & Fitness	74	79.57
	Food & Travel	48	51.61
	Lifestyle & Motivation	72	77.42
	Others	25	26.88
3. How much do you trust influencers' recommendations?	Not at all	5	5.38
	Slightly	8	8.60
	Moderately	17	18.28
	Very	25	26.88
	Completely	38	40.86
4. What makes an influencer trust worthy in your opinion?	Honesty & transparency	60	64.52
	Expertise in niche	40	43.01
	Consistent content	48	51.61
	Engagement with followers	68	73.12
	Brand collaborations	58	62.37
	Other	26	27.96

(Source: Field Survey)

Table 3 reveals that the majority of respondents prefer following mega influencers (41.94%), followed by macro influencers (32.26%), suggesting that individuals are more inclined toward influencers with larger audiences and wider reach. However, a noticeable portion also follows micro influencers (19.35%), indicating the presence of niche audience engagement. In terms of content preferences, fashion & beauty (82.80%), health & fitness (79.57%), and lifestyle & motivation (77.42%) emerge as the most engaging categories. This indicates that visually appealing and personally relatable content tends to attract more audience interaction, while categories like technology, food, and travel receive comparatively moderate engagement. In terms of trust levels on influencer's recommendations, the

majority of the respondents (40.86%) have complete trust on influencers, followed by high trust (26.88%) and only a small percentage expresses low trust, indicating that influencers play a credible role in shaping consumer perceptions and decisions. When examining factors that build trust, engagement with followers (73.12%) is identified as the most important element, followed by honesty & transparency (64.52%) and brand collaborations (62.37%). This highlights that audiences value interactive communication, authenticity, and visible partnerships. Overall, the findings reveal that influencer marketing is strongly driven by audience trust, content relevance, and active engagement, which collectively enhance the effectiveness of influencers in impacting consumer behavior.

Table 4: Influence on Purchase Behavior:



Questions	Category	Frequency	Percentage (%)
1. Have you ever purchased a product or service based on an influencer's recommendation?	Yes	56	60.22
	No	15	16.13
	Not sure	22	23.66
2. How often do you purchase products recommended by influencers?	Never	15	16.13
	Rarely	10	10.75
	Sometimes	12	12.90
	Frequently	25	26.88
	Very Frequently	31	33.33
3. What types of products have you purchased based on influencer recommendations?	Clothing/Fashion	58	62.37
	Beauty/Skincare	65	69.89
	Tech/Gadgets	25	26.88
	Food/Drinks	43	46.24
	Fitness/Health	62	66.67
	Digital services (courses, apps)	15	16.13
	Other	10	10.75
4. How satisfied were you with products bought through influencer recommendations?	Very Unsatisfied	8	8.60
	Unsatisfied	5	5.38
	Neutral	10	10.75
	Satisfied	28	30.11
	Very Satisfied	42	45.16
5. What factor influences your decision the most when buying from influencer recommendations?	Product reviews	58	62.37
	Influencer's credibility	70	75.27
	Discounts or promo codes	57	61.29
	Brand reputation	48	51.61
	Visual appeal of content	40	43.01
	Peer engagement/comments	38	40.86

(Source: Field Survey)

Table 4 reveals that influencer marketing has a noticeable impact on consumer purchasing decisions. The majority of the respondents (60.22%) reported that they have purchased a product or service based on an influencer's recommendation, while a smaller proportion (16.13%) have not, and 23.66% remain uncertain. This indicates that influencer-driven purchases are fairly common among consumers. In terms of purchase frequency, a significant number of respondents engage regularly with influencer recommendations. The majority of the respondents fall under very frequently (33.33%) and frequently (26.88%), suggesting that influencer promotions often translate into repeated buying behavior. Only a small percentage reported rarely or never making such purchases. In case of product categories, the most commonly purchased items are beauty/skincare (69.89%), fitness/health (66.67%), and clothing/fashion (62.37%). This suggests that influencers are particularly effective in industries that are visually driven and lifestyle-oriented. In contrast, categories like tech/gadgets (26.88%) and digital services (16.13%) show

Table 5: Results of Chi Square Test

Hypothesis	χ^2 Value	Df	Critical Value @ 0.05%	Result
1	20.74	2	5.99	Significant
2	19.07	2	5.99	Significant

(Source: Computed)

Table 5 shows the results of the Chi square test. In case of hypothesis 1 the computed value (20.74) is more than the critical value (5.99), so we have rejected the null hypothesis. This implies there is a significant relationship between following social media influencers and consumer purchase behavior. Respondents who follow influencers are significantly more likely to purchase products based on their recommendations. In case of hypothesis 2 the computed value (19.07) is more than the critical value (5.99), so we have rejected the null hypothesis. This implies that age has a significant influence on influencer-based purchases. There is a significant relationship between age and influencer-driven purchase behavior. Particularly younger respondents

lower influence, possibly due to the need for more detailed evaluation before purchase. Regarding satisfaction levels, the majority of respondents express positive experiences with influencer-recommended products. 45.16% are very satisfied and 30.11% are satisfied, while only a small proportion report dissatisfaction. This indicates that influencer recommendations generally meet or exceed consumer expectations, reinforcing trust and encouraging future purchases. Finally, the most influential factor in purchase decisions is the influencer's credibility (75.27%), followed by product reviews (62.37%) and discounts or promotional codes (61.29%). Factors such as brand reputation, visual appeal, and peer engagement also play important roles but to a lesser extent. This suggests that while promotional incentives matter, trust in the influencer remains the key driver of consumer behavior. Overall, the table demonstrates that influencer marketing significantly shapes purchasing behavior through a combination of credibility, satisfaction, and consistent engagement, making it an effective strategy for influencing consumer decisions.

(18–24) are more likely to make purchases influenced by social media influencers compared to other age groups.

Findings of the Study:

The analysis of the data reveals several important insights regarding the impact of influencer marketing on consumer behavior:

- The majority of respondents (60.21%) fall under 18–34 age group, indicating that younger individuals are the primary users of social media and are more exposed to influencer content.



- It is found that the YouTube and Instagram dominate usage, confirming that visually engaging and video-based content plays a crucial role in attracting users.
- The majority of the respondents (47.31%) spend 1–2 hours daily on social media, showing consistent exposure to digital content.
- More than 50% of the respondents follow influencers, and a large portion (62.36%) engages with them frequently. This indicates that influencer culture has a strong presence, although not universally adopted by all users.
- The Majority of the Respondents (42%) tend to follow mega influencers, suggesting a preference for influencers with a larger reach and visibility.
- Categories such as fashion & beauty, health & fitness, and lifestyle receive the highest engagement. These areas are closely linked to personal identity and daily life, making them more influential.
- The majority of respondents (67.74%) show highest trust in influencer recommendations. Trust is mainly built through engagement, transparency, and authenticity.
- More than half of the respondents have made purchases based on influencer recommendations, and many do so frequently. This confirms that influencer marketing has a direct impact on consumer buying behavior.
- Products related to beauty, fitness, and fashion are most commonly purchased through influencer promotions, while technical and digital products show lower influence.
- The majority of the respondents (45%) are very satisfied with their purchases, indicating that influencer recommendations generally meet expectations and reinforce trust.
- The most important factor influencing purchase decisions is the influencer's credibility, followed by product reviews and promotional offers. This highlights that trust outweighs mere advertising appeal.

Suggestions of the Study:

- Trust plays a vital role in consumer decisions. So influencers should maintain honesty in their promotions.
- Influencers should actively interact with followers. Comments, replies, live sessions significantly enhance credibility and trust.
- Brands should collaborate with influencers.
- Influencers should create engaging content in high-performing categories like fashion, fitness, and lifestyle.
- While mega influencers have wider reach, brands should also consider micro influencers who often have stronger connections with niche audiences.
- Consumers rely heavily on reviews before purchasing, so influencers should provide honest and informative content rather than purely promotional messages.
- Discount codes and special offers can effectively motivate consumers to make purchase decisions.
- Since younger users dominate social media usage, marketing strategies should be tailored to their preferences and behaviors.
- High satisfaction levels should be maintained by promoting only reliable products, as negative experiences can quickly damage trust.
- Brands should focus on platforms like YouTube and Instagram but also explore emerging platforms to reach wider audiences.

- Continuous feedback and analysis of consumer behavior should be used to refine influencer marketing campaigns for better effectiveness.

Conclusion:

This study shows that influencer marketing has a strong and direct effect on what people decide to buy, especially among young people and those who digitally active. Platforms like YouTube and Instagram are very popular among respondents, and many users trust the recommendations given by influencers—mainly when influencers seem real and interact with their followers. The study finds that influencer marketing not only changes people's plans to buy something but also makes them buy more often and feel satisfied. The trust in the influencer is the biggest reason people buy, even more than regular advertisements. If brands and influencers are open, interact with their audience, and share things that matter to them, they can build strong trust and get better results. As influencer marketing keeps changing, it is important for brands and influencers to listen to feedback, adjust to what users like, and always aim to give real value. This will help influencer marketing keep having a good effect on how people shop.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Original Article

The Home That Exiles: Rethinking Marriage through a Diasporic Feminist Lens

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Abstract

*This article investigates the intersection of marriage, domesticity, and diasporic identity as experienced by South Asian immigrant women, with Jhumpa Lahiri's *The Namesake* (2003) serving as its central literary text. Drawing on diasporic feminist theory, the article argues that for many immigrant women, the institution of marriage operates not only as a social contract but also as a site of cultural preservation, identity suppression, and emotional exile. Supplemented by readings of Bharati Mukherjee's *Jasmine* and Monica Ali's *Brick Lane*, the article demonstrates that the domestic space — far from being a refuge — becomes a terrain of double displacement: physical exile from the homeland and psychological exile within the adopted home. By examining characters such as Ashima Ganguli, the article challenges romanticised narratives of immigration and marriage, and calls for a reimagining of home as a space of agency, contradiction, and feminist becoming.*

Keywords: diaspora, feminism, marriage, Jhumpa Lahiri, *The Namesake*, domestic space, identity, immigrant women

Introduction: When Home Becomes a Sentence

Home is often imagined as a space of warmth, belonging, and rest. Yet for many immigrant women, the home — and the marriage that defines it — can become a form of confinement. The concept of home carries powerful symbolic weight in diasporic literature: it is simultaneously the place left behind, the place arrived in, and the internal landscape of selfhood that one carries between both. When marriage is added to this equation, the home becomes even more complex. It is at once a cultural institution, a survival strategy, and, for women in particular, a space where identity is negotiated, constrained, and sometimes lost.

This article takes Jhumpa Lahiri's acclaimed novel *The Namesake* (2003) as its primary text, with particular attention to the character of Ashima Ganguli, an Indian woman who marries Ashoke Ganguli and follows him to the United States. Ashima's experience of marriage and domesticity in America encapsulates what this article terms the "double exile" — the simultaneous displacement from one's homeland and from one's own selfhood within the marriage. To situate this reading within a broader critical framework, the article draws on supplementary works by Bharati Mukherjee and Monica Ali, alongside diasporic feminist scholarship by Stuart Hall, Avtar Brah, and Chandra Talpade Mohanty.

The central argument of this article is that marriage, within the diasporic context, functions as a mechanism of both cultural continuity and personal exile. While it is often presented as a stabilising force for immigrant communities — a way of preserving tradition, language, and social identity — it simultaneously traps women within roles that leave little room for self-definition, grief, or growth. Rethinking marriage through a diasporic feminist lens, therefore, is not merely a literary exercise but a political one.

Diasporic Feminism: A Theoretical Framework

To understand the experience of immigrant women in marriage, it is necessary to begin with the theoretical tools that diasporic feminist scholarship offers. Stuart Hall's conception of diasporic identity as never fixed, always in a state of "becoming," provides a crucial starting point.

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For Hall (1990), identity is a production that is never complete, always in process, and always constituted within representation rather than outside it. This is especially true for women in the diaspora, whose identities are shaped not only by the experience of migration but also by the gendered expectations that travel with them.

Avtar Brah's notion of the "politics of home" deepens this analysis. Brah (1996) distinguishes between "home" as a mythic place of origin — that imagined, idealised homeland to which one can never truly return — and "home" as the lived, everyday place of habitation. For immigrant women, both of these homes can be sites of exclusion. The homeland is often remembered through a nostalgic lens that erases women's own experiences of constraint, while the new home in the diaspora replicates and sometimes intensifies patriarchal structures. Marriage sits at the very centre of this tension, serving as the primary means through which both the old home and the new home make their demands on women's bodies and lives.

Chandra Talpade Mohanty (1988) offers a further layer of analysis in her critique of Western feminist constructions of the "Third World woman" as a homogeneous, victimised figure. Mohanty warns against flattening the diverse and complex experiences of women across cultures into a single, monolithic narrative. This article takes this warning seriously: Ashima Ganguli is not simply a victim. She is a woman navigating extraordinarily difficult circumstances with resilience, ambivalence, and quiet resistance. Recognising this complexity is central to the diasporic feminist project.

Ashima Ganguli and the Architecture of Exile

Lahiri introduces Ashima Ganguli in the very first pages of *The Namesake* in a scene of striking domestic ordinariness: she is in the kitchen, mixing Rice Krispies with peanuts, chopped red onion, and lime juice, trying to recreate a snack she misses from Calcutta. The scene is small, almost trivial, yet it carries an enormous emotional weight. Ashima is not simply cooking; she is attempting to reconstruct a home that no longer exists for her, to find in the flavours of a childhood snack some comfort against the vastness of her loneliness. Lahiri writes that the result is "a humble approximation" of what she craves — and this phrase resonates far beyond food.

Ashima's entire existence in America is a "humble approximation" — of belonging, of comfort, of selfhood. She did not choose her marriage in the conventional sense of romantic love. She married Ashoke, a man she barely knew, through an arrangement made by her family. This is not presented in the novel as oppressive in any simple way; Lahiri is too sophisticated a writer for that. What she does instead is trace the quiet accumulation of compromises and losses that Ashima must absorb. She arrives in America without friends, without family, without language, without any of the social infrastructure that normally sustains a woman through early marriage and motherhood. When she goes into labour with Gogol, she is terrified, far from everyone she loves, and deeply alone. "There is no word in any language," Lahiri writes, "for what she is." This linguistic gap — the absence of a word to name Ashima's

specific form of displacement — is itself a feminist statement. The experience of the immigrant woman in marriage has been so thoroughly overlooked that language itself has failed to account for her.

What makes Ashima's exile so acute is that it is invisible. She lives in a house, she has a husband, she raises children, she participates in the social life of the Bengali immigrant community in Cambridge and later in suburban Massachusetts. From the outside, her life looks like a success — the immigrant dream fulfilled. But Lahiri invites us inside Ashima's consciousness, and there we find a woman perpetually on the threshold, never quite inhabiting any space fully. She is too Indian for America, too changed by America to return fully to India. Marriage has transplanted her, but it has not given her roots. It has given her a function — wife, mother, keeper of cultural tradition — but not a self.

Comparative Readings: Mukherjee's *Jasmine* and Ali's *Brick Lane*

While Lahiri's *The Namesake* provides the central framework for this analysis, a comparative reading with Bharati Mukherjee's *Jasmine* (1989) and Monica Ali's *Brick Lane* (2003) reveals the broader patterns through which marriage operates as a site of exile in diasporic women's literature. Each of these novels features a South Asian immigrant woman negotiating the demands of marriage within the alien landscape of the West, and each demonstrates, in different ways, the tension between cultural loyalty and personal liberation.

Mukherjee's *Jasmine* is, in many ways, the most radical of the three texts. *Jasmine* — or *Jyoti*, or *Jane*, as she is variously renamed throughout the novel — is a Punjabi woman who travels to America after the murder of her husband and undergoes a series of radical transformations. Unlike Ashima, *Jasmine* refuses stasis. She remakes herself repeatedly, shedding names, identities, and relationships in a process that is both empowering and deeply traumatic. Mukherjee uses *Jasmine*'s journey to suggest that survival in the diaspora requires not the preservation of cultural identity but its violent reinvention. Marriage, in this context, becomes one of the many skins that *Jasmine* must shed: her first husband represents the old world, her relationships in America represent attempts at a new self. Yet even Mukherjee cannot entirely escape the structures she critiques — *Jasmine*'s freedom is always contingent, always shadowed by violence, always purchased at enormous cost.

Monica Ali's *Brick Lane* offers a more socially grounded portrait of marital exile. Nazneen, a Bangladeshi woman, is sent to London as a young bride to marry Chanu, a man she has never met. Like Ashima, Nazneen spends much of the novel confined to the domestic space — cooking, cleaning, raising children, waiting. Ali is interested in the texture of this waiting, in the way that time moves differently for women who are not permitted to move freely through the world. Nazneen's gradual awakening — her affair, her growing political consciousness, her ultimately brave decision to remain in London on her own terms — charts a feminist trajectory that moves from the paralysis of marital



exile toward a tentative, hard-won sense of self. Crucially, Ali does not present this awakening as a rejection of Nazneen's culture; rather, it is a renegotiation of the terms on which she inhabits it.

Read together, Ashima, Jasmine, and Nazneen constitute a feminist geography of the diasporic home. Each occupies the domestic space differently, each negotiates its demands through different strategies of resistance and accommodation, and each ultimately reveals the degree to which marriage — as an institution — is shaped by and reshapes the experience of exile.

Cultural Preservation and the Burden of Womanhood

One of the most significant insights of diasporic feminist scholarship is the degree to which the preservation of culture falls disproportionately on women's shoulders. In immigrant communities under pressure from the dominant culture, women's bodies, behaviour, and choices become the terrain on which cultural identity is defended. Women are expected to cook traditional food, speak the mother tongue at home, raise children within the cultural and religious traditions of the homeland, and maintain the social bonds of the diasporic community. These expectations are rarely experienced as burdensome in isolation; each is, in itself, an act of love and belonging. But collectively, they constitute a regime of expectation that leaves little space for women's own desires, ambitions, or contradictions.

In *The Namesake*, this burden is distributed across generations. Ashima carries it almost entirely alone in the early years of her marriage; later, the burden shifts to her children, who are expected to honour a culture they have never fully inhabited. Gogol's rebellions — against his name, against his heritage, against his parents' expectations — are in some ways made possible by Ashima's silent absorptions. She has, over decades, held the family's cultural identity together through an enormous and largely unacknowledged act of will. Her grief, when Ashoke dies, is not only the grief of a wife but the grief of a woman who has defined herself entirely in relation to others and must now confront the terrifying freedom of having no role to play.

This is where Lahiri's feminism is most subtle and most moving: she does not celebrate Ashima's liberation. She allows her to move, in the novel's final pages, toward something that looks like independence — she takes a part-time job, she divides her time between India and America, she reclaims her own rhythm — but Lahiri is honest about the cost. The home that once exiled Ashima now partially releases her, but the years of accommodation cannot be undone. She is not the woman she might have been; she is the woman she had to become.

Reimagining Home: Feminist Possibilities in the Diasporic Space

If marriage in the diasporic context has operated as a site of exile, the question that a feminist reading must address is: what alternative models of home and belonging are possible? Diasporic feminist scholars have increasingly argued for a conception of home that is relational rather than fixed, hybrid rather than pure, and open to the contradictions of lived experience.

Avtar Brah's concept of "diaspora space" is useful here. Brah argues that the diaspora space is inhabited not only by those who have migrated but by those who are racialised as migrants — and that within this space, multiple identities intersect and contest. A feminist reimagining of home within the diaspora would need to make room for women's voices, women's desires, and women's refusals alongside their accommodations. It would need to recognise that cultural preservation is valuable but must not come at the cost of women's selfhood.

Lahiri, Mukherjee, and Ali all, in their different ways, gesture toward such a reimagining. None of them resolves the tension between belonging and freedom, between cultural loyalty and personal desire. But each of them insists on making that tension visible — on refusing the comfortable narratives that sentimentalise immigrant marriage as either a perfect cultural continuity or a simple oppression to be overcome. In doing so, they create what might be called a feminist poetics of the diasporic home: a literature that is simultaneously inside and outside, both at home and in exile, and deeply, urgently alert to the lives of the women who inhabit its borderlands.

Conclusion

The home, as imagined in dominant cultural narratives, is a place of arrival. For many immigrant women, it is also a place of departure — from the self, from agency, from the life that might have been. This article has argued that marriage, in the diasporic context, frequently operates as a mechanism of double exile: it displaces women from their homeland while constraining them within the adopted home. Through close readings of Jhumpa Lahiri's *The Namesake*, supplemented by Mukherjee's *Jasmine* and Ali's *Brick Lane*, it has traced the ways in which immigrant women negotiate this exile — through silence, through labour, through quiet resistance, and, occasionally, through transformation.

A diasporic feminist lens does not offer easy solutions. What it does offer is a more honest account of the costs and possibilities embedded in the institution of marriage for women who live between cultures. It insists that these women's experiences are neither singular nor reducible to victimhood. It recognises the enormous complexity of cultural loyalty, personal desire, and the structures — familial, social, national — within which women's lives are lived. And it imagines, however tentatively, a home that does not exile — a space in which women might be both rooted and free, both culturally located and irreducibly themselves.

The title of this article — "The Home That Exiles" — is intended not as a final verdict but as a provocation. Homes can be reimagined. Marriages can be renegotiated. The diasporic feminist project, as exemplified in the literature examined here, is precisely the work of that reimagining: slow, difficult, unfinished, and necessary.

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Original Article

Intersectional Challenges and Pathways to Empowerment: Examining the Lives of Dalit Women in India

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Abstract:

Dalit women in India represent one of the most marginalized groups in the world, facing systemic oppression due to their intersectional identity at the nexus of caste, gender, and class. This study delves into the unique challenges faced by Dalit women in socio-economic, political, and cultural spheres, emphasizing the pervasive discrimination and violence they endure. Simultaneously, the research highlights their resistance, agency, and contributions to social justice movements, education, and political reform. Drawing from historical and contemporary perspectives, this study aims to foster a deeper understanding of the lived realities of Dalit women and suggests pathways for policy interventions and societal transformation.

Keywords: Dalit women, caste-based violence, gender oppression, social exclusion, empowerment, intersectionality, India, social justice

Introduction:

India's caste system, one of the oldest forms of social stratification, has historically relegated Dalits—formerly referred to as "Untouchables"—to the margins of society. Among Dalits, women face additional layers of discrimination and exploitation due to their gender, creating a compounded experience of oppression. Despite the constitutional abolition of "untouchability," caste-based discrimination persists in various forms, profoundly impacting Dalit women's lives. This study seeks to explore the intersectional challenges faced by Dalit women while emphasizing their resilience and strategies for empowerment. Through an analysis of socio-economic inequalities, gendered violence, political exclusion, and cultural erasure, the research underscores the urgent need for inclusive policy frameworks and societal awareness to address these issues.

Historical Context of Dalit Women:

1 Marginalization In The Caste System:

The caste system, codified in ancient Indian scriptures, dehumanized Dalits and assigned them menial roles in society. Dalit women were doubly oppressed, as their gender further subjected them to patriarchal norms within their community and society at large. Historically, they were denied access to education, land ownership, and religious practices, perpetuating their social exclusion.

2 Gendered Dimensions of Caste Oppression:

Dalit women were often the targets of systemic violence, including sexual exploitation by upper-caste men. Practices such as temple prostitution (Devadasi system) exemplify how caste and gender intersect to oppress Dalit women.

Contemporary Challenges Faced by Dalit Women:

1 Socio-Economic Inequalities:

Education: Despite affirmative action policies, Dalit women experience low literacy rates due to limited access to quality education and early dropout rates caused by caste-based discrimination.

Employment: A significant proportion of Dalit women are employed as manual laborers in unorganized sectors, often in unsafe and exploitative conditions.

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Healthcare: Dalit women face disproportionate health risks due to inadequate healthcare access and discriminatory practices in public health services.

2 Gender-Based Violence:

Caste-based violence, particularly sexual violence, is a pervasive issue. According to various reports, Dalit women are disproportionately targeted in cases of sexual assault, often as a means of asserting caste dominance. The lack of justice in such cases exacerbates their vulnerability.

3 Political Exclusion:

Although Dalit women have legal rights to participate in politics, they face barriers such as patriarchal norms, caste discrimination, and tokenism in leadership roles. Their representation in legislative bodies and decision-making forums remains inadequate.

Dalit Women's Resistance And Empowerment:

1 Grassroots Movements:

Dalit women have spearheaded several grassroots movements to combat caste and gender oppression. Organizations such as the National Federation of Dalit Women (NFDW) advocate for their rights and challenge systemic injustices.

2 Role Of Education In Empowerment:

Education has been a transformative tool for Dalit women, enabling them to break free from traditional constraints and assert their agency. Government initiatives like scholarships for Scheduled Castes have encouraged educational participation, though challenges persist.

3 Political And Social Advocacy:

Dalit women leaders such as B. R. Ambedkar's wife, Ramabai Ambedkar, and contemporary figures like Radhika Vemula have inspired movements for equality and justice. Their voices have played a crucial role in bringing caste and gender issues to the forefront of national and international discussions.

Intersectionality And Feminism:

Dalit women's issues often remain underrepresented in mainstream feminist movements, which tend to prioritize gender over caste. Intersectionality—a framework that considers overlapping systems of oppression—is essential to understanding the unique struggles of Dalit women. Dalit feminism has emerged as a distinct strand within feminist discourse, addressing the specific challenges posed by caste and gender hierarchies.

Policy Implications And Recommendations:

1 Strengthening Legal Protections:

Laws such as the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act must be enforced rigorously to ensure justice for Dalit women.

2 Enhancing Education And Economic Opportunities:

Targeted schemes to improve access to education, vocational training, and entrepreneurship opportunities for Dalit women are critical for their socio-economic upliftment.

3 Promoting Political Representation:

Efforts to increase Dalit women's participation in local governance and legislative bodies can amplify their voices in policymaking.

4 Awareness And Advocacy:

Awareness campaigns highlighting the intersectional challenges faced by Dalit women can challenge societal attitudes and promote inclusive practices.

Main Challenges For Dalit Women In India:

Dalit women in India face a unique set of challenges due to the intersection of caste and gender-based discrimination. These challenges manifest across social, economic, political, and cultural dimensions, perpetuating cycles of inequality and oppression.

1 Socio-Economic Marginalization:

Limited Access To Education:

Dalit women experience low literacy rates and limited access to quality education due to systemic caste-based discrimination, economic constraints, and cultural barriers.

Economic Exploitation:

A significant portion of Dalit women are employed in manual labor or informal sectors, such as agricultural work, domestic labor, or sanitation jobs, often under exploitative and unsafe conditions.

Poverty:

Dalit women disproportionately live in poverty, with limited access to resources, land ownership, and financial independence.

2 Caste-Based Violence And Gender Oppression:

Sexual Violence:

Dalit women are frequently targeted in cases of sexual violence, often as a tool of caste dominance. Perpetrators are rarely held accountable, reinforcing their vulnerability.

Domestic Violence:

Gender norms within patriarchal systems, both within and outside Dalit communities, subject Dalit women to high levels of domestic abuse.

Honor Crimes:

Inter-caste relationships often result in violence or ostracization, particularly for Dalit women, who are seen as bearers of caste purity by upper-caste groups.

3 Lack Of Access To Healthcare:

Discrimination In Health Services:

Dalit women frequently face discriminatory treatment in healthcare facilities, leading to inadequate and substandard care.

Maternal And Child Health Issues:

High rates of malnutrition, anemia, and maternal mortality are prevalent among Dalit women due to poor access to prenatal and postnatal care.

4 Social Stigma And Exclusion:

Untouchability Practices:

Despite legal abolition, untouchability practices continue to marginalize Dalit women, excluding them from community resources, public spaces, and cultural events.

Cultural Erasure:



Dalit women's contributions to art, culture, and social movements are often ignored or devalued in mainstream narratives.

5 Political Exclusion:

Barriers to Representation:

Dalit women face systemic barriers to political participation, including lack of resources, intimidation by dominant castes, and tokenistic inclusion in leadership roles.

Underrepresentation:

Their representation in political decision-making bodies is minimal, leaving their voices and issues unheard in governance.

6 Intersectional Discrimination:

Dalit women face layered discrimination due to their caste, gender, and often class status. Unlike upper-caste women or Dalit men, their challenges are compounded, making their experiences unique and frequently overlooked in feminist and Dalit movements.

7 Challenges In Legal Redress:

Ineffective Enforcement of Laws:

Although laws like the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act exist, they are poorly implemented, and cases of violence against Dalit women often go unreported or unresolved.

Judicial Bias:

Discrimination within the judicial system leads to delays, biased rulings, and lack of justice for Dalit women.

8 Psychological And Emotional Trauma:

The cumulative impact of systemic oppression, violence, and social exclusion leads to significant psychological stress and trauma, often unaddressed due to stigma around mental health in India.

9 Limited Access To Technology And Digital Literacy:

Dalit women are often excluded from technological advancements and digital literacy programs, limiting their access to education, information, and opportunities in a digital economy.

10 Environmental Exploitation:

Living Conditions:

Dalit women often live in unhygienic and environmentally degraded areas, with poor access to clean water, sanitation, and waste management facilities.

Climate Change Vulnerability:

They are disproportionately affected by climate change impacts, such as displacement and loss of livelihood, due to their socio-economic vulnerability.

Suggestions:

Education Access:

- Provide scholarships and free education for Dalit girls.
- Establish anti-discrimination policies in schools and colleges.

Economic Empowerment:

- Promote vocational training and skill development programs.
- Increase access to microfinance and entrepreneurship opportunities.

Combat Violence:

- Strengthen enforcement of laws like the SC/ST (Prevention of Atrocities) Act.
- Establish fast-track courts for cases of violence against Dalit women.

Healthcare Inclusion:

- Improve healthcare facilities in marginalized areas.
- Provide free maternal and child healthcare services.

Political Representation:

- Ensure Dalit women's inclusion in leadership roles and decision-making bodies.
- Conduct capacity-building programs to encourage political participation.

Awareness and Advocacy:

- Launch campaigns to combat caste-based stigma and discrimination.
- Promote Dalit women's voices in feminist and social justice movements.

Social and Legal Reforms:

- Strengthen the judicial system to ensure timely justice.
- Penalize discriminatory practices in public and private institutions.

Technological Inclusion:

- Provide digital literacy programs and access to technology for Dalit women.

Environmental and Living Standards:

- Improve living conditions through sanitation and clean water initiatives.
- Create programs to mitigate the impact of climate change on vulnerable communities.

Conclusion:

Dalit women in India face profound challenges arising from the intersection of caste, gender, and socio-economic inequalities. Despite constitutional safeguards and progressive legislation, systemic oppression continues to marginalize them in every aspect of life. Addressing these issues requires a holistic approach that combines legal enforcement, education, economic empowerment, healthcare access, and societal transformation.

Empowering Dalit women is not only essential for achieving social justice but also critical for fostering inclusive development in India. By amplifying their voices, dismantling discriminatory practices, and promoting equitable opportunities, society can pave the way for a future where Dalit women are treated with dignity and respect. A sustained commitment to addressing their unique challenges will ensure their rightful place as equal citizens in the fabric of Indian society.

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I would like to express my sincere gratitude to all those who have supported and guided me in the completion of this research project titled "Intersectional Challenges and Pathways to Empowerment: Examining the Lives of Dalit Women in India." I am deeply indebted to my guide/supervisor for their invaluable guidance, constructive feedback, and continuous encouragement throughout the course of this study. Their expertise and insights have been instrumental in shaping this research.



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Original Article

Mental Health and Workplace Productivity in the Digital Era

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Abstract

Digital transformation has significantly altered the nature of work, enabling flexibility, speed, and global connectivity. At the same time, it has introduced new psychological demands on employees, including continuous engagement with digital systems and blurred work-life boundaries. This paper explores how mental health influences workplace productivity within digitally driven environments. Using a conceptual and analytical approach, the study examines key issues such as technostress, burnout, and digital fatigue, and their impact on employee performance. The findings suggest that compromised mental well-being leads to measurable declines in productivity, while supportive organizational practices and digital well-being initiatives can enhance both mental health and efficiency. The paper highlights the need for integrating human-centred strategies into digital work models to ensure sustainable organizational growth.

Keywords: Mental health, digital workplace, productivity, technostress, employee well-being, hybrid work

Introduction

The increasing reliance on digital technologies has reshaped modern workplaces across industries. Tools such as virtual communication platforms, cloud-based systems, and automation technologies have improved operational efficiency and enabled remote work. However, these developments have also changed how employees experience work, often increasing psychological pressure.

The expectation of constant availability and the overlap between professional and personal life have made mental health a central concern. Employees today face challenges such as digital overload, stress, and reduced downtime. These factors directly influence productivity, making mental well-being a critical element in organizational performance.

Objectives of the Study

- To analyze the relationship between mental health and employee productivity
- To examine the psychological impact of digital work environments
- To identify key stressors such as technostress and burnout
- To propose strategies for improving well-being and performance

Review of Literature

Existing research indicates a strong connection between mental health and workplace outcomes. Poor mental health conditions, including anxiety and depression, are associated with reduced efficiency, increased absenteeism, and lower engagement levels.

Studies on digital workplaces highlight that excessive reliance on technology can create stress due to constant connectivity and information overload. This phenomenon, often referred to as technostress, affects both cognitive functioning and emotional stability.

At the same time, research suggests that well-designed digital interventions—such as online counseling and employee wellness platforms—can positively influence mental health. Organizations that prioritize psychological well-being tend to experience higher productivity and improved employee retention.

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Conceptual Framework

The study is based on a three-stage relationship:

Digital Work Environment → Mental Health Condition → Productivity Outcomes

- Digital work environment includes remote work systems, communication technologies, and digital workflows
- Mental health condition involves stress levels, emotional stability, and work-life balance
- Productivity outcomes refer to efficiency, quality of work, and attendance

Impact of Digital Work Environment on Mental Health

1 Technostress

Frequent interaction with digital tools can lead to mental fatigue. Employees may feel overwhelmed by constant updates, multitasking, and system demands.

2 Work-Life Boundary Issues

Remote work reduces physical separation between office and home, often leading to longer working hours and difficulty disconnecting.

3 Continuous Connectivity

The expectation to respond quickly to messages and emails creates pressure and reduces recovery time, contributing to stress and anxiety.

Relationship Between Mental Health and Productivity

Positive Effects of Good Mental Health

- Improved concentration and decision-making
- Higher levels of creativity and innovation
- Better collaboration and communication

Negative Effects of Poor Mental Health

- Reduced focus and efficiency
- Increased absenteeism and presenteeism
- Decline in overall job performance

Employees experiencing mental strain are less likely to perform at their full potential, which ultimately affects organizational outcomes.

Role of Digital Interventions

Digital tools can also support mental well-being when used effectively. Examples include:

- Virtual mental health counseling services
- Stress management and mindfulness applications
- AI-driven employee assistance systems

Such interventions help employees manage stress, maintain balance, and improve productivity.

Strategies for Enhancing Mental Health and Productivity

Organizational Measures

- Encourage flexible work policies with clear boundaries
- Provide access to mental health resources
- Promote a supportive and inclusive work culture

Technological Measures

- Simplify digital tools to reduce complexity
- Limit unnecessary notifications and interruptions
- Use technology to monitor and balance workloads

Individual Practices

- Develop time management skills
- Engage in regular breaks and offline activities
- Seek professional help when required

Implications for Sustainable Development

Mental health plays a significant role in long-term organizational sustainability. A healthy workforce contributes to economic growth, social stability, and improved quality of life. Addressing workplace mental health aligns with global development priorities, particularly in promoting well-being and productive employment.

Conclusion

The digital era has created a dynamic work environment that offers both opportunities and challenges. While technology enhances productivity, it also introduces factors that can negatively affect mental health. Organizations must adopt a balanced approach that combines digital innovation with employee well-being. Prioritizing mental health is essential not only for improving productivity but also for achieving sustainable and inclusive growth.

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Original Article

Field Documentation of Traditional Remedies in Selected Villages of Bhandara and Gondia Districts, Maharashtra, India.

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Abstract

*Ethnomedicinal knowledge in the Vidarbha region of Maharashtra represents a vital repository of traditional practices preserved among tribal and rural communities. Previous studies have documented diverse plant species used for human health, nutrition, and veterinary care; however, several villages in Bhandara and Gondia districts remain renowned for specific remedies that have not been systematically recorded. The present study undertook field visits and inquiries to compile information on village-specific treatments. Observations revealed distinct practices: Bela village administers a decoction of assorted leaves for heart disease on fixed dates; Pewtha applies bark of *Mallotus philippensis* with butter or ghee for skin ailments; Girola prepares powders of castor leaves and “unknown plants” for jaundice; Ashti prescribes immediate consumption of castor leaf juice mixed with “unidentified plant powder” for hepatitis; and Deori is recognized for traditional jaundice remedies. The recurrence of jaundice treatments across multiple sites underscores both the perceived prevalence of the disease and reliance on indigenous plant-based therapies. The deliberate withholding of certain plant names by local practitioners reflects the protective secrecy surrounding traditional knowledge systems. This documentation contributes to the preservation of indigenous practices and provides a foundation for future ethnobotanical validation, conservation, and potential pharmacological exploration.*

Keywords: Ethnomedicine, Vidarbha region, Indigenous knowledge, Bhandara and Gondia districts, Traditional plant remedies

Introduction:

Ethnomedicinal research in the Vidarbha region of Maharashtra has highlighted the rich traditional knowledge preserved among tribal and rural communities. Gupta, Rakhi, Vairale, Mohan, Chaudhari, Pramod, and Wate (2009) reported the documentation of 38 species belonging to 27 families used by the Gond tribe of Bhandara district in the treatment of diarrhoea and dysentery. Suprabha Chute and Vimal Dakhane (2022) recorded 46 wild vegetable species from 25 families among the Gond and Madia tribes of Lakhani taluka, emphasizing their role in daily diets and nutritional security. Similarly, Gadpayale, Khobragade, and Chaturvedi (2014) documented 41 ethnoveterinary medicinal plant species from 27 families and 39 genera, underscoring their importance for conservation and validation in veterinary treatment. Humane (2025) presented the first systematic account of ethnomedicinal plants used in the treatment of skin diseases in Bhandara district, aiming to preserve knowledge that is rapidly declining among traditional healers. More recently, an ethnobotanical analysis (2026) recorded 77 wild edible plant species representing 72 genera and 38 families, highlighting their cultural significance, nutritional value, and conservation potential.

Despite these contributions, many villages in the Bhandara and Gondia districts—located within the Vidarbha region of Maharashtra—remain renowned for specific medicinal remedies that have not been systematically documented. In these villages, treatments for diverse ailments are traditionally administered, and since ancient times, people have travelled from distant places to avail themselves of these remedies. The present study seeks to compile information regarding a selection of such villages and the remedies associated with them. Data were gathered through direct field visits and inquiries among local residents and surrounding communities, thereby contributing to the preservation and validation of indigenous medicinal knowledge.

Methodology:

In the Bhandara and Gondia districts—located within the Vidarbha region of the Indian state of Maharashtra—there are numerous villages renowned for specific medicinal remedies. In each of these villages, treatments are administered for various ailments; indeed, since ancient times, people have travelled from far and wide to avail themselves of these medicines.

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This paper compiles information regarding a selection of these villages and the specific remedies associated with them. The authors gathered this data by personally visiting the villages in question and by conducting inquiries among the local residents as well as people from the surrounding areas.

Objective:

To document and compile information on villages in the Bhandara and Gondia districts of Maharashtra that are renowned for specific traditional medicinal remedies, by recording the treatments administered for various ailments and gathering data through field visits and inquiries among local residents and surrounding communities.

Observation:

Ethnomedicinal practices were documented in villages located at varying distances from Bhandara in Maharashtra.

1. **Bela:** In Bela village, situated 6 km on the national highway towards Nagpur, a decoction prepared from assorted plant leaves was administered for heart disease, with the practice restricted to the 1st and 15th day of each month.

Comparative Table of Ethnomedicinal Practices:

Village	Distance from Bhandara	District	Disease Treated	Plant Use / Preparation	Remark
Bela	6 km (NH towards Nagpur)	Bhandara	Heart disease	Decoction of assorted leaves	Administered only on 1st and 15th of each month
Pewtha	16 km near Jawahar Nagar	Bhandara	Skin ailments	Bark of <i>Mallotus philippensis</i> rubbed with butter/ghee	Applied as paste on infected area
Girola	4 km on Pawni road	Bhandara	Hepatitis / Jaundice	Castor leaves and "unknown plants" dried, powdered, taken with sugar	Patients visit from distant places
Ashti	33 km from Bhandara	Nagpur	Hepatitis / Jaundice	Juice of castor leaves mixed with "unidentified plant powder"	Administered immediately after preparation
Deori	—	Gondia	Jaundice	"Unidentified plants" used in local remedy	Patients travel from surrounding regions

Note: Researchers retained the term "unknown" or "unidentified" in quotation marks to indicate that local practitioners intentionally withheld the plant names, thereby protecting their secrecy and preserving the cultural integrity of indigenous knowledge systems.

Conclusion and Result:

The documentation of ethnomedicinal practices in villages surrounding Bhandara and extending into Nagpur and Gondia districts demonstrates the persistence of localized, culturally embedded healing traditions. Each village maintains distinct remedies, ranging from decoctions and plant pastes to powdered preparations and plant extracts, which are administered for ailments such as heart disease, skin disorders, hepatitis, and jaundice. The recurrence of jaundice treatments across multiple sites highlights both the perceived prevalence of the disease and the reliance on indigenous plant-based therapies. The deliberate withholding of certain plant names by local practitioners reflects the protective secrecy surrounding traditional knowledge systems, ensuring their continuity within the community. Collectively, these findings underscore the importance of systematic documentation for preserving indigenous practices, while also providing a foundation for future validation and potential integration into broader ethnobotanical and pharmacological research.

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2. **Pewtha:** In Pewtha village, located 16 km near Jawahar Nagar, the bark of *Mallotus philippensis* (Rohan tree) was rubbed with butter or ghee to form a paste, which was applied externally for skin ailments.
3. **Girola:** In Girola village, 4 km on Pawni road, treatment for hepatitis was observed, wherein castor leaves and other unidentified plants were dried, powdered, and consumed with sugar; the site was noted to attract patients from distant places for jaundice treatment.
4. **Ashti:** In Ashti village, located 6.7 Km Khat on Ramtek Road and 33 km from Bhandara in Nagpur district, juice extracted from castor leaves was mixed with powdered material of unknown plants and administered immediately to patients suffering from jaundice.
5. **Deori:** In Deori village of Gondia district, remedies for jaundice were practiced, and the location was reported to draw patients from surrounding regions. These observations highlight the persistence of village-specific ethnomedicinal practices, with each site maintaining unique methods of preparation and administration, reflecting both cultural significance and perceived therapeutic efficacy.

Remedies in Selected Villages of Bhandara and Gondia Districts, Maharashtra, India." First and foremost, I extend my heartfelt thanks to my guide/supervisor for their valuable guidance, continuous encouragement, and constructive suggestions throughout the course of this research. Their expertise and support were instrumental in the successful completion of this work.

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Original Article

Women Empowerment and Economic Growth

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Abstract

Women empowerment is a critical issue in today's world, as it aims to increase women's economic, social, and political power. This literature review provides an overview of the concept of women's empowerment, its historical evolution, and its importance in achieving sustainable development goals. The review highlights the various factors that hinder women's empowerment and identifies successful strategies for empowering women, such as education, access to resources, and political participation. Finally, the review concludes with recommendations for policymakers, civil society organizations, and researchers to advance the cause of women empowerment.

Keywords: Women Empowerment, Gender Equality, Sustainable Development Goals, Education, Political Participation, Access to Resources, Empowerment Strategies.

Introduction

In the arena of personal development, empowerment forms an apogee of many a system of self-realisation or of identity reformation. Realising the solipsistic impracticality of everyone anarchistically attempting to exercise power over everyone else, empowerment advocates have adopted the word "empowerment" to offer the attractions of such power, but they generally constrain its individual exercise to potentiality and to feel-good uses within the individual psyche. The concept of personal development is seen as important by many employers, with emphasis placed on continuous learning, increased self-awareness and emotional intelligence. Empowerment is ultimately driven by the individual's belief in their capability to influence events.

Definition – Women Empowerment

Empowerment is a multi-faced, multi-dimensional and multi-layered concept. As such, it is not this or that, but is the action and interaction of various factors-physical, socioeconomic, political, mental, psychological, and attitudinal and so on. Women's empowerment could be described as a process in which women gain greater share of control over resources-material, human and intellectual like knowledge, information, ideas, and financial resources like money and access to money and control over decision making in the home, community, society and nation, and to gain power'. The term women's empowerment has come to be associated with women's struggle for social justice and equality.

Objectives

1. Economic Independence

Economic independence is the foundation of women's empowerment. It enables women to support themselves financially and reduces their dependency on others.

- **Workforce Participation:** Increasing women's participation in the workforce helps utilize their skills and talents, contributing to overall economic growth. Encouraging employment in diverse sectors like IT, manufacturing, entrepreneurship, and services is essential.
- **Equal Pay:** Women often face wage discrimination. Ensuring equal pay for equal work promotes fairness, motivation, and dignity.
- **Ownership of Assets:** When women own property, land, or businesses, they gain long-term financial security and bargaining power within families and society.

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Access to Financial Resources: Providing access to bank accounts, loans, credit facilities, and financial literacy programs helps women start businesses and manage finances effectively.

2. Gender Equality

Gender equality focuses on treating men and women equally in all spheres of life.

- **Social Equality:** Eliminating stereotypes and traditional biases that limit women's roles in society.
- **Cultural Equality:** Challenging harmful cultural practices such as dowry, child marriage, and restrictions on women's mobility.
- **Political Equality:** Ensuring women have equal opportunities to vote, contest elections, and participate in governance.
- **Ending Discrimination:** Laws and policies must actively prevent discrimination in workplaces, education, and public life.

3. Safety and Security

Safety is a basic human right and a key component of empowerment.

- **Ending Gender-Based Violence:** Measures must be taken to prevent domestic violence, sexual harassment, trafficking, and abuse.
- **Safe Workplaces:** Implementation of strict workplace policies against harassment and creating grievance redressal systems.
- **Public Safety:** Better policing, street lighting, and public awareness campaigns can make public spaces safer.
- **Support Systems:** Establishing helplines, shelters, and counseling services for victims.

4. Equal Access to Education

Education empowers women with knowledge, skills, and confidence.

- **Female Literacy:** Increasing literacy rates among girls and women improves their employment opportunities and quality of life.
- **Quality Education:** Providing access to schools, colleges, and vocational training ensures skill development.
- **Reducing Dropouts:** Addressing issues like poverty, early marriage, and lack of sanitation facilities that lead to school dropouts.
- **Digital Education:** Promoting access to technology and online learning platforms helps bridge the education gap.

5. Decision-Making Power

Empowerment means giving women the authority to make decisions in all areas of life.

- **Household Decisions:** Women should have a say in financial, educational, and personal matters within the family.
- **Leadership Roles:** Encouraging women to take leadership positions in business, politics, and organizations.

- **Policy-Making:** Representation of women in government ensures policies reflect their needs and concerns.

- **Confidence Building:** Training and mentorship programs help women develop leadership skills.

6. Legal Empowerment

Legal awareness ensures that women can protect their rights and seek justice.

- **Knowledge of Rights:** Women should be educated about laws related to equality, property rights, workplace safety, and protection against violence.
- **Access to Justice:** Legal aid services, fast-track courts, and affordable legal assistance should be available.
- **Implementation of Laws:** Strict enforcement of laws is necessary to prevent violations.
- **Reducing Barriers:** Simplifying legal procedures and reducing social stigma encourages women to report crimes.

Research Methodology

The present study adopts a **qualitative and descriptive research design** to examine the relationship between women empowerment and economic growth. The analysis is primarily based on **secondary data**, ensuring a comprehensive understanding of the topic through existing literature and empirical findings.

1 Nature of the Study

This research is **descriptive and analytical in nature**. It seeks to describe the concept of women empowerment and analyze its impact on economic growth across different contexts. The study does not involve primary data collection but instead relies on previously published and validated sources.

2 Sources of Data

The study utilizes **secondary data** collected from a wide range of credible and authoritative sources, including:

- **Academic Journals and Research Papers**

Peer-reviewed journals provided theoretical frameworks, empirical evidence, and prior research findings related to gender equality and economic development.

- **Reports from International Organizations**

Publications from institutions such as the World Bank, United Nations Development Programme, and International Labour Organization were used to obtain global statistics, gender indices, and policy insights.

- **Government Publications**

Reports and policy documents from the Government of India, including data on employment, literacy rates, and women-centric schemes, were analysed to understand the national perspective.

- **Online Databases and Statistical Portals**

Reliable databases such as national statistical offices and international data repositories were used to gather updated and relevant information.

3 Data Collection Method

Data was systematically collected through:



- Literature review of published articles and books
 - Analysis of official reports and policy documents
 - Compilation of statistical data from trusted databases
- The selection of sources was based on **relevance, authenticity, and recency** to ensure accuracy and reliability.

4 Tools and Techniques of Analysis

The study employs the following methods:

- **Descriptive Analysis**
Used to explain concepts such as women empowerment, gender equality, and economic growth in a structured manner.
- **Comparative Analysis**
Enables comparison between different countries or regions in terms of women's participation and economic outcomes.
- **Content Analysis**
Helps interpret qualitative information from reports and literature to identify patterns, trends, and relationships.
- **Trend Analysis (where applicable)**
Used to observe changes over time in indicators such as female labor force participation and economic growth.

Conclusion

Women empowerment is a cornerstone of sustainable and inclusive economic growth. This study highlights that when women are provided with equal access to education, employment opportunities, financial resources, and decision-making power, they significantly contribute to increasing productivity, improving household welfare, and strengthening national economies.

The analysis confirms a strong positive relationship between gender equality and economic progress. Economies that actively promote women's participation in the workforce tend to experience higher growth rates, reduced poverty levels, and more balanced income distribution. Women's entrepreneurship and involvement in innovation further accelerate economic diversification and resilience. Women empowerment is not merely a social objective but an economic imperative. For countries like India and other developing nations, prioritizing gender equality can unlock vast economic potential and drive inclusive development. Effective implementation of policies, awareness programs, and institutional support systems is essential to create an enabling environment where women can thrive and contribute meaningfully to economic growth.

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I would like to express my sincere gratitude to all those who have supported and guided me in the completion of this research project titled "Women Empowerment and Economic Growth." First and foremost, I would like to thank my guide/supervisor for their invaluable guidance, encouragement, and constructive suggestions throughout the course of this study. Their expertise and continuous support played a significant role in the successful completion of this research.

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Original Article

Socio-Economic and Career Dynamics of Gig Economy Workers in Karnataka: A Conceptual Review of Platform-Based Employment

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Abstract

The rise of the gig economy is a game-changing work trend in Karnataka, especially in its fast-growing cities like Bengaluru, which have seen a surge in flexible work arrangements enabled by digital platforms. This conceptual analysis explores the social and economic environments and career dynamics of gig economy workers through a systematic review of secondary data from recent research papers, policy reports and industry analyses. The results show that while gig work provides flexibility, independence and opportunities for earning income, it also creates income instability, lack of formal social security benefits and a lack of opportunities for long-term career progression. The research also highlights that in platform-based organisations, the primary mechanisms of management are algorithms that determine task allocation, performance management and worker autonomy. These systems often establish power imbalances between platforms and workers, resulting in a loss of autonomy and bargaining power. In conclusion, the paper highlights the ambivalence of gig work as an economic opportunity and vulnerability. The paper emphasises the need for holistic policy measures, institutional framework and inclusive labour regulations to improve the sustainability and well-being of gig workers in Karnataka.

Introduction

The world of work has been transformed in recent years by the rapid advances in technology, digitalisation and the rise of platform-based business models. A major consequence of this shift has been the rise of the gig economy, which entails short-term, flexible, and on-demand work that is mediated through digital platforms. Gig work is distinct from conventional employment structures, as it operates beyond the boundaries of traditional organisational structures and shifts the employment relationship. Globally, this transformation has changed labour markets by enhancing flexibility in employment, while also posing challenges to job security and workers' protection (Pankaj & Jha, 2024). In India, the gig economy has experienced significant expansion, especially in tech-savvy states like Karnataka. Growth in digital infrastructure, rising smartphone usage, and the emergence of platform-based gig work in areas like transportation, food delivery and freelancing have all contributed to the adoption of gig work. Cities such as Bengaluru have become key destinations for gig work, drawing in many young workers looking for flexible employment. As per Srinivas (2025), gig work is a vital source of employment for young people in urban Karnataka, with impacts on income, work satisfaction, and learning. Likewise, a recent study in the International Journal of Developmental Research (2025) points out that gig employment in some parts of Karnataka is primarily driven by the lack of formal employment opportunities, increasing digital exposure and the flexibility it offers. While the gig economy is rapidly growing, it has a paradoxical character with its positives and negatives. It offers flexibility, freedom, and accessibility, allowing workers to select their work hours, and operate multiple income streams. On the other hand, it leads to socio-economic vulnerabilities, such as precarious livelihoods, lack of employment benefits and lack of job security.

Arora (2025) points out that although gig work increases labour market participation, it also leads to unstable income streams. Similarly, Ramachandran and Reena (2025) highlight that gig workers in India primarily lack access to basic social security benefits such as health insurance, pensions and job security, which contributes to their socio-economic vulnerability.

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The nature of gig work adds to these complexities. Gig economy platforms are heavily dependent on algorithmically driven management systems that control task distribution, pricing, performance monitoring and ratings. These often establish unequal power dynamics between platforms and workers, constraining worker autonomy despite the apparent flexibility of gig work (Tuscano & Bhattacharya, 2025). Additionally, research such as Saseendran et al. (2025) shows that gig workers are generally part of informal labour markets, which limit their chances for career advancement and skill development. Bavya (2025) also suggests that while gig work encourages skill-based participation, it is not an effective mechanism for integrating workers into career pathways of the formal economy.

In terms of socio-economic factors, gig workers may come from economically disadvantaged groups such as young people, migrants, and those with limited access to formal work. Das (2024) notes that the gig economy is crucial for tackling India's unemployment issues, but it also entrenches structural inequalities in income distribution and social security. In addition, gender inequality and occupational segmentation are also evident in the gig economy, with some occupations dominated by particular groups (International Journal of Developmental Research, 2025).

A further important aspect of gig work is its career implications. Gig work lacks institutionalised career advancement, training and development, and a formalised promotion system. This leads to workers viewing gig work as an "add-on" or short-term employment rather than a sustainable career choice (Srinivas, 2025). Without a formal career path, workers have fewer opportunities for upward mobility, which in turn affects employment stability and workers' overall career advancement and economic security (Arora, 2025).

In this light, the gig economy in Karnataka is an enigma that offers both inclusion and insecurity. Though it has provided more opportunities for livelihoods in the state, it has also brought into focus issues of labour rights, social protection and sustainable career growth. While the literature offers significant insights into various dimensions of gig work, there is a need for a conceptual approach that bridges socio-economic and career-related factors in the context of Karnataka.

In this context, the purpose of this study is to conceptually explore the socio-economic and career-related position of gig economy workers in Karnataka through secondary data. Through an integrated review of recent research studies, policy briefs and industry reports, this paper aims to present a comprehensive view of the opportunities and challenges of gig work. The research adds to the existing literature on digital labour markets and provides key insights for policymakers, platform companies, and scholars interested in the future of work. (Kenney & Zysman, 2016; Srnicek, 2017).

Theoretical background Gig Economy

There are several theoretical perspectives that can help us to understand the gig economy and its effects on workers. The Dual Labour Market Theory divides the labour market into primary and secondary labour segments, with gig workers

typically found in the latter segment with low wages, employment insecurity and low mobility. This helps us understand the precarious working conditions faced by gig workers, despite the strong demand for labour. Additionally, the Informal Labour Market Theory explains that gig work falls outside formal labour market regulations, without legal, contractual and institutional support. This contributes to the precarity of gig workers in terms of income and social security.

A further critical theory is Algorithmic Management Theory, which details how online platforms manage workers using algorithms that determine work allocation, prices, and performance. This forms unequal power relations, with limited autonomy for workers despite the illusion of flexibility. Finally, the Gig Economy Framework underpins the flexibility-insecurity paradox, where workers obtain access to work but at the expense of stability, career progression and security. These theories offer a holistic view of the socio-economic and career implications for gig workers. (Vallas & Schor, 2020; Sundararajan, 2016).

Bengaluru is a leading gig economy centre in India, with the growth of digital labour platforms like Uber, Swiggy and Zomato. Bengaluru represents a substantial proportion of platform workers in the state of Karnataka, partly due to high digital infrastructure and growing demand for platform services in urban areas, and abundant youth and migrant workforce. According to NITI Aayog (2022), the gig economy is poised to expand rapidly in India, with urban centres such as Bengaluru as the main nodes of platform-based work. Likewise, the International Labour Organization (2021) points out that the emergence of digital labour platforms has changed work arrangements, especially in cities of developing nations.

The growth of the gig economy in Bengaluru is not without vulnerabilities. Available literature shows that gig workers suffer from income uncertainty, long working hours, and lack of formal social security, which is typical for platform-based jobs (Berg et al., 2018; Duggan et al., 2020). Incomes are highly dependent on demand and workers often work for long hours to earn a living. Moreover, the lack of formal employer-employee relations limits access to employment rights and benefits, contributing to the informal nature of gig work (De Stefano, 2016).

A further major issue is algorithmic management, where online platforms manage work allocation, pricing and performance assessments through algorithms. This leads to lack of transparency and balance in decision-making, constraining workers' freedom and bargaining power (Wood et al., 2019; Tuscano & Bhattacharya, 2025). Consequently, gig work is not about absolute flexibility but rather about platform or algorithmically mediated flexibility, in which the latter operates to restrict workers' autonomy.

The Government of Karnataka has introduced policy measures, such as the proposed Karnataka Platform-Based Gig Workers (Social Security and Welfare) Act, 2025, to address these issues and enhance worker well-being through measures like insurance, social security, and grievance redressal mechanisms. It also recommends a welfare fee on aggregators to benefit gig workers' social security (NITI



Aayog, 2022). Yet, despite these legislative initiatives, challenges like low wages, opacity in platform management, and risks associated with gig work, along with the lack of long-term career opportunities, continue to affect the socio-economic conditions of gig workers in Bengaluru.

While research on the gig economy is increasing, there are key gaps. Research to date has either examined the socio-economic context of gig workers or the structural characteristics of platform-based work, but with little integration of these two perspectives. Moreover, there is a paucity of regional conceptual analysis specific to the state of Karnataka, particularly in terms of examining the impact of platform governance and algorithmic control on economic and career outcomes. Further, existing studies have typically used empirical research methods, with little emphasis on a broader conceptual framework that integrates research evidence. As such, this study seeks to address these gaps by providing an integrated conceptual review of socio-economic and career-related aspects of the gig economy.

Objectives of the Study

1. To analyse the socio-economic status of gig economy workers in Karnataka
2. To examine the career-related dynamics and sustainability of gig work

Research Methodology

The current study follows a conceptual and qualitative secondary data analysis research design. The research adopts a systematic literature review approach to explore the socio-economic and career prospects of gig economy workers in Karnataka. The data were extracted from a broad variety of reputable sources, such as peer-reviewed journal articles, government reports, policy briefs, industry reports and working papers on the gig economy and platform-based work. The literature reviewed is mainly recent (2016 - 2025) to capture the most current knowledge. The studies were critically analysed and integrated through a thematic analysis framework, where themes including platform governance, algorithmic management, income instability, job autonomy, social security and career sustainability were identified and explored. This analysis also informed the development of an integrated conceptual model that describes the links between factors driven by platform design and worker outcomes. This approach allows for a panoramic view of the current knowledge, as well as the gaps and theoretical connections in the literature on the gig economy.

Literature Review and Conceptual Analysis

1 Socio-Economic Status of Gig Workers

The existing literature presents a nuanced understanding of the socio-economic status of gig workers in Karnataka, highlighting both enabling and constraining factors. Srinivas (2025) emphasizes that gig employment contributes to income generation, job satisfaction, and skill enhancement among urban youth, indicating its growing relevance in contemporary labour markets. However, the study also points to significant income variability, where earnings fluctuate based on demand conditions and time invested, thereby limiting financial stability.

Complementing this, findings from the *International Journal of Developmental Research* (2025) reveal that the expansion of gig work, particularly in regions such as North Karnataka, is largely driven by structural constraints in the formal job market and increased digital accessibility through smartphones. Despite its inclusiveness, the nature of gig work remains largely informal, characterized by weak employment relationships and dependence on platform mechanisms. Further, Ramachandran and Reena (2025) highlight the critical gap in social protection, noting that gig workers often lack access to basic benefits such as health coverage, pensions, and employment security. This absence of institutional support contributes to long-term economic vulnerability. In a similar vein, Pankaj and Jha (2024) draw attention to the precarious working conditions experienced by gig workers, including extended working hours, low and inconsistent wages, and exposure to exploitative practices. Adding a broader perspective, Das (2024) argues that while the gig economy serves as an alternative employment avenue in the face of rising unemployment, it simultaneously perpetuates socio-economic inequalities, reflecting its inherently dualistic character within the labour market.

2 Career-Related Dynamics of Gig Work

The research suggests that career pathways in the gig economy are largely uncertain. Srinivas (2025) observes that while gig work offers opportunities for skill development and learning, it is not necessarily linked with structured career development, and is regarded by workers as a temporary or complementary form of work. This perspective is further supported by the *International Journal of Developmental Research* (2025), which shows that gig workers, especially in areas like North Karnataka, struggle to have a career in the platform economy because of the lack of advancement opportunities and absence of a promotion system. More broadly, Saseendran et al. (2025) suggest that in India, gig work is rooted in the informal economy, limiting career advancement and growth. Likewise, Bavya (2025) points out that while gig work offers skill-based opportunities, it remains isolated from formal career structures of traditional employment. Another key aspect impacting career pathways is algorithmic management, in which platform-based systems dictate task assignments, performance assessments and worker visibility. As suggested by Tuscano and Bhattacharya (2025), this undermines worker autonomy and limits career advancement. Also, according to Arora (2025), while flexibility makes gig work more appealing, it does not guarantee consistency in career development, thus contributing to the notion of temporary work in gig economy.

Although previous research offers valuable insights on the gig economy, it tends to take a piecemeal approach by treating socio-economic environment, career patterns and platform governance separately. There is little attempt to theorise these elements within an integrated framework. Moreover, the majority of studies focus on the flexibility and earning potential of gig work without critically assessing the sustainability of gig work as a career. This

underlines the need to better integrate and theorise the gig economy.

Conceptual Framework

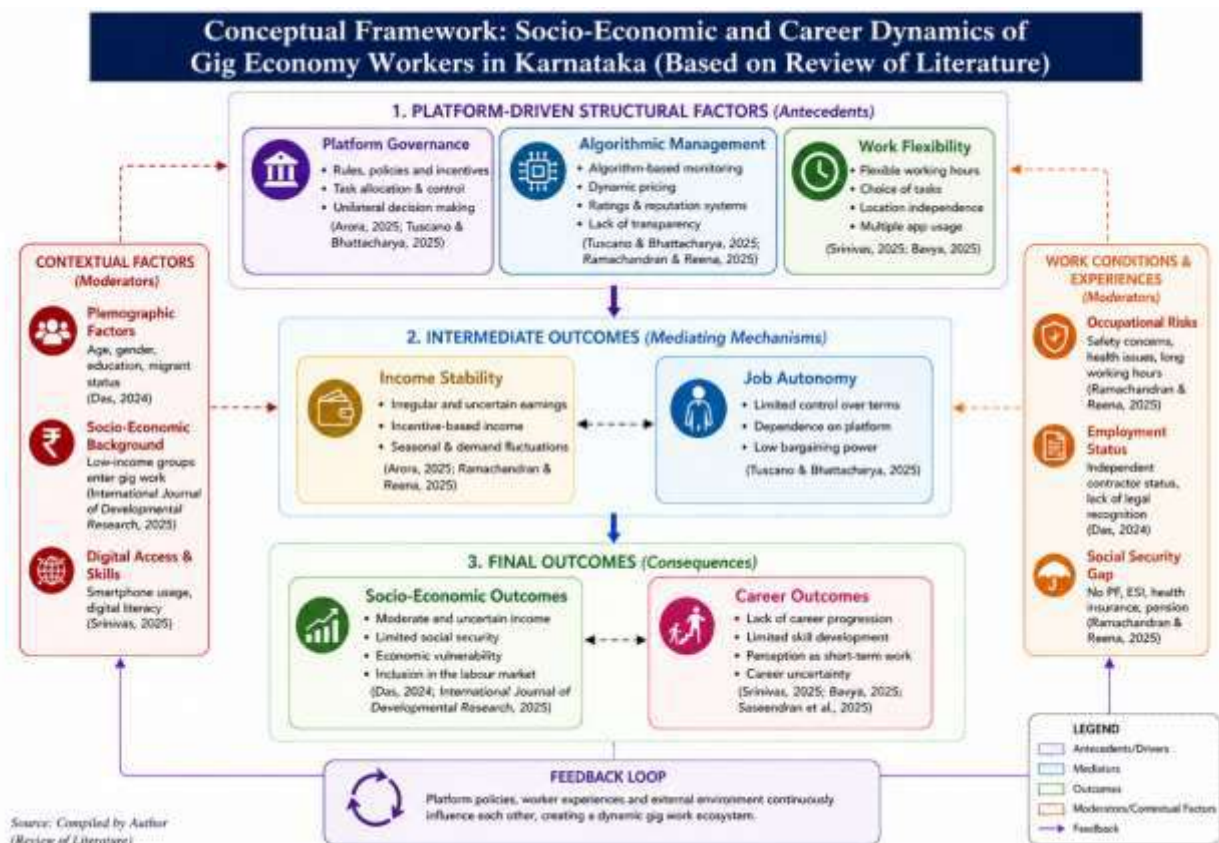
The conceptual framework illustrates the structural dynamics of gig economy work by integrating insights from existing literature on platform-based employment. At the first level, platform-driven factors such as platform governance, algorithmic management, and work flexibility act as primary determinants shaping the nature of gig work. Platform governance defines operational rules and incentive systems, while algorithmic management controls task allocation, pricing, and performance evaluation through automated systems (Tuscano & Bhattacharya, 2025; Arora, 2025). In contrast, work flexibility allows workers to choose their working hours and tasks, thereby enhancing labour market participation (Srinivas, 2025).

These factors influence intermediate outcomes, namely income stability and job autonomy. The literature indicates that gig workers often experience fluctuating and demand-dependent earnings, leading to income instability (Ramachandran & Reena, 2025). At the same time, algorithmic control reduces job autonomy by limiting workers' control over work processes and decision-making,

thereby weakening their bargaining power (Tuscano & Bhattacharya, 2025).

At the final level, these intermediate conditions shape broader outcomes related to socio-economic status and career sustainability. While gig work provides income opportunities and enhances labour market inclusion, it also results in economic vulnerability due to lack of social security and unstable earnings (Das, 2024; International Journal of Developmental Research, 2025). Furthermore, the absence of structured career paths, training opportunities, and promotion systems limits long-term career growth, leading to career uncertainty among gig workers (Bavya, 2025; Saseendran et al., 2025).

The framework also incorporates contextual factors such as demographic characteristics, socio-economic background, and digital access, which influence workers' participation in the gig economy. Additionally, work conditions, including occupational risks and lack of legal protection, further intensify worker vulnerability. Overall, the model highlights a fundamental paradox in the gig economy: while it promotes flexibility and economic inclusion, it simultaneously generates socio-economic insecurity and career instability, reinforcing the dual nature of platform-based employment.



This framework contributes to the literature by integrating socio-economic and career dimensions of gig work into a unified analytical structure, addressing the fragmented nature of prior studies

Discussion

The insights gained from the conceptual framework suggest that the gig economy in Karnataka is a structurally dual system, which integrates flexibility and insecurity in platform-based labour market participation. Inclusion and participation in the labour market, especially for urban youth, are enhanced by gig platforms, but this is contingent



on algorithmic and demand-driven conditions. This implies that gig work is not complete (unregulated) labour market freedom but a regulated labour structure through digital governance.

From a socio-economic point of view, the literature consistently suggests that gig work brings down barriers to participation by circumventing traditional access to labour markets, such as qualifications and formal employment (Srinivas, 2025; International Journal of Developmental Research, 2025). But this inclusivity comes at the cost of risk-shifting to the worker. Unlike traditional labour markets that institutionalise stable income streams, the income of gig workers is based on demand, causing instability. This adds to Arora's (2025) view that gig work, despite increasing participation, institutionalises income insecurity. In parallel, the lack of institutional arrangements such as health insurance, pension and legal frameworks supports the view that gig work relates more to the informal labour market (Ramachandran & Reena, 2025).

The career analysis clearly demonstrates the gap between short- and long-term employability. While it can enable skill building and short-term earning opportunities, it does not have the institutional mechanisms required for career advancement, such as promotion mechanisms, organisational learning processes and skill certificates. This echoes Saseendran et al. (2025) who place gig work in the informal economy, and thus restrict upward mobility. Additionally, Bavya (2025) notes that gig work is not linked to formal careers, perpetuating the notion of gig work as a stepping-stone to other forms of employment. This suggests that gig work supports labour force participation without facilitating career capital building, and thus, undermining employability.

A key analytical angle of the study is the impact of algorithmic management on economic and career outcomes. In contrast to conventional management, the governance of platforms is based on algorithmically driven management that allocates tasks, sets prices and controls the placement of workers. This establishes a power dependency, with workers' survival and income dependent on algorithms. It limits worker autonomy, and increases performance pressure via rating systems, as argued by Tuscano and Bhattacharya (2025). As a result, the flexibility of gig work needs to be understood as constrained by algorithms, giving rise to "controlled or managed flexibility".

Furthermore, the findings highlight that the gig economy is part of the risk restructuring process, in which risks previously shouldered by the employer are transferred to workers. Das (2024) suggests that this shift entrenches structural inequalities by outsourcing risks, including the variability of income, insecurity and lack of protection. This risk-shifting mechanism reduces workers' bargaining power and ability to negotiate for better terms of work or compensation. Gig workers thus face an imbalanced power dynamic with the platform in control.

The combination of these factors creates a paradox in the labour market, as gig work offers opportunities for work but also creates insecurity in the labour market. While flexibility offers workers the opportunity to participate in multiple labour markets, and select their work hours, this is

tempered by platform incentives, algorithmic steering, and market conditions. Thus, the research adds to the existing body of knowledge by showing that gig work cannot be considered simply a flexible work arrangement but rather a hybrid model of inclusion, dependency and vulnerability.

More broadly, the discourse points out that the gig economy in Karnataka is not just an alternative employment model, but a digitally mediated labour regime, which alters the nature of employment. It drives labour market growth, but also promotes socio-economic insecurity and constrains career prospects. This simultaneously points to the need for greater labour rights protection and regulatory responses, and the future of platform-based work in emerging markets.

Implications

1 Policy Implications

The study findings indicate the need for a holistic policy approach to address the issues facing gig workers. First, inclusive labour policies should be created to provide gig workers with social security benefits like health insurance, retirement pensions and worker's compensation. Second, mechanisms should be established to increase transparency of algorithmic management systems, especially related to task allocation and payment determination. Third, minimum wages and income protection schemes should be put in place to buffer income fluctuations. Finally, training and retraining programs should be established to enhance the skills and career development of gig workers.

2. Managerial Implications

From the managerial point of view, the platform firms must adopt more worker-focused strategies for the sustainability of the gig economy. This means offering equitable incentive structures, reducing over-reliance on performance evaluation, and offering support policies such as training and safety measures. Finally, platforms need to focus on enhancing worker engagement and trust through offering regular employment opportunities and effective communication channels. These measures can improve worker retention and reduce turnover rates.

3. Limitation and Future Research: This research is conceptual and uses secondary data, and therefore it is difficult to empirically validate the proposed model. Future studies can build on this study by collecting primary data and validating the conceptual framework through the application of statistical methods such as Structural Equation Modelling (SEM). Moreover, cross-state or cross-national studies can help to better understand the gig economy across different regions.

Conclusion

The gig economy in Karnataka is a double-edged sword, serving as a major source of employment generation, especially for the youth in urban areas, while also creating various socio-economic vulnerabilities for the workers. While platform-based work provides flexibility, low barriers to entry and a range of income sources, it is characterised by income uncertainty, lack of social security and poor career prospects. The absence of a clear career path and skill development opportunities also contributes to the view of gig work as a precarious or casual employment. Furthermore, the governance and control of platforms and



algorithms generate power imbalances, weakening the bargaining power and autonomy of workers. Against this backdrop, the research underscores the need for holistic regulatory frameworks and inclusive labour policies to address income security, social protection and skill development to sustain and build a supportive environment for a sustainable gig economy in Karnataka.

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The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Original Article

Health, Fitness, and Wellness in Modern Society

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Abstract

In modern society, health, fitness, and wellness have become essential components of a balanced life. With rapid urbanization, technological advancements, and lifestyle changes, individuals face both opportunities and challenges in maintaining overall well-being. This paper explores the concepts of health, fitness, and wellness, their interrelationship, the impact of modern lifestyles, and strategies to promote a healthier society

Introduction

Health is not merely the absence of disease but a state of complete physical, mental, and social well-being. Fitness refers to the body's ability to perform daily activities efficiently, while wellness is a broader concept that includes overall life satisfaction and balance.

In today's fast-paced world, sedentary lifestyles, unhealthy diets, and stress have negatively impacted health. Therefore, understanding and promoting health, fitness, and wellness is crucial.

Concept of Health

According to the World Health Organization, health includes:

- Physical well-being
- Mental well-being
- Social well-being

Types of Health

1. **Physical Health** – Proper functioning of body systems
2. **Mental Health** – Emotional and psychological stability
3. **Social Health** – Healthy relationships and social interactions

Concept of Fitness

Fitness is the ability to carry out daily tasks without fatigue and with enough energy for leisure activities.

Components of Fitness

- Cardiovascular endurance
 - Muscular strength
 - Flexibility
 - Body composition
- Regular physical activities like Yoga, walking, and sports improve fitness levels.

Concept of Wellness

Wellness is a holistic integration of physical, mental, and social well-being.

Dimensions of Wellness

- Physical wellness
- Emotional wellness
- Social wellness
- Spiritual wellness
- Intellectual wellness

Wellness focuses on preventive care and lifestyle choices.

Impact of Modern Lifestyle on Health

Modern society has introduced several challenges:

Sedentary Lifestyle: Increased screen time and desk jobs reduce physical activity.

Unhealthy Diet: Consumption of processed and fast-food leads to diseases like:

- Obesity
- Type 2 Diabetes

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- **Stress and Mental Health Issues:** Work pressure and social media influence increase anxiety and depression.

Technological Influence: While technology helps track fitness, excessive use reduces physical movement.

Importance of Health, Fitness, and Wellness

- Improves quality of life
- Increases life expectancy
- Enhances productivity
- Reduces healthcare costs
- Promotes mental peace and happiness

Strategies to Improve Health and Wellness

Regular Physical Activity: Engage in at least 30 minutes of exercise daily.

Balanced Diet: Include fruits, vegetables, proteins, and whole grains.

Mental Health Care: Practice meditation, mindfulness, and relaxation techniques.

Adequate Sleep: 7–8 hours of sleep is essential for recovery and well-being.

Health Education and Awareness: Government and institutions should promote healthy lifestyles.

Role of Society and Government

- Health awareness campaigns
- Fitness programs in schools and workplaces
- Public parks and recreational facilities
- Policies to reduce junk food consumption

Conclusion

Health, fitness, and wellness are interconnected and essential for a productive and fulfilling life. In modern society, individuals must adopt healthy habits and lifestyles to combat the negative impacts of technological and social changes. A combined effort by individuals, communities, and governments is necessary to achieve a healthier future.

Take care of your body,

It's the only place

You have to live...

Acknowledgment

I would like to express my sincere gratitude to all those who supported and guided me in the completion of this work titled "Health, Fitness, and Wellness in Modern Society." First and foremost, I am deeply thankful to my guide/supervisor for their valuable guidance, continuous encouragement, and insightful suggestions throughout the preparation of this study. Their expertise and support played a crucial role in shaping the direction and quality of this work.

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Conflicts of interest

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1. World Health Organization reports on health and wellness
2. Research articles on fitness and lifestyle diseases
3. Books on health education and wellness



Original Article

Appraisal of Groundwater Quality for Drinking Purposes Using Physico-Chemical Parameters in the Southern Region of Ratnagiri District, Maharashtra, India

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Abstract

In the southern part of the Ratnagiri district in Maharashtra, India, groundwater is the main source of drinking water. As a result of the growing strain from factors that are both natural and artificial, evaluating its quality is crucial. The Water Quality Index (WQI) approach and a few physico-chemical criteria are used in this study to assess groundwater quality for drinking. Ten groundwater samples (S1–S10) were collected from various locations and evaluated according to standard protocols for analysis of parameters including pH, total dissolved solids (TDS), total hardness (TH), Nitrate, Iron, Sulphate, magnesium (Mg^{2+}), and chloride (Cl^-). The outcomes were contrasted with the acceptable parameters set out by international and national drinking water standards. The analysis revealed variations in groundwater quality across different sampling sites. While parameters such as pH were generally within acceptable limits, certain locations exhibited elevated levels of TDS, hardness, and chloride, indicating mineral dissolution and possible influence of local environmental factors. The study indicates that although groundwater is suitable for drinking, continuous monitoring and effective groundwater management practices are essential to ensure safe and sustainable use of this vital resource. The findings provide important baseline data for future research and support decision-making for water resource management in coastal regions.

Keywords: Water Quality index, Drinking water, WHO assessment, Ratnagiri, Maharashtra

Introduction

Water is one of the most essential natural resources for sustaining life and maintaining ecological balance. Among various sources, groundwater plays a crucial role in meeting drinking, agricultural, and industrial water demands, especially in rural and semi-urban regions. Because surface water is scarce and rainfall varies seasonally, groundwater is the main supply of drinkable water in coastal districts like Ratnagiri in Maharashtra. However, both natural and human activities are posing a growing threat to groundwater quality. Geological formations, coastal intrusion, agricultural runoff, inappropriate waste disposal, and the exploitation of pesticides and fertilizers significantly influence the physico-chemical properties of groundwater. These factors may lead to the presence of undesirable constituents such as high total dissolved solids (TDS), hardness, nitrates, iron, and other contaminants, thereby affecting its suitability for drinking purposes. High quality drinking water is essential for our good health and healthy life. Thus, it is essential to know details about various physico-chemical parameters such as odour, colour, temperature, acidity, hardness, pH, sulphate, chloride, alkalinity content in water. While chemical tests should be conducted for its BOD, COD, dissolved oxygen, alkalinity, hardness, and other characteristics, some physical tests should be conducted for its physical appearance, such as temperature, colour, odour, pH, and turbidity. The assessment of water quality using individual metrics does not accurately reflect the overall status of the water, leading to an insufficient understanding of its quality. Consequently, the Water Quality Index (WQI) has been extensively utilized as an effective tool for combining various water quality criteria into a single numerical value that evaluates overall water quality.

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For researchers, policymakers, and the general public, the WQI simplifies complex data, making it easier to understand. The study was conducted in Rajapur, located in the southern region of the Ratnagiri district within the Konkan division of Maharashtra, India. Rajapur Taluka is situated in the South-Konkan coastal belt, bordered by the Arabian Sea to the west and the Sahyadri mountain range to the east. It lies approximately at the confluence of the Arjuna and Kodavali rivers. The focus of this study is the evaluation of groundwater quality in several villages located in the southern Ratnagiri district of Maharashtra. The assessment was conducted on various physico-chemical parameters, including pH, total dissolved solids, chloride, fluoride, iron, nitrate, sulphate, total hardness, alkalinity, and turbidity. To assess the suitability of groundwater for drinking purposes, the Water Quality Index (WQI) was calculated using the weighted arithmetic method.

This study aims to determine the overall quality of groundwater and pinpoint areas that may require water treatment or management strategies. The findings will support sustainable water resource management and enhance understanding of the groundwater conditions in the region.

Material and Methods:

• Study Area

The study area, Rajapur (16.65°N 73.52°E), is an administrative block in the southernmost part of Ratnagiri district, Maharashtra. The average elevation is approximately 72-75m above sea level, with varying topography in the surrounding. The region is characterized by Deccan Trap Basalt and extensive Lateritic plateaus. These laterite caps are a defining feature of the Konkan landscape and are critical for the areas ground water characteristics. Ten sampling stations were chosen according to their geological positions. Samples were collected from ten different villages from Rajapur Tehsil including Jaitapur, Nate, Kasheli, Juve, Ambolga, Prindavan, ansure, Pachal, Oni, Dongar[1].

• Sample Collection

Sample were collected from various locations including Jaitapur, Nate, Kasheli, Juve, Ambolga, Prindavan, ansure, Pachal, Oni, Dongar from their respective water resources. The collected sample were transported to lab and physico-chemical parameters were investigated by various methods.

To prevent misidentification, manual sampling adhered to established standards, utilizing plastic containers and appropriate labelling. The recommendations from the Ground Water Board for sample preservation were strictly followed prior to analysis. Bacteriological measurements were conducted using 300 ml glass bottles, while 1000 ml polyethylene bottles were employed for physico-chemical parameters. Before sampling, the bottles were thoroughly cleaned with nitric acid and rinsed with deionized water to avoid any contamination [2,3,4].

Methodology

Sr.No	Studied Parameter	Method used
1	pH	pH meter
2	Total Hardness	Complexometric titration
3	Turbidity	Turbiditymetry
4	Alkalinity	Titrimetrically
5	calcium (Ca) and total hardness	EDTA titration
6	nitrate (NO ₃ ⁻) and phosphate (PO ₄ ³⁻)	Spectrophotometric techniques
7	chloride (Cl ⁻)	Argentometric titration
8	Total dissolved solids (TDS)	Conductivity

Table 1 Experimental methods for analysis of Parameters of water

Sample No.	Name of the village	Physical parameters				Biological parameters	
		Temperature	Colour	Turbidity	TDS	E. Coli	Total Coliform CFU/100ml
S 1	Jaitapur	27	0	2.61	160	0	0
S 2	Nate	27	0	1.77	195	0	0
S 3	Kasheli	28	0	1.5	130	0	0
S 4	Juve	27	0	0.9	168	0	0
S 5	Ambolga	27	0	0.81	130	0	0
S 6	Prindavan	27	0	1.6	190	0	0
S 7	Ansure	28	0	0.9	193	0	0
S 8	Pachal	27	0	1.5	130	0	0
S 9	Oni	28	0	1.5	130	0	0
S 10	Dongar	29	0	0.9	195	0	0

Table 2 Experimental data for Physical Parameters of water

Result and Discussion

Physical Parameters Discussion

The experimental physical parameter data summarized in Table 2 offers valuable insights into the water quality of various villages.

• Temperature



Temperature ranged from 27 to 29 °C, with an average of 28 °C, indicating a moderately warm environment suitable for microbial and chemical stability. Slight spatial differences in temperature likely reflect local micro- climates, vegetation cover, and depth of dug wells.

- *Turbidity*

A measure of a liquid's relative clarity, turbidity is mostly utilized for suspended particles in water that obstruct light. Turbidity can be caused by both organic and inorganic materials. Turbidity may thereby increase the risk of contracting a waterborne infection. The turbidity levels (0.9-2.81 NTU) shown in Table 2 were significantly below the BIS-permissible limit of 5 NTU, indicating little organic matter or suspended particles.

In contrast to other rural regions, the turbidity values recorded in Rajapur, Ratnagiri (0.9–2.81 NTU) are significantly lower than those observed by Akter et al. (2016) in rural Bangladesh, where the mean turbidity was 4.5 NTU and nearly 12% of samples exceeded WHO guidelines [6]. These comparisons suggest that groundwater in the southern region of Rajapur remains less mineralized and clearer than in semiarid or coastal saline regions.

- *Total Dissolved Solids (TDS)*

Total dissolved solids are a measure of the many types of minerals that are present in water (TDS). The amount of TDS is closely related to how pure and high-quality the water is. Total Dissolved Solids (TDS), ranging from 150 to 195 mg/L, remained within safe limits (<500 mg/L per WHO/BIS), though Nate, Ansure and Dongar showed relatively higher TDS, possibly due to higher mineral dissolution from rock-water interactions.

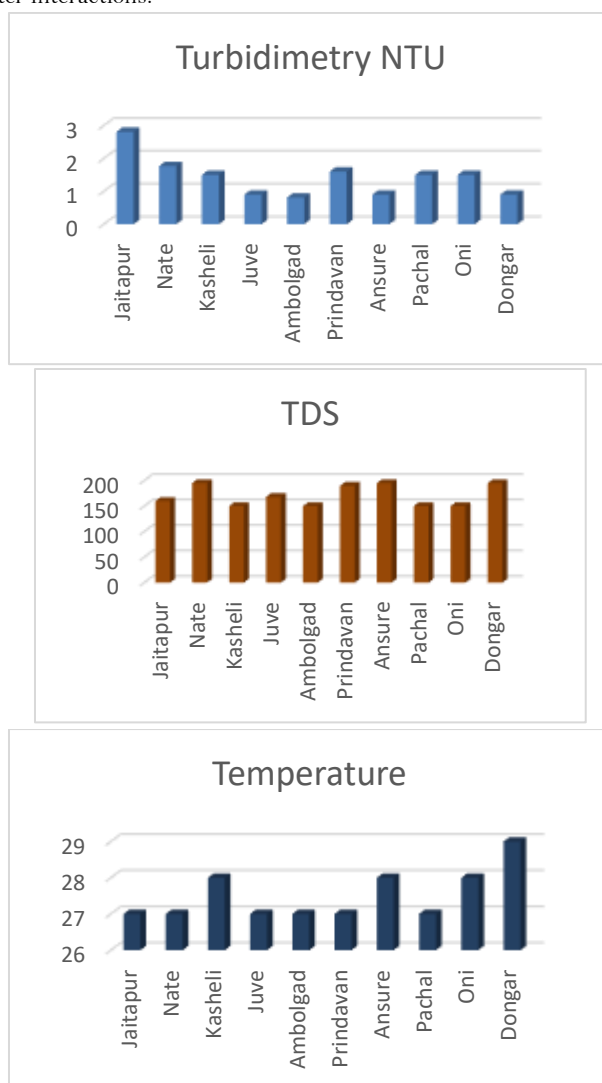


Fig.1 Experimental data for Physical Parameters as Turbidity, Total Dissolve Solids and Temperature

Chemical Parameters Discussion

The experimental chemical parameter data in Table 3 offer a comprehensive view of various water quality parameters in different villages.



Sample No.	Village name	chloride (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	pH	Total Alkalinity (mg/l)	Total hardness (mg/l)
S 1	Jaitapur	50	0	0.07	0.51	5.31	6.81	75	50
S 2	Nate	35	0	0.02	8.1	7.2	7.7	63	72
S 3	Kasheli	30	0	0.08	0.71	5	7.5	50	50
S 4	Juve	32	0	0.12	9.2	3	6.65	28	30
S 5	Ambolgad	20	0	0.08	8.2	5	6.18	50	50
S 6	Prindavan	36	0	0.28	6.1	9.1	6.8	44	36
S 7	Ansura	42	0	0.081	6.1	6	7.2	62	72
S 8	Pachal	30	0	0.08	0.81	5	7.5	50	50
S 9	Oni	30	0	0.081	0.71	5	7.5	50	50
S 10	Dongar	42	0	0.081	6.1	7.2	7.2	62	72

Table 3 Experimental data for Chemical parameters of water

- *Alkalinity*

Carbonates and bicarbonates are the cause of alkalinity. Alkalinity could be a chemical process that explains how water can neutralise acids. Table 3 illustrates Alkalinity, ranging from 28 to 75 mg/L, plays a vital role in buffering pH changes. Jaitapur recorded the highest values, likely due to carbonate-rich soils and low runoff conditions. Village like Juve recorded lower alkalinity, which could be due to faster recharge or less mineral contact.

- *Chloride*

The quantity of chloride varies greatly in all forms of natural waters. The amount of chloride in water will automatically grow as the mineral concentration does. The high concentration of chloride is caused by human activity. Chloride levels (20-50 mg/L) remained well below BIS limits (250 mg/L). Jaitapur shows higher Chloride content while Ambolgad shows low Chloride content.

- *Nitrate*

Nitrate concentrations varied from 0.51 to 9.2 mg/L with the highest values in Juve. These levels are within BIS limits (45 mg/L), but their variation may be linked to fertilizer leaching or proximity to agricultural lands. Jaitapur showed the lowest nitrate value possibly due to lesser agricultural influence or deeper aquifers. Korom (1992) reported denitrification rates as high as 20 mg/L per year under favourable conditions. The relatively low nitrate values in Rajapur suggest that natural denitrification, coupled with limited fertilizer infiltration, is effective in moderating nitrate concentrations. This kinetic perspective supports the conclusion that aquifer geochemistry and microbial processes play an essential role in maintaining safe groundwater nitrate levels in the region [7].

- *Sulphate*

Sulphate ions are prevalent in natural water, and the majority of these ions are soluble in water. Sulphate levels ranged from 3.0 to 9.1 mg/L, well under the acceptable limit of 200 mg/L. The peak observed in Prindavan may be related to sulphate-bearing minerals or fertilizer use, while village like Juve showed lower values possibly due to lower mineral weathering or dilution from recharge.

- *Iron*

Iron levels (0.02-0.2 mg/L) were below the threshold (0.3 mg/L), confirming absence of iron contamination, Higher values in Juve may stem from lateritic soils common to Konkan, rich in iron oxides.

- *Total Hardness*

Total Hardness is a crucial indicator of its quality however it is to be used for agricultural, domestic, and/or industrial purposes. It is due to the presence of excess of Calcium, magnesium and Iron salts [8]. Total Hardness ranged from 30 to 72 mg/L, with the highest in Nate, Ansura and Dongar. All values fall within the BIS acceptable range (200 mg/L), and this hardness is likely due to natural leaching of calcium and magnesium from aquifer rock.

- *pH*

pH is an indicator of the existence of biological life. pH value 7 to 14 is alkaline, pH value 0 to 7 is acidic and pH value 7 is neutral [9]. pH values ranged from 6.18 to 7.7, indicating neutral to slightly alkaline water, which is typical for regions with limestone or alkaline soil content and suggest that the water is slightly acidic to neutral in most of the villages. These values are within acceptable limits (6.5-8.5) and support suitability for drinking purposes. Local differences may be attributed to soil chemistry and vegetation interaction with groundwater. The minimal variation suggests similar geological substrata and minimal industrial pollution.

Ochuko et al. (2014), who documented 60-140 mg/l in Southern Nigeria, reflecting geological and industrial influences absent in Ratnagiri. Similarly, iron concentrations here (0.02-0.2 mg/L) were consistently below BIS limits (0.3 mg/L), whereas Rao and Nageswararao (2013) reported mean values of 0.45 mg/L in Andhra Pradesh groundwater, often leading to WQI classification as "poor". These findings highlight that Ratnagiri groundwater is comparatively less impacted by anthropogenic and lithological contamination than in many other developing regions [10,11,12].

These findings highlight the need for further analysis and investigation to understand the potential causes of variations in water quality parameters and to assess the overall suitability of the water for different uses, such as drinking, agriculture, or industrial purposes, in the sampled villages.



Biological Parameters Discussion

The water samples meet international potability standards and show no signs of recent fecal contamination, as indicated by the absence of *E. Coli* and Total Coliforms (0 CFU/100mL). These results demonstrate that the water source maintains a high level of microbiological integrity, with no bacterial pathogens detected at the time the sample was collected.

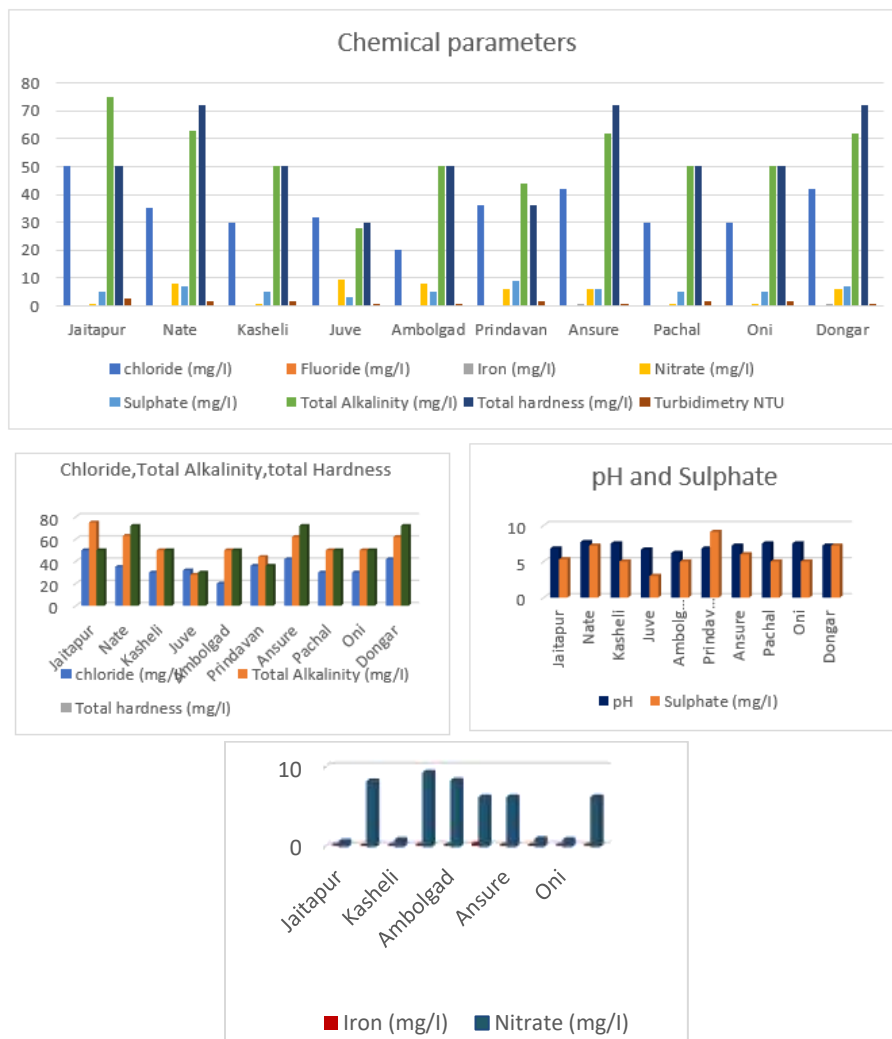


Fig. 2 Experimental data for Chemical Parameters as Chloride, Total Alkalinity

Water Quality Index (WQI) Interpretation

The Water Quality Index is defined as a technique of rating that provides the composite influence of individual water quality parameters on the overall quality of water. This index serves as a valuable tool for assessing the health of water bodies, helping policymakers and environmentalists make informed decisions about water management and conservation. By simplifying complex data into a single score, it allows for easier communication and understanding of water quality issues among the general public. It is a numerical representation or scoring system used to assess and summarize the overall quality of water based on multiple water parameters. The WQI considers various physical, chemical, and biological factors to provide a single value that indicates the water's quality status [12-15].

$$WQI = \sum_{i=1}^{i=n} W_i \times Q_i$$

where Q_i is the quality rating for i^{th} parameter and W_i is the unit weightage

WQI Range	Classification	Water Quality Status
0-25	Excellent	Suitable for drinking
26-50	Good	Minor treatment recommended
51-75	Poor	Treatment required
76-100	Very Poor	Extensive treatment needed
>100	Unsuitable for drinking	Unsafe and unfit

Table 4 Classification of WQI scale



The computed WQI values in this study (all <50, categorized as "Excellent" or "Good") compare favourably with international studies Akter et al. (2016) reported that 30% of rural Bangladesh samples exceeded WQI 75, classifying them as "poor" [12]. Similarly, Ochuko et al. (2014) found that River Ase in Nigeria often yielded WQI values above 80, rendering the water "unsuitable for drinking" without extensive treatment [13].

Sr.No	Parameters	Bureau of Indian Standard (BIS)	World Health Organization (WHO)
1	pH	6.5-8.5	7-8
2	Turbidity	5 NTU	5 NTU
3	Total Dissolve Solids	500	300-1200
4	Total Hardness	200	500
5	Total Alkalinity	200	-
6	Magnesium	30	150
7	Chlorine	250	250
8	Calcium	75	200
9	Sulphates	200	250
10	Fluoride	1	1.5
11	Iron	0.3	0.3
12	Nitrate	45	50

Table 5: Standard Values of water quality by BIS and WHO parameters

Groundwater of Rajapur is still comparatively safe for drinking, as seen by the lack of WQI exceedances, which supports the area's advantages of minimal industrial development and agricultural growth. It is computed by giving each water parameter such as temperature, pH, turbidity, dissolved oxygen, total dissolved solids, etc. Every parameter is rated according to its measured value in relation to particular water quality criteria or guidelines, and each parameter is given a weight based on its relative importance [12-15].

Conclusion

The physicochemical assessment of groundwater in Rajapur, District Ratnagiri, indicates generally potable conditions with localized spatial heterogeneity. Parameters including temperature, turbidity, pH, and Total Dissolved Solids (TDS) remained relatively stable across the sampling sites, suggesting a moderately mineralized and clear aqueous environment. While fluoride concentrations remained below detectable limits, significant variations were observed in **TDS** (150 to 195 mg/L), **total alkalinity** (28-75 mg/L), **chloride** (20-50 mg/L), **nitrate** (0.51-9.2 mg/L). The calculated **Water Quality Index (WQI)** values ranged from 18.42 to 22.56, classifying the groundwater across all monitored locations as "Excellent" to "Good" & suitable for drinking according to established rating scales. (Table 4)

This study addresses a critical knowledge gap in the systematic assessment of groundwater within coastal districts influenced by varying land-use patterns. These findings provide evidence-based insights for environmental monitoring and the formulation of targeted policy interventions aimed at ensuring sustainable groundwater governance amidst increasing demographic and climatic pressures.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Original Article

Sustainable Finance and Green Investment

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Abstract:

Introduction: Sustainable finance refers to making financial decisions by considering environmental, social, and governance (ESG) factors. The aim is to support long-term investments in activities that are beneficial for the economy and the planet. This includes green investment, which funds projects that help the environment, such as renewable energy, energy efficiency, and infrastructure that can cope with climate change. Objective of study: The goal is to examine the current status, growth, and future plans for green finance, including green bonds and funds, across different areas, especially in developing countries. It also aims to identify challenges like funding issues and the factors that encourage people to support green financial initiatives. Research methodology: Research in sustainable finance and green investment often uses a mix of methods. These include systematic literature reviews (SLR) following the PRISMA framework, quantitative analysis like econometric modelling and regression, and qualitative methods such as case studies and policy analysis. Key techniques also involve bibliometric mapping, tracking trends in green bond markets, and optimizing ESG (Environmental, Social, and Governance) portfolios. Data analysis: Data analysis in sustainable finance shows that companies with high ESG scores generally perform well financially over time and manage risks more effectively. Green investments, such as green bonds and projects in renewable energy, are growing rapidly. For example, green bonds reached over a billion dollars in 2021. Findings: In 2021, the green bond market grew by 50%, reaching over half a trillion dollars, largely driven by investments in climate-focused areas. Renewable energy projects like onshore wind and solar PV are the main areas where green investments are being directed, followed by low-carbon transport. Recommendations: Focus on Green, Social, and Sustainability Bonds, as they can offer good returns while also helping the environment. Invest directly in solar, wind, and sustainable infrastructure to support the transition to a low-carbon economy. Conclusion: Sustainable finance and green investment are important tools for moving towards a low-carbon economy. They help direct money towards eco-friendly projects, renewable energy, and sustainable infrastructure.

Keyword: Sustainable, Finance, Green Investment, Environmental, Social, Governance

Introduction:

Sustainable finance means using environmental, social, and governance (ESG) factors when making financial choices to support long-term investments in activities that are good for the economy and the planet. This includes green investment, which helps fund projects that help the environment, like renewable energy, energy efficiency, and building infrastructure that can withstand climate change. It helps make financial systems match global sustainability goals, like the Paris Agreement, and helps manage risks while supporting economic growth.

Key Concepts and Components:

Sustainable Finance: This covers a wide range of practices, standards, and financial products designed to achieve both financial returns and positive environmental or social effects.

Green Investment/Finance: This is part of sustainable finance that specifically funds projects with environmental benefits, such as renewable energy, green buildings, and sustainable transportation. **ESG Integration:** This is when environmental, social, and governance factors are considered during traditional financial analysis to better understand possible risks and opportunities.

Impact Investing: This type of investment aims to create positive, measurable social and environmental impact while also making a financial return.

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Instruments and Strategies:

Green Bonds: These are debt instruments used to fund projects that have environmental benefits, like climate change initiatives. The market value of these bonds has reached billions in recent years.

Sustainability-Linked Loans: These are loans that offer financial rewards to borrowers who meet certain sustainability goals.

ESG Funds/ETFs: These are mutual funds or exchange-traded funds that invest in companies with strong sustainability practices, like the iShares MSCI KLD 400 Social ETF.

Carbon Markets/Offsets: These are financial tools that allow organizations to reduce their greenhouse gas emissions by investing in projects that cut emissions elsewhere.

Drivers and Importance:

Risk Mitigation: Sustainable finance helps manage environmental, climate, and social risks that can affect financial performance.

Regulatory Support: Policies and regulations, such as the European Green Deal, are encouraging more sustainable financial flows.

Demand: There is increasing interest from investors in aligning their investments with the United Nations Sustainable Development Goals (SDGs).

Objective Of Study:

Key objectives of study include:

- Examining the current situation, growth, and future plans for green finance, such as green bonds and funds, in various areas, especially in developing regions.
- Reviewing the role of rules, policies, and support systems in encouraging green innovation and the move towards sustainable practices.
- Identifying challenges like funding problems and the factors that motivate people to support green financial initiatives.
- Understanding how green investments directly contribute to sustainable development, including reducing pollution and minimizing climate change impacts.
- Assessing how much investors know about, feel towards, and are interested in green financial products.

Research Methodology:

Research methods in sustainable finance and green investment often combine various approaches. These include systematic literature reviews (SLR) using the PRISMA framework, quantitative analysis such as econometric modeling and regression, and qualitative methods like case studies and policy analysis. Key techniques also involve bibliometric mapping, studying trends in green bond markets, and optimizing ESG (Environmental, Social, Governance) portfolios.

Common research methodologies include:

Systematic Literature Review (SLR): This approach uses frameworks like PRISMA to gather and summarize existing

studies from sources such as Scopus, helping to identify areas that need more research.

Bibliometric Mapping/Analysis: Tools such as VOSviewer are used to examine how keywords are connected, how influential authors are, and the main topics in green finance literature.

Quantitative/Econometric Analysis: This involves using panel data, regression models, and time-series analysis to evaluate how green finance influences financial results, economic growth, and environmental outcomes.

Case Studies: These focus on specific green financial products like green bonds or sustainability-linked loans, or on investments in particular industries.

Multi criteria Decision-Making (MCDM): Techniques like the Analytical Hierarchy Process (AHP) and TOPSIS are used to compare and rank challenges, opportunities, and supports for green investment.

Policy/Document Analysis: This looks at regulations, sustainability reports, and other policy documents to understand how institutions support green finance.

Common data sources include:

Financial Data Providers: Services like Bloomberg or Refinitiv Eikon, or platforms focused on ESG data.

Research Databases: Scopus, Web of Science, and ScienceDirect.

Policy and Sustainability Reports: Information from the Green Finance Platform, UNEP FI, and reports from central banks.

Typical research workflow includes:

Preparation: Choosing relevant keywords such as 'Green Finance,' 'ESG,' or 'Climate Finance.'

Data Acquisition: Collecting data from databases like Scopus or Web of Science and selecting studies based on certain criteria.

Analysis: Using quantitative methods to look at trends and cause-and-effect relationships, or qualitative methods to explore themes.

Reporting: Putting the findings together to offer insights for investors, policymakers, and financial institutions.

Data Analysis and Interpretation:

Data analysis on sustainable finance shows that companies with high ESG (Environmental, Social, and Governance) scores tend to do well financially in the long run and handle risks better. Green investments, like green bonds and projects focused on renewable energy, are growing quickly. For instance, green bonds reached over a billion dollars in 2021. This growth is mainly because of global goals to fight climate change, but there are still issues with the quality of data and the risk of greenwashing.

Analysis and Interpretation Trends:

1. Risk Mitigation:

ESG integration is used to avoid investing in risky areas, such as fossil fuels, to protect portfolios. By looking at environmental, social, and governance factors, investors can spot risks that standard financial measures might miss. This helps avoid companies or industries that pose high ESG-related risks, such as those involved in fossil fuels, poor labor conditions, or weak corporate governance. Doing this



can help keep investments stable and prevent long-term losses.

Key Risk Mitigation Functions of ESG:

Stranded Asset Risk Mitigation: Selling off investments in fossil fuels helps investors avoid "stranded assets"—resources that may become outdated or unprofitable due to environmental policies, regulations, or the shift to a clean energy economy.

Operational and Regulatory Risk Reduction: ESG assessments help identify companies with poor environmental practices or weak safety standards, which helps reduce legal risks, penalties, or operational failures.

Reputational Protection: By avoiding industries linked to controversy, such as high-emission fuels or unethical labor conditions, investors can protect their reputation and avoid legal problems.

Proactive Threat Management: ESG helps investors anticipate long-term risks related to sustainability and move capital toward more stable and sustainable options.

Protective Mechanisms in Action:

Negative/Exclusionary Screening: Removing industries that are considered high-risk or unethical, like thermal coal or oil sands.

Thematic Investing: Redirecting investments toward renewable energy or green technologies to prepare for the decline of carbon-heavy industries.

Materiality Analysis: Using frameworks like SASB or TCFD to assess which risks are most likely to affect finances, such as supply chain issues or climate change effects.

2. Predictive Modeling:

Using advanced data analytics is key to predicting the impact of green projects and making the best use of resources.

Predictive modeling and data analysis are important for moving green projects forward by looking at historical data, machine learning, and real-time information to estimate environmental effects and use resources smartly. These tools allow for forward-thinking decisions in areas like renewable energy, waste reduction, and sustainable supply chains, replacing reactive approaches with proactive insights.

Key Applications and Benefits:

Optimization of Resources: Machine learning and data mining help use resources more efficiently, such as reducing waste, lowering packaging use, and managing water during droughts.

Green Project Forecasting: Advanced analytics allow stakeholders to simulate the effects of climate change, assess the results of green projects, and find sustainable suppliers by examining environmental performance.

Energy Management: In smart buildings and infrastructure, energy management systems use predictive analytics to optimize energy use and cut down costs.

Enhanced Decision-Making: These models give detailed data on factors like land use and vegetation, helping with better strategic planning and risk management.

Sustainable Agriculture: Predictive models are used to boost crop production, manage resources effectively, and reduce food waste.

3. Regulation Analysis:

Studies show that policy actions, such as guidelines for green bonds, are important for encouraging investor confidence, especially in developing markets.

Policies like green bond guidelines, tax breaks, and standardized reports are key to building trust and expanding markets in emerging countries. They help manage information gaps and reduce the chance of greenwashing, which encourages more institutional investment. Strong rules, like China's 2015 guidance, help build trust, limit financial constraints for issuers, and support sustainable development.

Key regulatory elements to increase investor confidence:

Standardized Guidelines: Setting clear definitions and categories (like Green Bond Principles) for what qualifies as a "green" project is necessary.

Mandatory Reporting/Verification: Third-party checks help reduce information gaps, making sure projects meet environmental standards and building trust while lowering reputational risks.

Incentive Mechanisms: Tax breaks and subsidies make green bonds more appealing than traditional financial tools.

Regulatory Support in Emerging Markets: Developing countries need strong policy structures, such as those adopted by India's SEBI, to shift from optional to mandatory reporting and support market growth.

The green bond market has seen significant growth, supported by these policies, with global issuance reaching over a billion dollars by the end of 2023.

Result:

Sustainable finance and green investment are growing quickly to help meet climate goals. In 2021, the total amount of green bonds issued worldwide went past half a trillion dollars. In India, green finance reached a high of INR 3,712 billion (\$50 billion) during the financial year 2021/22, with a focus on renewable energy and electric vehicles. Some major trends include more private companies getting involved, an increase in green bond issuances, and a stronger emphasis on using environmental, social, and governance (ESG) factors to support energy efficiency.

Key results and trends from the research include:

- **Market Growth:** The green bond market is growing quickly. India has become the fourth-largest issuer of sustainability-linked debt among emerging economies, with a 186% increase by December 2024.
- **Funding Focus:** In India, about 98% of the money for climate adaptation comes from within the country, mostly from government budgets. These funds are mostly used for clean energy, energy efficiency, and clean transport, while less attention is given to agricultural adaptation.
- **Sector Participation:** While public funding has been the main source so far, private companies are also getting more



involved. Private sector funding increased by 13% and reached \$310 billion in 2019/2020.

- **Key Drivers:** The rise in green investment is mainly due to the need for low-carbon energy. India needs a lot of investment to meet its net-zero emissions goal by 2070.

Finding:

Sustainable finance and green investment are moving faster than ever to meet climate goals, with green bond issuance crossing \$500 billion in 2021.

The main findings show a trend of including ESG factors in decision-making, and around \$53 to \$90 trillion is needed for the energy transition by 2035. Key reasons for this growth are strong policy support and the use of artificial intelligence in data analysis. However, there are still challenges in having clear and consistent definitions for green investments.

Key Findings and Trends:

- **Market Growth:** In 2021, the green bond market grew by 50%, reaching over half a trillion dollars, mainly due to investments focused on the climate.
- **"Green the Finance":** This goes beyond just funding projects; it also involves changing the financial system so that it supports environmental goals and helps build a sustainable, low-carbon economy.
- **Key Sectors:** Renewable energy projects, such as onshore wind and solar PV, are the main areas where green investments are going, followed by low-carbon transport.
- **Role of Private Sector:** Private companies have significantly increased their support for green initiatives. Sustainable investment funds and social impact bonds are now more common.
- **Regional Focus (India Example):** India is expanding its efforts, aiming to reach 500 gigawatts of renewable energy by 2030. About 83% of the finance for reducing emissions comes from within the country.
- **AI Implementation:** Artificial intelligence is being used to estimate solar potential and build prediction models for carbon pricing, such as carbon yield curves.

Discussion:

Sustainable finance and green investment use environmental, social, and governance (ESG) factors to guide how money is invested. This helps support long-term sustainability and address the issue of climate change. These strategies involve sending money to projects that are good for the environment, like clean energy and pollution control, and changing the way the global financial system works so it focuses more on sustainability than just making quick profits.

Key Concepts and Components:

Green Finance: This type of finance is used to fund projects that help the environment, such as renewable energy, making energy use more efficient, and managing waste.

ESG Integration: This looks at three main areas—environmental (like climate change), social (like how a company treats its workers and communities), and governance (like how a company is run and its ethical standards)—to evaluate risks and opportunities.

Impact Investing: This is when money is invested to create positive environmental or social change, while also making a profit.

Instruments: Tools like green bonds, loans that are linked to sustainability goals, and funds that focus on ESG factors are important in this area.

Drivers and Benefits:

Risk Mitigation: Managing environmental issues helps reduce risks for investments over the long term.

Regulatory Changes: Governments and regulators are creating stronger rules to make sure the financial system supports sustainable development.

Consumer Demand: More people, including investors and consumers, are looking for banking and investment options that are responsible, ethical, and sustainable.

Challenges:

Transparency: Making sure that reports about ESG factors are true and not misleading (like when companies falsely say they are eco-friendly) is important.

Complexity: It's difficult to properly assess the environmental impact of investments.

Recommendation:

Sustainable finance and green investment aim to direct money towards projects that are good for the environment, low-carbon, and can handle the changes caused by climate. Important strategies include investing in green bonds, ESG-focused funds, renewable energy, and sustainable infrastructure. Successful approaches involve making things more open and clear using standard reporting methods like BRSR, using carbon pricing, and providing credit guarantees to reduce risks.

Key Recommendations for Sustainable Finance & Investment:

- **Diversify into Green Debt and Equity:** Focus on Green, Social, and Sustainability Bonds, which can offer good returns and help the environment.
- **Use ESG-Focused Funds:** Choose investment vehicles that strictly follow ESG criteria to keep your portfolio sustainable.
- **Target Renewable Energy Infrastructure:** Invest directly in solar, wind, and sustainable infrastructure to support the move to a low-carbon economy.
- **Utilize "Green" Banking Products:** Both individuals and businesses can use green deposits, green loans, and green mortgages that support energy-efficient homes and projects.
- **Leverage Regulatory & Policy Incentives:** Keep an eye on government actions such as tax breaks for green bonds and carbon market tools.
- **Prioritize Transparency & Reporting:** Support companies that follow strict environmental reporting standards, such as BRSR in India.
- **Engage in Impact Investing:** Look for investments that aim to deliver measurable environmental benefits along with good returns.

Conclusion:



Sustainable finance and green investment are important tools to move towards a low-carbon economy, directing money to eco-friendly projects, renewable energy, and sustainable infrastructure.

They help create long-term ecological, social, and economic value by using ESG factors in decision-making, cutting down emissions, and managing climate change risks.

Key Conclusions:

Essential Transition Tool: Sustainable finance moves beyond traditional metrics to include environmental, social, and governance (ESG) factors, helping address long-term sustainability needs.

Economic Impact: Green investments in areas like renewable energy, energy efficiency, and clean technology not only help cut emissions but also create jobs, boost economic growth, and improve energy security.

Key Instruments: Green bonds, sustainability-linked loans, and other financial products are vital for funding green projects.

Market Trends: Although green finance is growing quickly, especially in emerging economies like India, it's still not as developed as traditional markets.

Challenges: The sector needs clearer definitions, consistent policies, and better ways to assess "greenwashing".

To reach a sustainable future, it's important to have good policies and new financial strategies that connect available capital with the needs of green projects.

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Original Article

Sustainable Development and Social Justice in India: A Constitutional Perspective.

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Abstract

This study examines the constitutional framework of India in promoting social justice and sustainable development, highlighting their interrelationship and practical significance. It analyses key constitutional provisions, including Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties, which collectively establish a foundation for equitable and environmentally responsible governance. The research further explores the proactive role of the judiciary in interpreting these provisions, particularly through judicial activism and Public Interest Litigation, to expand the scope of rights such as the right to life under Article 21 to include environmental protection and human dignity. Using a doctrinal and qualitative research methodology based on secondary sources, the study evaluates landmark judicial decisions and policy frameworks. It identifies the intrinsic link between social justice and sustainability, emphasizing that inclusive development is essential for long-term environmental balance. The paper also discusses major challenges such as weak implementation of laws, socio-economic inequalities, and conflicts between development and environmental protection. Finally, the study suggests policy reforms, including strengthening governance mechanisms, promoting inclusive participation, enhancing public awareness, and aligning national strategies with global Sustainable Development Goals. The research concludes that achieving a balance between social justice and sustainable development is essential for ensuring an equitable, inclusive, and sustainable future in India.

Keywords: Sustainable Development, Social Justice, Indian Constitution, Fundamental Rights, Directive Principles

Introduction

The concepts of social justice and sustainable development have become central to modern governance, particularly in developing countries like India, where economic growth must be balanced with equity and environmental protection. Social justice aims to ensure fairness, equality, and dignity for all individuals, especially marginalized and vulnerable groups, while sustainable development focuses on meeting present needs without compromising the ability of future generations to meet their own needs. These two principles are deeply interconnected and mutually reinforcing. The Constitution of India provides a comprehensive framework that supports both social justice and sustainability. Fundamental Rights guarantee equality, freedom, and the right to life, while Directive Principles of State Policy guide the state in promoting welfare, equitable distribution of resources, and environmental protection. Additionally, Fundamental Duties emphasize the responsibility of citizens to safeguard the natural environment. Together, these provisions create a strong constitutional basis for inclusive and sustainable development. Over time, the judiciary has played a transformative role in strengthening this framework. Through progressive interpretations of constitutional provisions, particularly Article 21, the courts have expanded the scope of the right to life to include environmental rights, health, and livelihood. Mechanisms such as Public Interest Litigation have further enabled access to justice for marginalized communities and facilitated the enforcement of environmental and social rights.

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Despite these advancements, significant challenges remain in achieving the goals of social justice and sustainable development. Issues such as environmental degradation, socio-economic inequality, weak implementation of laws, and institutional inefficiencies continue to hinder progress. These challenges highlight the need for effective governance, inclusive policies, and active public participation. This study seeks to analyse the constitutional provisions related to social justice and sustainability, examine their interrelationship, evaluate the role of the judiciary, and identify key challenges along with potential policy reforms. By doing so, it aims to contribute to a deeper understanding of how constitutional values can guide India toward a more equitable and sustainable future.

Objectives of the Study

1. To analyse the constitutional provision related to social justice and sustainability.
2. To examine the relationship between social justice and sustainability.
3. To study the role of the judiciary in promoting these principles.
4. To identify challenges and suggest policy reforms.

Research Methodology

This study uses secondary data and is grounded in doctrinal and qualitative research technique. The following secondary sources are utilized for research: Constitutional clauses; court rulings; United Nations Development Programme reports; scholarly publications and journal articles. This research is analytical and interpretive.

Conceptual Framework

1 Sustainable Development

The concept gained prominence through the World Commission on Environment and Development report (Our Common Future, 1987), which defines it as development that meets present needs without compromising future generations.

It comprises the following tenets: economic expansion, social integration, and environmental preservation. All three conditions must be met in order to guarantee sustainable development.

2 Social Justice

Social justice refers to equitable distribution of resources and opportunities, ensuring dignity and equality for all individuals. Social justice was promised to Indian citizens under the Indian Constitution.

Constitutional Provisions Supporting Sustainable Development and Social Justice

1 Fundamental Rights

1. Article 14 – Right to equality

The right to equality ensures that all citizens have equal opportunity and dignity. It prohibits discrimination on the basis of race, caste, gender, or religion. The fundamental rights of the constitution protect the rights of underprivileged peoples.

2. Article 19 – Freedom rights

Article 19 guarantees the right to free speech and expression, peaceful assembly, the formation of

associations/unions/cooperative societies, residence and settlement, and the practice of any profession. It helps attain social justice.,

3. Article 21 – Right to life

Article 21 of the Indian Constitution guarantees the protection of life and personal liberty. It has been broadened through court interpretation to include the right to a clean environment, including pollution-free water and air, as well as protection against dangerous industry. This right contributes to the conservation of the environment, which is one of the principles of sustainable development. The judiciary has construed Article 21 to include environmental protection, so combining sustainability and fundamental rights.

2 Directive Principles of State Policy (DPSPs)

1. Article 38 – Promote welfare of the people
2. Article 39 – Equitable distribution of resources
3. Article 47 – Public health improvement
4. Article 48A – Protection of environment

DPSPs guide the state in implementing policies that ensure sustainable and inclusive development.

3 Fundamental Duties

1. Article 51A(g) – Duty to protect and improve the natural environment.

Role of Judiciary in Promoting Sustainability and Justice

The Supreme Court of India and High Courts have played a transformative role in advancing both social justice and sustainable development by creatively interpreting the Constitution of India. Through judicial activism, Public Interest Litigation (PIL), and the evolution of environmental jurisprudence, the judiciary has expanded constitutional rights to include socio-economic and environmental dimensions.

1 Judicial Activism and Expansive Interpretation of Fundamental Rights

One of the most significant contributions of the judiciary has been the expansion of Article 21 (Right to Life). Initially interpreted narrowly, it now includes:

- Right to a clean and healthy environment
- Right to livelihood
- Right to health and human dignity

This expansion has created a direct constitutional link between social justice and sustainable development. e.g., in *Olga Tellis v. Bombay Municipal Corporation*, the Court recognized livelihood as an integral part of the right to life, thereby protecting vulnerable populations such as pavement dwellers.

2 Public Interest Litigation (PIL)

The introduction of PIL has democratized access to justice, allowing individuals and groups to approach courts on behalf of marginalized communities. PILs have enabled courts to address issues like environmental degradation, bonded labour, and displacement. Relaxation of locus standi has empowered NGOs and activists. Courts have taken *Suo motu* cognizance in many public welfare matters. Through PIL, the judiciary has ensured that



governance aligns with constitutional values of equity and sustainability.

3 Development of Environmental Jurisprudence

The judiciary has significantly contributed to environmental protection by establishing key legal principles:

- Precautionary Principle – Prevent harm before it occurs
- Polluter Pays Principle – Polluters must bear the cost of damage
- Public Trust Doctrine – Natural resources are held in trust by the state for public use

These principles were clearly articulated in *Vellore Citizens Welfare Forum v. Union of India*, marking a turning point in Indian environmental law.

Similarly, in *M.C. Mehta v. Union of India*, the Court issued directions on industrial pollution, Ganga River cleaning, and vehicular emissions, strengthening sustainable development practices.

4 Balancing Development and Environmental Protection

The judiciary has often been required to balance economic development with environmental sustainability.

- Courts have scrutinized large development projects (dams, industries, mining)
- Introduced the concept of “sustainable development” as a guiding principle
- Ensured that environmental impact assessments (EIA) are followed

Judicial decisions emphasize that development should not come at the cost of ecological degradation or social injustice.

5 Protection of Marginalized and Vulnerable Groups

Social justice is central to constitutional governance, and the judiciary has actively protected:

- Scheduled Castes and Scheduled Tribes
- Women and children
- Economically weaker sections

Judicial interventions have addressed displacement, land rights, labour exploitation, and access to basic services, ensuring inclusive development.

6 Enforcement of Directive Principles of State Policy (DPSPs)

Although DPSPs are non-justiciable, courts have integrated them into Fundamental Rights. By harmonizing DPSPs with Fundamental Rights, the judiciary has strengthened the constitutional mandate for sustainable and equitable development.

8 Judicial Innovation and Continuing Mandamus

Courts have adopted innovative mechanisms such as:

- Continuing mandamus (ongoing supervision of cases)
- Expert committees for environmental assessment
- Monitoring compliance through periodic reports

This ensures long-term enforcement of sustainable development goals. The judiciary has emerged as a key driver of sustainable development and social justice in India.

Link Between Sustainable Development and Social Justice

Sustainable development and social justice are deeply interconnected. Development cannot be considered “sustainable” unless it is equitable, inclusive, and just, and social justice cannot be achieved without ensuring long-term environmental and economic sustainability. In the Indian context, this relationship is embedded within the framework of the Constitution of India and reinforced by global commitments of the United Nations.

1 Interdependence of Equity and Sustainability

Sustainable development emphasizes meeting present needs without compromising future generations. However, this goal cannot be achieved without addressing existing inequalities. Unequal access to resources (land, water, energy) leads to unsustainable exploitation. Poverty forces marginalized communities to depend heavily on natural resources. Equitable distribution ensures both resource conservation and social stability. Thus, social justice acts as a foundation for sustainability.

2 Environmental Degradation and Social Inequality

Environmental impact disproportionately affects vulnerable groups. Poor communities often reside in dirty or ecologically sensitive places. Lack of resources increases vulnerability to climate change (e.g., floods and droughts). Industrial projects and urban expansion frequently displace vulnerable communities. This emphasizes the importance of environmental justice, which involves a fair distribution of environmental benefits and burdens.

3 Climate Justice as a Bridging Concept

The idea of climate justice connects human rights with environmental sustainability. Developing countries like India contribute less to global emissions but face severe impacts. Within countries, marginalized communities bear the highest risks. Climate justice demands fair distribution of responsibilities and resources. Global frameworks promoted by the United Nations emphasize equity in climate action.

4 Inclusive Development and Participation

Sustainable development requires participatory governance that actively involves people at all levels of society. This includes the inclusion of local communities in decision-making processes, ensuring that their needs and perspectives are adequately represented. Grassroots institutions such as Panchayati Raj Institutions play a vital role in decentralizing governance and promoting local accountability. Additionally, recognizing and integrating indigenous knowledge systems can contribute to more effective and environmentally sound practices. Such participation helps ensure that development policies are context-specific, equitable, and aligned with the principles of sustainability.

5 Gender and Social Justice Dimensions

Women and marginalized groups play a crucial role in promoting sustainability, particularly because women are often the primary managers of water, forests, and household resources. Despite this, gender inequality continues to limit their participation in decision-making processes related to environmental governance and development policies. Empowering women through equal



opportunities, education, and inclusion in leadership can lead to more effective and sustainable environmental outcomes. Therefore, ensuring gender justice is essential for achieving sustainable development goals and fostering inclusive growth.

6 Resource Distribution and Economic Justice

Economic inequality significantly undermines the goals of sustainability. The concentration of wealth in the hands of a few often leads to overconsumption of resources, while a large section of the population lacks access to basic necessities, resulting in widespread underdevelopment. This imbalance not only affects social equity but also puts pressure on environmental resources. In contrast, fair and equitable distribution of resources promotes balanced growth and enhances resource efficiency. In this context, policies aligned with Article 39 of the Constitution emphasize the importance of equitable distribution of wealth and resources to support both social justice and sustainable development.

7 Human Rights-Based Approach to Development

A rights-based approach integrates sustainability with justice:

- Right to clean environment (Article 21 interpretation)
- Right to livelihood and health
- Access to water, sanitation, and education

This approach ensures that development is people-centered and rights-oriented.

8 Urban-Rural Divide and Development Imbalance

Urban areas often receive a greater share of investment and infrastructure development, which leads to the relative neglect of rural regions. As a result, rural populations continue to depend heavily on natural resources for their livelihoods, making them more vulnerable to environmental degradation and economic instability. This imbalance highlights the need for sustainable development strategies that address regional disparities and ensure equitable distribution of resources and opportunities. Bridging the gap between urban and rural areas is therefore essential for achieving inclusive and balanced growth.

9 Indigenous and Tribal Perspectives

Indigenous communities have traditionally practiced sustainable living:

- Forest conservation and biodiversity protection
- Community-based resource management

However, they face displacement due to development projects. Protecting their rights ensures both cultural survival and environmental sustainability.

10 Critical Perspective

While policies emphasize both sustainability and social justice, conflicts often arise:

- Large infrastructure projects vs displacement
- Industrial growth vs environmental protection
- Economic efficiency vs equity
- Balancing these requires strong governance, legal frameworks, and ethical policymaking.

The relationship between sustainable development and social justice is mutually reinforcing. Sustainable policies must prioritize equity, while social justice initiatives must incorporate environmental concerns. In India, aligning

constitutional values with global sustainability goals can ensure a development model that is inclusive, equitable, and environmentally responsible.

Challenges

Achieving a balance between sustainable development and social justice in India is complex due to multiple structural and governance-related challenges. These challenges often intersect, making policy implementation difficult and uneven across regions.

1 Development vs Environment Conflict

One of the most enduring issues is the conflict between economic growth and environmental protection. Rapid industrialization, infrastructure expansion, and urbanization are necessary for economic progress but frequently result in environmental deterioration. Large-scale projects such as dams, mining operations, and roadways frequently cause deforestation, biodiversity loss, and relocation of local inhabitants, especially tribal tribes. While environmental impact assessments (EIAs) are required, they are sometimes improperly completed or influenced by economic considerations. This creates a situation in which short-term economic advantages take precedence over long-term environmental sustainability and social equality.

2 Weak Implementation of Laws and Policies

India possesses a comprehensive legal and policy framework for environmental protection and social welfare. However, implementation remains a major concern. Weak enforcement mechanisms, lack of coordination among government agencies, and bureaucratic inefficiencies hinder effective policy execution. Even directives issued by the Supreme Court of India face delays or partial compliance at the ground level. Monitoring systems are often inadequate, and corruption further undermines the effectiveness of governance. As a result, there is a significant gap between policy formulation and actual outcomes.

3 Socio-Economic Inequality

Deep-rooted socio-economic inequalities continue to obstruct both sustainable development and social justice. Marginalized communities, including Scheduled Castes, Scheduled Tribes, women, and rural populations, often lack access to essential resources such as land, education, healthcare, and employment opportunities. This inequality forces many to depend heavily on natural resources for survival, leading to overexploitation and environmental degradation. Additionally, the benefits of development are unevenly distributed, with urban and affluent populations gaining more advantages compared to rural and disadvantaged groups. Such disparities weaken the inclusive nature of development and hinder long-term sustainability.

4 Institutional Inefficiency

Institutional weaknesses further complicate the implementation of sustainable development policies. Many government bodies lack adequate technical expertise, financial resources, and trained personnel to address complex environmental and social issues. Decentralized institutions like Panchayati Raj Institutions often face limitations in autonomy and capacity, reducing their effectiveness in grassroots governance. Bureaucratic delays, overlapping jurisdictions, and lack of accountability



mechanisms also contribute to inefficiency. Without strong and responsive institutions, even well-designed policies fail to produce desired outcomes.

These challenges highlight the need for a coordinated and integrated approach to development. Addressing conflicts between growth and sustainability, strengthening implementation mechanisms, reducing inequality, and improving institutional capacity are essential steps toward achieving a just and sustainable society.

Recommendations

1 Strengthen Governance

Effective governance is central to achieving sustainable development and social justice. There is a need to enhance institutional capacity, transparency, and accountability across all levels of government. Decentralized institutions such as Panchayati Raj Institutions should be empowered with adequate financial resources, administrative autonomy, and technical expertise. Strengthening e-governance mechanisms can reduce corruption, improve service delivery, and ensure real-time monitoring of welfare and environmental programs. Coordination among central, state, and local governments must also be improved to avoid policy fragmentation.

2 Promote Inclusion

Inclusive development ensures that marginalized and vulnerable groups benefit equally from growth processes. Policies must prioritize Scheduled Castes, Scheduled Tribes, women, and economically weaker sections. Special emphasis should be placed on gender equality by encouraging women's participation in governance and decision-making. Inclusive frameworks should also recognize the rights of indigenous communities over natural resources. Social justice can be strengthened by ensuring equitable access to education, healthcare, employment, and basic services.

3 Enhance Awareness

Public awareness plays a critical role in achieving sustainability. Citizens must be informed about their environmental rights and duties under the Constitution of India, particularly Article 51A(g), which emphasizes environmental protection. Educational institutions should integrate sustainability into curricula, while governments and civil society organizations should conduct awareness campaigns on climate change, conservation, and responsible consumption. Community participation through Gram Sabhas and local forums can further strengthen grassroots engagement.

4 Improve Legal Frameworks

Although India has a robust legal structure, gaps remain in enforcement and coordination. Environmental laws should be strictly implemented, and penalties for violations must be strengthened. The judiciary, particularly the Supreme Court of India, should continue to play a proactive role in safeguarding environmental and social rights. Additionally, there is a need to streamline overlapping laws, improve regulatory mechanisms, and establish specialized environmental courts or tribunals for faster resolution of cases.

5 Align with Sustainable Development Goals (SDGs)

India's development strategies should be closely aligned with the SDGs set by the United Nations. This includes integrating SDG targets into national and state-level planning processes, monitoring progress through measurable indicators, and ensuring policy coherence. Institutions like NITI Aayog play a crucial role in tracking progress and promoting best practices. Aligning constitutional values with global sustainability goals will help India achieve inclusive, equitable, and environmentally responsible development.

A comprehensive approach combining strong governance, inclusive policies, legal reforms, and public participation is essential to achieve sustainable development and social justice. These measures, when effectively implemented, can transform constitutional ideals into practical outcomes, ensuring a balanced and equitable future.

Conclusion

The study highlights that the Constitution of India provides a strong foundation for promoting both social justice and sustainable development through its Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties. These provisions collectively ensure equality, human dignity, and environmental protection, forming an integrated framework for inclusive governance.

The judiciary has played a crucial role in strengthening this framework by expanding the scope of the right to life under Article 21 to include environmental protection, health, and livelihood. Through mechanisms like Public Interest Litigation, the courts have improved access to justice and protected the rights of marginalized communities.

However, several challenges continue to hinder progress, including conflicts between development and environmental conservation, weak implementation of laws, socio-economic inequalities, and institutional inefficiencies. These issues highlight the gap between constitutional ideals and practical outcomes.

The study concludes that social justice and sustainable development are interdependent and must be pursued together. Achieving this balance requires strong governance, effective law enforcement, inclusive policies, and active public participation. Aligning national strategies with global sustainability goals will further support India in building an equitable, inclusive, and environmentally sustainable future.

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Original Article

Aligning Classroom Practices with Sustainable Development Goals: Teachers' Experiences and Challenges in Secondary Education

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Abstract

The United Nations Sustainable Development Goals (SDGs) and the framework of the United Nations Educational, Scientific, and Cultural Organization Education for Sustainable Development (ESD) have made the incorporation of sustainability principles into formal education a global priority. Teachers are important agents in converting policy objectives into meaningful classroom practices, and secondary education is crucial in helping students develop sustainability awareness and responsible citizenship. Few qualitative studies have looked at how teachers experience and manage the process of coordinating classroom instruction with global sustainability goals, despite the growing emphasis on sustainability-oriented education. The purpose of this study is to investigate teachers' perspectives, experiences, and difficulties in incorporating SDG-related practices into secondary school classrooms. The study uses semi-structured interviews to gather detailed information from secondary school teachers who were specifically chosen, using a qualitative research design based on an interpretivist paradigm. Thematic analysis is used to find recurrent patterns in the data regarding implementation barriers, institutional support, sustainability awareness, and pedagogical strategies. The goal of the study is to comprehend how educators apply sustainability ideas to curriculum delivery, classroom interactions, and student engagement. It is anticipated that the results will show that although teachers recognize the value of sustainability education, they face many obstacles, such as a lack of professional development opportunities, rigid curricula, inadequate teaching materials, and a lack of policy-level direction. It is anticipated that the results will show that although teachers recognize the value of sustainability education, they face many obstacles, such as a lack of professional development opportunities, rigid curricula, inadequate teaching materials, and a lack of policy-level direction. Innovative teaching strategies and adaptive teaching techniques used to incorporate sustainability themes into various subject areas may also be identified by the study. This study adds to the expanding conversation on sustainability education by showcasing teachers' real-world experiences and provides useful information for legislators, curriculum designers, and school administrators. The results highlight the necessity of more robust institutional support networks and teacher capacity-building programs to improve the successful execution of sustainability objectives in secondary education settings.

Keywords: Sustainable Development Goals (SDG), United Nations Educational, Scientific and Cultural Organization Education for Sustainable Development (ESD), Secondary Education, Teacher Experiences, Classroom Practices
Educational Policy Implementation

Introduction

In 2015, the United Nations established 17 interconnected global goals—known as the Sustainable Development Goals (SDGs)—to address poverty and inequality and to protect the planet by 2030. These 169 specific targets aim to promote peace, education, health, and climate action. Due to growing environmental deterioration, social inequality, climate change, and resource depletion, sustainability has emerged as a key issue in the conversation about global development. By fostering knowledge, values, and competencies that support sustainable lifestyles and responsible citizenship, education is widely acknowledged as a transformative mechanism for addressing these global challenges. The goal of sustainability education is to give students the skills they need to comprehend complicated global issues and support social, economic, and environmental well-being.

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Consequently, there is a growing expectation that educational establishments incorporate sustainability principles into their teaching and learning procedures. With the adoption of the United Nations Sustainable Development Goals (SDGs), a universal framework comprising 17 goals intended to address urgent global challenges by 2030, the global commitment to sustainability gained significant momentum. SDG 4 highlights inclusive, equitable, high-quality education and encourages opportunities for lifelong learning for all. More precisely, Target 4.7 emphasizes how crucial it is to guarantee that every student gains the knowledge and abilities required to advance sustainable development, such as environmental responsibility, global citizenship, and sustainability awareness.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) established Education for Sustainable Development (ESD) as a strategic educational approach that supports social justice, economic viability, and environmental integrity by empowering students to make informed decisions. ESD encourages critical thinking, interdisciplinary learning, and group problem-solving and active engagement in addressing sustainability-related issues. Schools are encouraged to incorporate sustainability themes into institutional practices, pedagogy, and curriculum design through ESD. Since adolescents start to develop critical awareness, social responsibility, and independent decision-making skills during secondary education, this stage is especially crucial for sustainability integration. By incorporating sustainability concepts into subject matter, class discussions, and experiential learning exercises, teachers play a crucial role in integrating sustainability policies into classroom practice. Their teaching methods, convictions, and professional skills have a big impact on how students receive and comprehend sustainability education. Teachers facilitate values, attitudes, and behaviours that are consistent with sustainable development principles in addition to implementing curricula.

Problem Statement

Even though sustainability education is becoming more and more important globally, there is still a big disconnect between what is expected at the policy level and how it is actually implemented in classrooms. While international frameworks like UNESCO's Education for Sustainable Development (ESD) and the Sustainable Development Goals (SDGs) promote the incorporation of sustainability principles into educational systems, the conversion of these policies into effective classroom practices is still uneven. Due to a lack of funding, inflexible curricula, inadequate institutional support, and unprepared teachers, many schools still struggle to integrate sustainability concepts across disciplines. Teachers are supposed to be key players in putting sustainability education into practice, but they frequently run into real-world obstacles that make it difficult for them to match classroom procedures with global sustainability goals. Although policies place a strong emphasis on integrating sustainability, little focus has been

placed on how educators understand these requirements and manage their application in regular classroom settings. Instead of being methodically incorporated into classroom instruction, sustainability education is still dispersed, theoretical, or limited to isolated projects in many educational settings. Additionally, the majority of the literature that has already been written has concentrated on curriculum design, policy frameworks, or student outcomes; teachers' experiences as frontline implementers of sustainability education have received relatively less attention. The goals of educational policies and classroom realities are not aligned due to a lack of adequate teacher-centred qualitative research. In order to determine the factors influencing sustainability integration and to create workable strategies that facilitate successful implementation, it is crucial to comprehend the perspectives of educators.

Research Gap

There is still a lack of qualitative research on secondary school teachers' real experiences incorporating Sustainable Development Goals into their lesson plans, despite the growing scholarly interest in sustainability education. Prior studies have frequently concentrated on theoretical discussions, curriculum models, or quantitative assessments of students' sustainability awareness. Fewer studies, however, examine how educators personally encounter, understand, and negotiate expectations related to sustainability in their professional practice. Teachers in secondary schools work in intricate learning environments that are influenced by curriculum requirements, institutional policies, time constraints, and resource availability. Their experiences provide insightful information about the opportunities, difficulties, and flexible teaching methods associated with sustainability integration. However, teachers' perspectives are still underrepresented in research on sustainability education, especially when it comes to the daily application of SDG-aligned practices. By examining teachers' actual experiences in coordinating classroom procedures with sustainability objectives in secondary education settings, this study fills this knowledge gap. By concentrating on the viewpoints of teachers, the study advances our knowledge of how sustainability education is implemented in classrooms and pinpoints the contextual elements that either facilitate or obstruct it. It is anticipated that the results will add to the body of knowledge already available on sustainability education and offer evidence-based perspectives to policymakers, curriculum designers, and educational establishments looking to improve the incorporation of sustainability concepts in classrooms.

Literature Review

Concept of Sustainable Development Goals in Education

Since the United Nations Sustainable Development Goals (SDGs) were adopted in 2015, the integration of sustainability into education has gained international recognition. The SDGs emphasize education as a vital catalyst for sustainable transformation and offer a thorough framework for tackling environmental, social, and economic



issues (United Nations, 2015). Goal 4 of the 17 SDGs is to guarantee inclusive, equitable, and high-quality education while encouraging opportunities for lifelong learning for everyone. The need for students to gain the knowledge, abilities, attitudes, and values required to advance human rights, global citizenship, gender equality, sustainable development, and cultural diversity is particularly highlighted in Target 4.7. Education is increasingly seen as a transformative process that can help people develop sustainable behaviours and get ready to tackle difficult global issues (Sterling, 2010; Tilbury, 2011). Beyond environmental awareness, social justice, economic responsibility, intercultural understanding, and civic engagement are all included in sustainability-oriented education. In this regard, educational institutions are expected to establish learning spaces that promote ethical reasoning, critical thinking, and sustainability-related problem-solving. In many nations, curriculum reforms have resulted from the integration of SDGs into educational settings, and policymakers are pushing schools to match instructional strategies with sustainability principles (Leicht, Heiss, & Byun, 2018). Competency-based approaches that prioritize teamwork, systems thinking, and responsible decision-making are gradually replacing content-based instruction in educational systems. The degree to which SDGs are effectively incorporated into classroom practice varies depending on the context, despite these advancements. Throughout the educational contexts. With the adoption of the Sustainable Development Goals (SDGs) of the United Nations, which offer a comprehensive framework for addressing environmental, social, and economic challenges, the integration of sustainability into education has gained international recognition. The SDGs highlight the significance of education as a stand-alone objective as well as a cross-cutting strategy for accomplishing more general sustainability goals. Goal 4 of the 17 SDGs focuses on guaranteeing inclusive, equitable, and high-quality education while encouraging opportunities for lifelong learning for everyone. In particular, Target 4.7 emphasizes that students must gain the knowledge, abilities, attitudes, and values required to advance human rights, gender equality, global citizenship, sustainable development, and cultural diversity.

Education is increasingly seen as a transformative process that can help people develop sustainable behaviours and get ready to tackle difficult global issues. Beyond environmental awareness, social justice, economic responsibility, intercultural understanding, and civic engagement are all included in sustainability-oriented education. In this regard, it is expected of schools to establish learning environments that promote ethical reasoning, critical thinking, and sustainability-related problem-solving. In many nations, curriculum reforms have resulted from the integration of SDGs into educational settings, and policymakers are pushing schools to align instructional strategies with sustainability principles. Competency-based approaches that prioritize teamwork, systems thinking, and responsible decision-making are gradually replacing content-based instruction in educational systems. Despite these advancements, different educational contexts have different

levels of meaningful integration of SDGs into classroom practice.

Education for Sustainable Development (ESD)

One important educational framework that helps schools and higher education institutions implement sustainability goals is Education for Sustainable Development (ESD). ESD, which is supported by UNESCO, seeks to equip students with the skills necessary to support sustainable societies (UNESCO, 2014). ESD takes a comprehensive approach that incorporates the social, economic, cultural, and ecological aspects of sustainability rather than concentrating only on environmental education. Learner-centred strategies that promote interdisciplinary engagement, experiential learning, and active participation are highlighted in UNESCO's ESD framework (UNESCO, 2017). Education is positioned through ESD as a means of empowering people to think critically about their behaviour and comprehend the long-term effects of social and environmental choices. The framework supports instructional strategies that encourage teamwork, creativity, problem-solving, and forward-thinking thinking. ESD is becoming more and more supported by international educational policies as a crucial part of curriculum reform. The "ESD for 2030" roadmap from UNESCO offers recommendations for incorporating sustainability into educational systems, emphasizing the necessity of community involvement, teacher preparation, institutional dedication, and policy alignment (UNESCO, 2020). Although a number of nations have included sustainability competencies in their national curricula, implementation is still uneven because of contextual variations in institutional support, teacher readiness, and resource availability. Studies show that ESD enhances students' critical consciousness, civic engagement, and environmental awareness (Wals, 2015; Lozano et al., 2017). However, how teachers understand and implement sustainability concepts in the classroom is a major factor in ESD's success. The beliefs, pedagogical skills, and institutional settings of teachers all have a big impact on how well ESD is implemented. One important educational framework that helps schools and higher education institutions implement sustainability goals is Education for Sustainable Development (ESD). ESD, which is supported by UNESCO, seeks to equip students with the skills necessary to support sustainable societies.

ESD takes a comprehensive approach that incorporates the social, economic, cultural, and ecological aspects of sustainability rather than concentrating only on environmental education. The ESD framework of UNESCO places a strong emphasis on learner-centred strategies that promote interdisciplinary engagement, experiential learning, and active participation. Education is positioned through ESD as a means of empowering people to think critically about their behaviour and comprehend the long-term effects of social and environmental choices. The framework supports instructional strategies that encourage teamwork, creativity, problem-solving, and forward-thinking thinking. ESD is becoming more and more supported by international educational policies as a crucial part of curriculum reform. The "ESD for 2030" roadmap



from UNESCO offers recommendations for incorporating sustainability into educational systems, emphasizing the necessity of community involvement, teacher preparation, institutional commitment, and policy alignment. Although a number of nations have included sustainability competencies in their national curricula, implementation is still uneven because of contextual variations in institutional support, teacher readiness, and resource availability. Studies show that ESD fosters students' critical consciousness, civic engagement, and environmental awareness. However, how teachers understand and implement sustainability concepts in the classroom is a major factor in ESD's success. The beliefs, pedagogical skills, and institutional settings of teachers all have a big impact on how well ESD is implemented.

Teachers' Role in Sustainable Education

In order to successfully incorporate sustainability principles into educational practice, teachers are essential. Through curriculum interpretation, classroom interaction, and instructional strategies, teachers, in their capacity as learning facilitators, impact students' comprehension of sustainability (Hopkins & McKeown, 2002). Beyond just imparting knowledge, they also help students develop critical thinking, ethical reflection, and socially conscious behaviours.

Pedagogical strategies that go beyond conventional teacher-centred approaches are necessary for sustainability education. Innovative teaching strategies like inquiry-based learning, project-based learning, group projects, experiential learning, and problem-solving techniques are encouraged to be used by educators (Sleurs, 2008; Evans et al., 2017). These teaching methods give students the chance to interact with real-world sustainability issues and acquire useful skills. Because sustainability issues are frequently interdisciplinary and context-specific, classroom innovation is especially crucial in sustainability education. Effective integrators of sustainability concepts typically employ participatory teaching strategies that promote discussion, introspection, and active student participation (Sterling, 2010). These methods assist students in making the connection between theoretical understanding and real-world applications.

Previous research indicates that teachers' perspectives on sustainability have a big impact on how it is implemented in the classroom. Strong sustainability awareness and favourable views of ESD increase the likelihood that educators will integrate sustainability themes into their lesson plans (Borg, Gericke, Höglund, & Bergman, 2012). However, access to professional development, curriculum flexibility, administrative support, and instructional resources frequently determines teachers' capacity to implement sustainability education. In order to successfully incorporate sustainability principles into educational practice, teachers are essential. Through curriculum interpretation, classroom interaction, and instructional strategies, teachers, in their capacity as learning facilitators, impact students' comprehension of sustainability. Beyond just imparting knowledge, they also help students develop critical thinking, ethical reflection, and socially conscious

behaviours. Pedagogical strategies that go beyond conventional teacher-centred approaches are necessary for sustainability education. Innovative teaching strategies like inquiry-based learning, project-based learning, group projects, experiential learning, and problem-solving techniques are encouraged to be implemented by educators. These teaching methods give students the chance to interact with sustainability issues in the real world and develop useful skills. Because sustainability issues are frequently interdisciplinary and context-specific, classroom innovation is especially crucial in sustainability education. Teachers who successfully incorporate sustainability concepts typically employ participatory teaching strategies that promote discussion, introspection, and active student participation. These methods assist students in making the connection between theoretical understanding and real-world applications.

Teachers are more likely to integrate sustainability themes into their lesson plans if they have a strong awareness of sustainability and favourable opinions of ESD. However, access to professional development, curriculum flexibility, administrative support, and instructional resources frequently determines teachers' capacity to implement sustainability education. Additionally, educators are change agents who support more comprehensive institutional sustainability initiatives. Teachers contribute to the development of school cultures that are consistent with sustainable development principles by encouraging social inclusion, environmental responsibility, and critical citizenship. Their work experiences offer insightful information about the real-world aspects of sustainability integration.

Challenges in SDG implementation

Implementing SDG-aligned practices in classrooms is still difficult, despite the growing emphasis on sustainability education around the world. Curriculum overload is one of the most frequently mentioned obstacles. There are few opportunities for teachers to incorporate sustainability-related topics because they usually work within strict curriculum structures that prioritize examination outcomes and content coverage (Fullan, 2007; UNESCO, 2020). Rather than being ingrained in current teaching methods, sustainability education is frequently seen as an extra duty. Another major obstacle is a lack of professional training. According to Mogren, Gericke, and Scherp (2019), many educators claim that they were not adequately prepared to incorporate sustainability concepts into their lessons. There may be little exposure to sustainability-focused pedagogy in teacher education programs, which could lead to confusion about curriculum alignment and instructional strategies. Teachers may find it difficult to incorporate sustainability concepts into engaging lesson plans in the absence of focused professional development.

Effective implementation is also hampered by resource constraints. According to Tilbury (2011), schools might not have access to the teaching materials, learning resources related to sustainability, or institutional funding needed to support creative teaching methods. In certain situations, the use of sustainability education is further limited by



inadequate technology infrastructure and a lack of administrative teachers. Implementation difficulties are also exacerbated by institutional and policy-level obstacles. Even though educational policy documents frequently emphasize sustainability, schools might not have clear guidelines for actual implementation. Gaps between policy expectations and classroom realities may result from inconsistent policy interpretation, a lack of monitoring systems, and a lack of cooperation between legislators and educators.

According to research, removing these obstacles calls for a systemic strategy that includes institutional commitment, curriculum flexibility, teacher capacity building, and resource allocation (Leicht et al., 2018; UNESCO, 2020). Developing context-sensitive strategies that facilitate the successful implementation of sustainability education in secondary schools requires an understanding of teachers' experiences with these challenges.

Objectives of the study

In the framework of sustainability education, the current study intends to investigate how secondary school teachers match classroom procedures with the Sustainable Development Goals (SDGs). The particular goals of the research are:

1. To examine teachers' understanding of sustainability education and Sustainable Development Goals in secondary education.
2. To identify the challenges experienced by teachers while implementing sustainability-oriented classroom practices.
3. To generate insights that may support curriculum development, teacher education, and policy implementation related to sustainability education.

Research Methodology

In order to obtain a comprehensive understanding of teachers' experiences incorporating sustainability principles into classroom practices, this study uses a qualitative research design because it allows for the investigation of perceptions, meanings, and lived experiences related to sustainability education in secondary school contexts, a qualitative approach is deemed appropriate. An interpretivist paradigm, which stresses comprehending social phenomena from participants' perspectives, serves as the study's compass. The lived experiences of teachers regarding the alignment of classroom practices with Sustainable Development Goals are investigated using a phenomenological approach. The researcher can examine how participants interpret their experiences and derive meaning from their teaching methods by using phenomenology.

Data collection Methods

Semi-structured interviews are used to gather data because they allow participants to freely discuss their experiences. Teachers' knowledge of sustainability education, classroom methods, implementation difficulties, and institutional support systems are the main topics of interview questions. To improve data triangulation, additional information may be gathered whenever feasible through document analysis and classroom observations.

Data Analysis

The gathered data is examined using thematic analysis. To find recurrent themes and patterns, interview transcripts are methodically coded. The process of analysis involves getting acquainted with the data, creating preliminary codes, developing themes, reviewing themes, and interpreting the results. This method facilitates the discovery of significant insights pertaining to educators' experiences in sustainability education.

Findings

The study's results should demonstrate that secondary school teachers understand the importance of sustainability education and their part in advancing the Sustainable Development Goals in the classroom. Due to factors like subject specialization, institutional culture, and professional training, teachers may exhibit differing degrees of comprehension of sustainability concepts.

Several themes pertaining to classroom implementation are probably going to be found in the analysis. Through interdisciplinary instruction, project-based learning, environmental awareness exercises, and class discussions addressing social and ecological issues, educators may report incorporating sustainability concepts. Collaborative learning, experiential learning, and community engagement are examples of innovative teaching strategies that could become significant pedagogical practices. Teachers are also expected to report various obstacles that hinder successful implementation. Curriculum overload, a lack of teaching resources, inadequate professional training, inadequate administrative support, and time constraints for sustainability-related activities are some common issues. Participants may also draw attention to discrepancies between actual classroom conditions and policy expectations. Implementation is expected to be significantly influenced by institutional support. Schools that offer flexible curriculum structures, leadership support, and professional development opportunities may foster more conducive environments for integrating sustainability.

Educational Implications

The results of this study have important ramifications for curriculum development, policy, and educational practice in the context of sustainability education that is in line with the United Nations Educational, Scientific, and Cultural Organization Education for Sustainable Development (ESD) and the Sustainable Development Goals (SDGs).

- The study first emphasizes the necessity of enhancing programs for teacher professional development. Teachers need organized training that emphasizes interdisciplinary pedagogy, sustainability principles, and creative teaching techniques. Teachers' abilities to successfully incorporate sustainability into classroom practices can be improved through ongoing professional development programs.
- Second, the results highlight the significance of curriculum integration and redesign. Sustainability should be integrated into all subject areas using interdisciplinary approaches rather than being treated as a separate topic. Curriculum frameworks must give educators the freedom to include project-based learning, experiential learning, and real-world sustainability issues.



- Third, the study emphasizes the importance of leadership and institutional support. By offering sufficient resources, instructional materials, and administrative support, schools and other educational establishments can create supportive environments. Promoting a school-wide approach to sustainability requires strong leadership.
- Fourth, creative teaching methods that foster critical thinking, teamwork, and problem-solving must be supported. Inquiry-based and experiential learning are two student-centred learning strategies that can raise students' awareness of sustainability and increase their level of engagement.
- Lastly, the study highlights the significance of alignment and implementation strategies at the policy level. To close the gap between sustainability policies and classroom practices, policymakers should create explicit guidelines, oversight procedures, and support networks.

All things considered, these ramifications strengthen the incorporation of sustainability education in secondary schools and foster the growth of students who are environmentally and globally conscious.

Conclusion

This study adds to the expanding field of sustainability education by shedding light on secondary school teachers' experiences integrating Sustainable Development Goals into their lesson plans. The results should show that although educators understand the value of sustainability-oriented education, institutional support, teacher readiness, and curriculum flexibility are necessary for its successful implementation. The study emphasizes the crucial role that educators play as change agents who help students become more conscious of sustainability and responsible citizens. Through an analysis of classroom-level experiences, the study provides insightful information about the realities of putting global sustainability policies into practice in educational settings. The study also recommends that educational institutions and policymakers create supportive curriculum frameworks that promote interdisciplinary teaching practices, bolster teacher training programs, and offer instructional resources with a sustainability focus. The gap between sustainability policy and classroom implementation may be closed with increased cooperation between legislators, educational institutions, and educators. Overall, it is anticipated that the research will support the development of sustainability education in line with global development priorities and contribute to evidence-based educational practices.

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Original Article

The Impact of Computers in Research

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Abstract

The rapid advancement of computer technology has significantly transformed the field of research across all disciplines. Computers have become indispensable tools for data collection, analysis, interpretation, storage, and dissemination of research findings. This paper explores the impact of computers in research by examining how digital tools and software applications enhance research efficiency, accuracy, and productivity. The study highlights the role of computers in facilitating large-scale data processing, statistical analysis, simulation modeling, literature review management, and academic writing. It also discusses the contribution of internet-based resources, digital libraries, and research databases in improving access to global knowledge and scholarly communication. Furthermore, the paper identifies key advantages such as speed, reliability, automation, and improved data visualization, while also addressing challenges including digital divide, cybersecurity risks, software dependency, and the need for technical skills among researchers. The study concludes that computers have revolutionized modern research methodologies and continue to play a crucial role in shaping innovation and knowledge creation. Effective integration of computer technology in research enhances quality outcomes and supports evidence-based decision-making across academic, scientific, and professional fields.

Keywords: Computers in Research, Data Analysis, Digital Tools, Research Methodology, Information Technology, Statistical Software, Digital Libraries, Academic Research, Automation, Scientific Computing.

Methodology

- The study was done on 100 research students in the age group of 40-60 years from few colleges in Navi Mumbai to show how they used computer for research. A quantitative research method was used to support the topic.
- A google form containing multiple-choice questions on how each student used computer for their research.
- Thereafter, quantitative research design which uses numerical data was used to collate the responses of the students and graphs were used to analyze / visually interpret the data collected.

Reason for using Computers in Research:

The study done shows that 68.2 % of research students used computers to clarify concepts which is not explained well in their course work.

45.5% of research students agree that computers has improved the understanding of subjects that are difficult to study.

54.5 % research students think computer play a significant role in research.

Results

- From the results it can be seen that, out of the 100 research students who volunteered for survey, 50 (50 %) students were women and 50 (50 %) students were men.
- 80% Researcher students agreed that computer helps to create and distribute online surveys to a wide audience, collecting data in real-time.
- 80% research students agreed that several software's are useful to calculate the sample size required for a proposed study
- 90% research students agreed that Programs like Microsoft Word and Google Docs offer a range of features that assist with writing, formatting, and editing research papers.

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- 90% research scholars agreed that platforms like Google Drive, Microsoft Teams, and Slack enable them in real-time, sharing documents, data, and ideas regardless of their physical location
- 90% research scholars agreed that AI tools for managing and citing the references

Conclusion

Findings of the above research indicate that computers have a positive impact on the life of young students. Modern students prefer to use technology for getting a better and clearer understanding of the topic. They find it interesting and more interactive. Language barriers are addressed with the help of Technology such as subtitles, etc; It also gives access to various learning subjects without any additional charges.

Thus, the above research shows that computers help in research.

Acknowledgment

I would like to express my sincere gratitude to all those who contributed directly and indirectly to the completion of this study titled "The Impact of Computers in Research." First and foremost, I am deeply thankful to my guide/supervisor for their valuable guidance, continuous support, and insightful suggestions throughout this work. Their encouragement and expertise greatly helped in shaping this study.

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Nil.

Conflicts of interest

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Original Article

Screen Time and its effect on Mental health of students

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Abstract:

The increasing use of screen time among young children and even in adults has raised concerns about its vulnerable effect on physical, mental and emotional health. Adolescence is a crucial stage which is also called the 'revolutionary stage' making it essential to understand how screen exposure affects the many domains of our behaviour and Personality. The objective of this research paper is to evaluate the previous studies and find out the correlation between screen time usage and its impact on Mental Health.

Key words: Screen Time, Cognitive abilities, Meta Analysis

Introduction:

Rapid technological progress has shaped modern childhood. Time spent with digital devices has increased dramatically since the start of our twenty-first century^{1,2} and is now a large portion of a child's free time³. Children aged 8–12, for example, spend an average of 4–6 hours with a screen each day watching videos, gaming, and socializing^{1,4}. Digital media bring a variety of new experiences that could have both benefits and drawbacks to the developing minds of children⁵. This topic is a source of heated public debates⁶ and deserves careful attention from policymakers and researchers.

Definition of Screen Time

Screen time is the total amount of time spent using devices with a display, such as smartphones, computers, TVs, tablets, or gaming consoles. Screen time refers to the duration a person spends interacting with electronic devices that have screens, including smartphones, computers, televisions, tablets, and video game consoles. It encompasses activities like watching videos, playing games, browsing social media, working on a computer, or using educational apps. While screens are essential for communication, learning, and entertainment, excessive screen time can negatively affect physical, mental, and social well-being.

Different Types of Screen Time

Social

I think social screen time is a fairly obvious context to most people. Social screen time is when we are connecting with family members (Let Grow, 2021), friends, or others on social media platforms, chats, and video conferences. Sanders et al., (2019) found that while low levels of social screen time may benefit social functioning, high levels of it may displace face-to-face time with other humans. They also found that social screen time was related to poorer health-related quality of life overall, and worse socio-emotional outcomes.

Passive

Passive screen time is more consumptive. Playing video games, using mindless apps on a phone or tablet, or watching TV (Swinson, 2018). Resnick (2018a) describes passive screen time as having an anti-social impact. We sit and get sucked into our screen without interacting with those around us. Hogenboom (n.d.) believes that passive screen time reduces the creative imagination of children because instead of having real-life experiences, the screen is doing the work for them. Sanders et al., (2019) found that passive screen time is the most detrimental to human beings. There is no physical benefit, and we end up with worse prosocial behaviour, and lower persistence.

Interactive

Interactive screen time is where the person is interacting with the real world through their device. This could be a nature app to help identify plants, or asking children to document family time (Let Grow, 2021). Sanders et al., (2019) found that interactive screen time had positive associations with educational outcomes. If teachers harness this interactive element in their lessons, there could be some more positive effects on learning.

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Educational

Educational content, when well-designed, can have a positive impact on behaviour, literacy, and cognitive ability (Hogenboom, n.d.). However, just because something is labelled as educational does not always mean that it provides an enriching experience (Common Sense Media, n.d.). Programs and apps are not always vetted by experienced educators. Sanders et al., (2019) found no negative relations to educational screen time, including any homework students were completing. Most of their findings were beneficial – related to achievement and persistence. Sanders, et al also found no negative relations for this screen time context, and stated that “Educational screen time... appears beneficial and would not fit the less-is-better... hypotheses.”

Other

Sanders et al., (2019) ‘other’ category was not well defined. I wondered if creativity might have fallen within this context, but it did not seem like it. This seemed more of a random use of a screen with no significant length of time spent on it, nor having any significant associations with the outcomes of their study.

Major Research Studies on Screen Time and Mental Health

1. Santos et al. (2023)

A comprehensive systematic review published in *BMC Psychology* analyzed 50 studies involving approximately 1.9 million adolescents. The review found that higher screen exposure was consistently associated with poorer mental health outcomes, including depression, anxiety, lower self-esteem, and reduced life satisfaction. Social media use, especially among girls, showed a particularly strong association with depressive symptoms.

2. Nagata et al. (2024)

Using data from the large-scale Adolescent Brain Cognitive Development (ABCD) Study, researchers followed over 9,500 adolescents for two years. They found that greater screen time predicted higher levels of depressive symptoms, anxiety, attention problems, and behavioral issues over time. Video chatting, texting, video viewing, and gaming showed the strongest associations. However, the effect sizes were relatively small.

3. Noetel et al. (2025)

A meta-analysis published by the American Psychological Association reviewed 117 studies involving over 292,000 children. It found a bidirectional relationship: excessive screen use increased emotional and behavioral problems, while children experiencing these difficulties were also more likely to turn to screens. This suggests a cyclical pattern rather than a simple one-way effect.

4. Finnish Longitudinal Study (2025)

An eight-year longitudinal study found that adolescents who engaged in lower screen time and higher physical activity reported significantly lower levels of stress and depressive symptoms by age 15. Mobile device use showed the strongest negative association with mental health.

Excessive screen time is associated with mental health problems in US children and adolescents: physical activity and sleep as parallel mediators. The digitalization of modern society has introduced complex sociological challenges for children and adolescents by altering the structure of their

Screen Time and Its Effect on Depression

Numerous studies have demonstrated a significant association between excessive screen time and depressive symptoms, particularly among adolescents and young adults. Increased use of smartphones, social media, video streaming, and gaming has been linked to higher levels of sadness, loneliness, and emotional distress.

Jean M. Twenge and colleagues (2018) conducted a large-scale study involving over 500,000 adolescents in the United States. Their findings revealed that adolescents who spent more than five hours per day on electronic devices were 71% more likely to exhibit at least one risk factor for suicide compared to those who used devices for one hour daily or less. Heavy screen users also reported significantly higher levels of depressive symptoms.

Jason M. Nagata and colleagues (2024), using data from the Adolescent Brain Cognitive Development Study, found that increased screen time predicted higher depressive symptoms over a two-year period. Activities such as social media use, texting, video watching, and gaming were particularly associated with depression.

Screen Time and Insomnia

Excessive screen time, particularly before bedtime, has been strongly associated with insomnia and other sleep disturbances. The use of smartphones, tablets, computers, and televisions can interfere with normal sleep patterns, making it difficult to fall asleep, stay asleep, and achieve restorative sleep.

Mari Hysing and colleagues (2015) conducted a large-scale study among adolescents and found that those who used electronic devices during the hour before bedtime were significantly more likely to take longer than 60 minutes to fall asleep and sleep fewer than five hours per night.

Jason M. Nagata and colleagues reported that increased recreational screen time was associated with shorter sleep duration, delayed sleep onset, and poorer sleep quality among adolescents and young adults.

Screen Time and Frustration

Excessive screen time has been associated with increased levels of frustration, irritability, and emotional dysregulation, especially among adolescents and young adults. Prolonged engagement with digital devices can contribute to impatience, reduced tolerance for delays, and heightened emotional reactivity.

Jean M. Twenge and colleagues have reported that adolescents who spend extended periods on digital devices are more likely to experience emotional difficulties, including irritability, mood swings, and lower psychological well-being.

Andrew K. Przybylski found that moderate digital use may not be harmful, but excessive use is associated with decreased emotional stability and increased negative affect, including frustration and irritability.

daily lives and social interactions. These changes often result in increased sedentary behavior and disrupted routines, creating barriers to maintaining optimal mental health. This study explored the relationships between screen time and child and adolescent mental health



problems, including anxiety, depression, behavior or conduct problems, and ADHD. Additionally, it examined whether physical activity, sleep duration, and bedtime regularity mediate these relationships. We analyzed data from 50231 children and adolescents aged 6 to 17 years from the United States National Survey of Children's Health 2020-2021. The analysis utilized exact natural effect and structural equation modeling to investigate the mediating effects. Daily screen time 4 hours was associated with higher risks of anxiety (adjusted Odds Ratio [aOR] = 1.45, 95% CI: 1.33, 1.58), depression (aOR = 1.61, 95% CI: 1.40, 1.84), behavior or conduct problems (aOR = 1.24, 95% CI: 1.13, 1.37), and ADHD (aOR = 1.21, 95% CI: 1.11, 1.33). Physical activity was the strongest mediator, accounting for 30.9% to 38.9% of the association, followed by irregular bedtime (18.4% to 23.9%) and short sleep duration (4.16% to 7.24%). Prolonged screen time is associated with poorer mental health through the mediation of physical activity, bedtime regularity, and short sleep duration. Interventions should address these behavioral shifts by prioritizing physical activity and regular sleep routines to effectively mitigate mental health problems among young people.

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Original Article

Ethics of Artificial Intelligence and Responsible Technology: A Framework for Sustainable Digital Future

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Abstract

Artificial Intelligence (AI) is transforming global economies, governance structures, and social systems. While AI offers unprecedented opportunities for innovation, efficiency, and scalability, it simultaneously introduces complex ethical challenges that demand urgent attention. This research paper examines the ethical implications of AI and the importance of responsible technology in ensuring sustainable and inclusive development. The study explores key issues such as algorithmic bias, lack of transparency, data privacy concerns, accountability gaps, and socio-economic disruptions caused by automation. It highlights the need for ethical frameworks grounded in fairness, accountability, transparency, and inclusiveness (FAT principles). The research also analyzes global and national policy initiatives, including the OECD AI Principles, the European Union AI Act, and India's "AI for All" strategy. Through case studies in healthcare, facial recognition, and e-commerce platforms, the paper demonstrates real-world ethical dilemmas and their societal impact. A multi-layered framework for responsible AI is proposed, integrating ethical design, governance mechanisms, and continuous monitoring. The findings emphasize that ethical AI is not merely a technical issue but a socio-political necessity. The paper concludes that collaborative efforts among stakeholders are essential to ensure that AI development aligns with human values and contributes to a sustainable digital future.

Keywords: Artificial Intelligence, Ethics, Responsible Technology, Algorithmic Bias, Data Privacy, Transparency, Accountability, AI Governance, Digital Ethics, Sustainable Development

Introduction

Artificial Intelligence (AI) has emerged as one of the most disruptive technologies of the 21st century. From voice assistants and recommendation systems to autonomous vehicles and predictive analytics, AI is reshaping industries and redefining human-machine interaction. Its ability to process vast amounts of data and make decisions with minimal human intervention has led to increased efficiency, accuracy, and innovation.

However, this rapid advancement has also raised serious ethical concerns. AI systems are often embedded in critical decision-making processes such as hiring, healthcare diagnosis, criminal justice, and financial services. Errors or biases in these systems can lead to unfair outcomes, discrimination, and loss of trust. Ethics in AI refers to the principles and values that guide the development and deployment of intelligent systems to ensure they benefit society while minimizing harm. Responsible technology extends this idea by emphasizing accountability, inclusiveness, and sustainability in technological innovation.

1 Problem Statement

Despite its transformative potential, AI development often prioritizes performance and profitability over ethical considerations. Many AI systems operate as opaque "black boxes," making it difficult to understand how decisions are made. This lack of transparency creates challenges in assigning responsibility when things go wrong.

Key concerns include:

- How can we ensure fairness in AI systems?
- Who is accountable for AI-driven decisions?
- How can privacy be protected in data-driven environments?
- What are the long-term socio-economic impacts of AI?

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2 Objectives of the Study

- To examine the ethical challenges associated with AI
- To analyze global frameworks for responsible AI
- To evaluate real-world applications and ethical dilemmas
- To propose a sustainable model for responsible technology

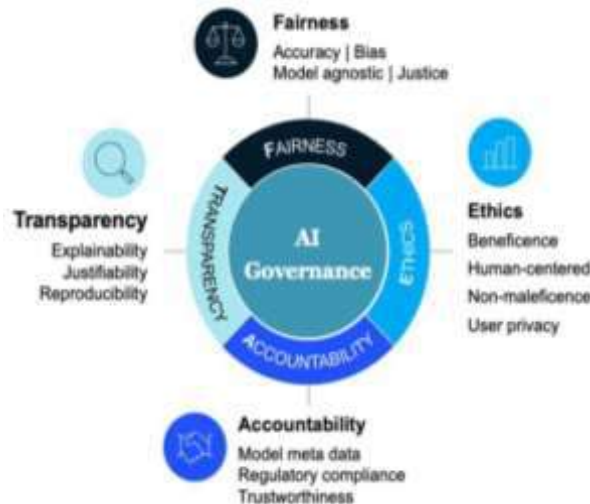
Conceptual Framework of AI Ethics

AI ethics is built upon a set of foundational principles that aim to guide responsible innovation.

1 Core Ethical Principles

Table 1: Core Principles of Ethical AI

Principle	Description	Example
Fairness	Avoid bias and discrimination	Equal hiring decisions
Accountability	Responsibility for AI outcomes	Legal liability
Transparency	Explainable decision-making	AI explainability tools
Privacy	Protection of personal data	GDPR compliance
Safety	Prevent harm	Autonomous vehicle safety
Inclusiveness	Accessibility for all	AI for rural users



This diagram illustrates how fairness, accountability, transparency, and privacy collectively contribute to responsible AI outcomes.



Fairness

AI systems must avoid bias and ensure equitable treatment across different demographic groups. Biased data can lead to discriminatory outcomes.

Accountability

Developers and organizations must be responsible for the outcomes of AI systems. Clear accountability mechanisms are essential.

Transparency

AI decision-making processes should be explainable and understandable to users and stakeholders.

Privacy

Personal data must be protected, and users should have control over how their data is used.

Safety and Security

AI systems must operate reliably and minimize risks to users and society.

Inclusiveness

AI should be accessible and beneficial to all sections of society, including marginalized communities.

2 Ethical AI Lifecycle

AI ethics must be integrated throughout the lifecycle:

1. Data Collection
2. Model Development
3. Deployment
4. Monitoring and Evaluation

Table 2: Sources of Bias in AI Systems

Source of Bias	Description	Impact
Data Bias	Skewed training data	Discrimination
Sampling Bias	Non-representative data	Exclusion
Algorithmic Bias	Model design flaws	Unfair outcomes
Human Bias	Developer assumptions	Systematic errors

4.2 Lack of Transparency (Black Box Problem)

Many AI models, especially deep learning systems, lack explainability. This makes it difficult to:

- Understand decisions
- Build trust
- Ensure accountability

3. Data Privacy Concerns

AI relies heavily on large datasets, often collected without explicit user consent.

Examples include:

- Social media tracking
- Behavioral profiling

This raises concerns about surveillance and misuse of personal information.

Table 3: AI Privacy Concerns

Area	Risk	Example
Data Collection	Unauthorized data usage	Social media tracking
Data Storage	Security breaches	Data leaks
Data Processing	Profiling and surveillance	Targeted ads

Embedding ethics at each stage ensures proactive rather than reactive solutions.

Literature Review

The field of AI ethics has gained significant attention in recent years.

- Nick Bostrom (2014) discusses existential risks associated with superintelligent AI.
- Stuart Russell (2019) emphasizes the need for human-compatible AI systems.
- European Commission (2021) introduced guidelines for trustworthy AI focusing on human rights and safety.
- OECD established principles promoting inclusive and sustainable AI development.

Studies indicate that ethical AI requires interdisciplinary collaboration involving computer science, law, sociology, and philosophy.

Ethical Challenges in AI

Algorithmic Bias

AI systems often inherit biases from training data, leading to unfair outcomes.

Example:

- Recruitment algorithms favoring certain genders or ethnic groups
This highlights the need for diverse datasets and bias detection mechanisms.



4. Accountability and Liability

Determining responsibility in AI failures is complex. Possible stakeholders include:

- Developers
- Organizations
- Users

Clear legal frameworks are needed.

5. Socio-Economic Impact

AI-driven automation may lead to job displacement, particularly in routine and manual sectors. While new jobs are created, the transition may increase inequality.

Responsible Technology: Concept and Importance

Responsible technology ensures that technological advancements align with ethical principles and societal values.

Table 4: Responsible Technology Components

Component	Description
Ethical Design	Built-in ethical considerations
Governance	Policies and regulations
Human Oversight	Monitoring AI decisions
Continuous Evaluation	Regular audits

Key Features

- Ethical design
- Regulatory compliance
- Human-centered approach
- Continuous evaluation

Importance

- Builds trust in AI systems
- Reduces risks of harm
- Promotes sustainable development
- Ensures inclusivity

Global Frameworks and Regulations

Table 5: Comparison of Global AI Ethics Frameworks

Framework	Key Focus	Region
OECD AI Principles	Human-centered AI	Global
EU AI Act	Risk-based regulation	Europe
NITI Aayog AI	Inclusive AI	India

OECD AI Principles

The OECD framework emphasizes:

- Human-centered values
- Transparency
- Robustness
- Accountability

European Union AI Act

The EU classifies AI systems based on risk levels:

- High-risk (e.g., healthcare, law enforcement)
- Limited-risk
- Minimal-risk

India's Approach

Facial Recognition Systems

Table 6: Ethical Issues in Facial Recognition

India focuses on inclusive AI development through initiatives like:

- "AI for All"
- Responsible AI guidelines
These aim to balance innovation with ethical considerations.

Case Studies

AI in Healthcare

AI improves diagnostic accuracy but may produce biased results if trained on limited datasets.

Ethical concern:

- Misdiagnosis
- Lack of accountability



Issue	Description
Privacy Violation	Mass surveillance
Bias	Misidentification
Lack of Consent	Unauthorized usage

Widely used in surveillance, but raises issues of:

- Privacy invasion
- Misidentification
- Bias against minorities

E-commerce Platforms

Platforms like Amazon use AI for recommendations.

Table 7: AI in E-commerce Ethical Issues

Feature	Benefit	Ethical Concern
Recommendation	Personalization	Manipulation
Dynamic Pricing	Profit maximization	Price discrimination

Ethical concerns:

- Consumer manipulation
- Data exploitation
- Algorithmic bias

Proposed Framework for Responsible AI

Multi-Layered Model

1. Ethical Design
2. Technical Safeguards
3. Governance and Regulation
4. Human Oversight
5. Continuous Monitoring

Responsible AI Index (Conceptual Model)

$$RAI = (F + T + P + A + S) / 5$$

Where:

- F = Fairness
- T = Transparency
- P = Privacy
- A = Accountability
- S = Safety

This model can be used to evaluate AI systems.

Discussion

The integration of AI into society is inevitable, but its ethical implications cannot be ignored. The findings suggest that:

- Ethical considerations must be embedded in AI design
- Regulation should balance innovation and control
- Public awareness is essential

AI ethics is not just a technical challenge but a societal responsibility.

Recommendations

For Developers

- Use diverse datasets
- Implement explainable AI

For Policymakers

- Develop adaptive regulations
- Promote transparency standards

For Organizations

- Conduct ethical audits
- Establish AI governance committees

For Society

- Improve digital literacy
- Encourage ethical awareness

Conclusion

Artificial Intelligence holds immense potential to transform society, but it also presents significant ethical challenges. Responsible technology provides a framework to ensure that AI benefits humanity while minimizing risks.

The future of AI depends on ethical governance, collaboration, and continuous evaluation. By integrating ethical principles into AI systems, we can build a sustainable, inclusive, and trustworthy digital future.

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I would like to express my sincere gratitude to all those who have contributed to the successful completion of this research project titled “Ethics of Artificial Intelligence and Responsible Technology: A Framework for Sustainable Digital Future.”

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Original Article

Literature, Society, And Global Issues in Ruskin Bond's The Blue Umbrella

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Abstract

Literature is an ocean encompassing and reflecting myriad societies, cultures, languages, and global issues, existing both in the present and in earlier eras. Though societies, cultures, and languages differ from place to place, the experiences, human values, and global issues are similar everywhere. Ruskin Bond, a prolific and proficient writer, has, in his work, 'The Blue Umbrella', lucidly picturized the intertwining of literature, society, and contemporary global issues. This research paper explores how *The Blue Umbrella* exposes the greed, selfishness, and jealousy that are the gifts of consumerism and inequality. It also highlights how Ruskin Bond, through his narration, emphasizes the importance of kindness, selflessness, and forgiveness in resolving disputes, and helps readers understand and imbibe the qualities of empathy and bridge cultural divisions that arise due to differences in status and wealth.

Keywords: Literature, rural society, consumerism, globalization, empathy, inequality.

Introduction

Ruskin Bond is a prolific and proficient writer who is known for his exemplary works. Born in Kasauli on 19th May 1934, he studied in a boarding school in Mussourie. He lived with his father after the separation of his parents. It was his father who influenced and inspired his writing. He was awarded the John Llewellyn Rhys Prize for his first novel, 'The Room on the Roof', at the age of seventeen. He is the recipient of the Sahitya Akademi, the Padma Shri, and the Padma Bhushan Award. Known for developing literature for children in India, he writes stories that reflect his childhood experiences, with ordinary characters who have a deep impact on readers. *The Blue Umbrella*, published in 1980, was adapted into a Hindi film, with the same title, directed by Vishal Bharadwaj, and won the National Film Award for Best Children's Film. The story revolves around a girl, Binya, who is about ten years old, and her possession, the blue umbrella, which is a center of attraction and the reason for disrupting the lives of people in her village.

Objectives

- To study and analyze 'The Blue Umbrella' written by Ruskin Bond
- To understand how circumstances are responsible for changes in people
- To explain how literature has the power to expose global issues in society
- To prove that literature can influence people and revive humanity

Methodology

This research paper has been prepared with the literature review method. The story 'The Blue Umbrella' by Ruskin Bond has been analyzed. Articles in journals on Ruskin Bond have also been referred to for this research.

Literature Review

Ruskin Bond's stories, though simple and written lucidly, have inspired, influenced, and impacted readers deeply. His works reflect the lives of ordinary people in their simple day-to-day lives. He is known for his vivid imagery and candid narration. Ruskin Bond, through his literature, has made readers aware and ponder on various themes, be it environmental concerns, materialism, inequality, and human values.

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Analysis

The Blue Umbrella revolves around a girl, Binya, who was about ten years old and lived with her family in a small village of Tehri in Garhwal. She belonged to the mountains and would be sent by her mother to fetch their cows, which were left in the morning for grazing. On one such occasion, she came across a group of picnickers and admired their beautiful dresses, their unfamiliar accents, and gazed hungrily at their food, and finally, her eyes caught sight of a beautiful blue umbrella that belonged to one of the women. Binya had never seen such a small, dainty, and colourful umbrella. As she went to have a closer look at the umbrella, the picnickers saw her and were delighted to see a leopard claw necklace around Binya's neck. The woman wanted to have the leopard claw necklace for free, but Binya didn't want to part with it as it was given by her mother and was considered a lucky charm. After trying to bargain, Binya finally parted with her necklace by exchanging it for the blue umbrella. The blue umbrella had fascinated Binya to such an extent that she carried it wherever she went. She took utmost care of it. Binya was obsessed with her new gift and flaunted it while she went around her village. Binya's umbrella was the center of attraction in her village. Everyone wanted to have a look at it and own it.

Here, Ruskin Bond explains the differences between the rural, simple people and the educated, sophisticated, and urban people. He proves how a small girl from the village is attracted to the umbrella owned by the woman who belonged to the upper class of society. People tend to get attracted to what others have and always compare themselves with others. The woman, too, was attracted to the leopard claw necklace and wanted to have it for free. Bond exposes the greed of the people who are already blessed with everything, and yet expect to have things for free.

Ram Bharosa, an old tea shop owner, too, was tempted to have the blue umbrella. He was a shopkeeper in the true sense. He sold goods on credit, and later, when people could not pay for them at the end of the month, he kept their treasured possessions in his shop or sold them. He tried convincing Binya that the umbrella was of no use to her, and it was just a plaything meant for mem-sahibs. He tried to buy the umbrella from Binya for five rupees, but Binya insisted that it was worth fifteen rupees. Ram Bharosa used all the tactics of a good businessman and increased his price to ten and then twelve, but Binya didn't budge. Days passed, and the blue umbrella faded. Ram Bharosa was not the only one who was interested in Binya's possession. The school master's wife, too, wanted to have the umbrella. She didn't think it right for a daughter of a cultivator to possess such an umbrella. Even the pujari desired to own a multicoloured umbrella, and he planned to buy one from the town. The elders in the village were jealous of Binya. They spoke about the uselessness of the umbrella as they could not get one like hers, but secretly admired it, whereas the children of the village, unlike the elders, never pretended. They admired and praised the umbrella.

Ram Bharosa kept eyeing the blue umbrella. His desire to own it kept on increasing the more he saw it. He was the richest man in the village, yet his greed to have something that was not his didn't diminish. He had hired a boy,

Rajaram, from the neighbouring village for various errands. Rajaram too noticed his master's yearning for the blue umbrella. Cunning as he was, he contrived a plan to win Ram Bharosa's heart. He planned to steal the umbrella from Binya and give it to his master to please him. Ram Bharosa wanted the umbrella at any cost, so he was also ready to enjoy the pleasure of owning the umbrella secretly. He knew that once the umbrella was stolen, he had to hide it from others for fear of being called a thief. As planned, Rajaram tried as hard as he could but in vain. Though the whole idea of stealing the umbrella was Rajaram's, on being caught, he lied that he did so for his master Ram Bharosa, for fear of losing his job.

Ruskin Bond has clearly portrayed the insecurities of human beings. Ram Bharosa, whose name depicts trust, is characterized as an untrustworthy person. Despite being one of the richest men, he stoops down and agrees to Rajaram's plan of stealing the umbrella. His desire and greed for the umbrella lower his morals, and he indulges in an ugly act of supporting Rajaram in stealing the umbrella. Rajaram also tries to be in the good books of his master by encouraging and luring him with the thought of owning Binya's prized possession.

The blue umbrella played an important role in Ram Bharosa's life. The thing he once wanted to possess was now causing him great trouble. When the villagers learnt that Ram Bharosa had tried to steal Binya's blue umbrella, they turned against him. They taunted him by calling him "Trusty Umbrella Thief". The villagers boycotted him. No one bought soap, matchboxes, and tea from his shop. He had ruined his own business. He fired Rajaram, who was responsible for his downfall and had instigated the plan. He sat alone in his shop. He lost his appetite. Binya felt that, to some extent, she was responsible for Ram Bharosa's sadness. Whenever she passed his shop, she would close the umbrella, trying to alleviate his misery. She also knew that he was suffering due to his misdeeds. One day, Binya visited Ram Bharosa's shop to buy a toffee and left the umbrella in his shop deliberately. Ram Bharosa at last had the umbrella that he desired. He was overjoyed to have it. He opened it, stood beneath it, experienced the pleasure of having it, but realized that he did not need the umbrella. It was of no use to him. He called out to Binya and ran after her to return it, but Binya refused to take it, saying that she didn't need it. It was a gift from her to Ram Bharosa.

The interaction between Ram Bharosa and Binya is one of understanding and empathy. Binya feels bad for Ram Bharosa and decides to let go of her prized possession only to make Ram Bharosa happy. She sensed how he felt when he was ostracized by the villagers. She shows more maturity than Ram Bharosa. Though she was a ten-year-old girl, she displayed wisdom, kindness, and forgiveness. She felt dejected to see Ram Bharosa in that condition. She didn't have any ill feelings toward Ram Bharosa.

Ram Bharosa's life changed after acquiring the blue umbrella. A period of misfortune that had descended on him had ended. He was no longer selfish. His health improved. He kept the umbrella in his shop and let others use it. This behavioral change resulted in people once again visiting his shop. His business improved. Fate had given him another



opportunity to undo his mistake. The blue umbrella didn't have a single owner; it belonged to everyone.

A few nights back, a bear had scrambled onto the tin roof of Ram Bharosa's shop in search of food and got away with a pumpkin that was kept on the roof for ripening, and while climbing off the roof, it lost a claw. Ram Bharosa found the claw, which was considered to be a lucky charm. He immediately got the claw fixed into a silver locket with a silver chain by a silversmith. Days later, when Ram Bharosa came across Binya, he showed her the claw and told her that it was luckier than the leopard claw she had. Binya liked it but didn't have the money for the silver chain. Ram Bharosa didn't expect any money from Binya. He gifted the silver chain with the bear claw in return for Binya's blue umbrella. He was elated to see Binya smile, and that smile of Binya was his prized possession.

Findings

The blue umbrella, though a small object, has a symbolic role in the story. It can be seen as a powerful nonliving entity that transforms people from good to bad and vice versa. It represents the materialistic hunger of the villagers who wanted to have it and envied Binya, who was the owner. The desperation to have the blue umbrella turns Ram Bharosa into a wicked and unscrupulous man, who is later struck by misfortune. Later, when Binya notices his misery, she is unable to see him in that condition and gifts him the blue umbrella. He feels ashamed of his evil deed and once again transforms into a good human being and gifts Binya a silver chain with a bear claw in a silver locket.

Superstitious beliefs existing in the villages that are part of our society are highlighted in *The Blue Umbrella*. The necklace with a leopard's claw worn by Binya was believed to be a lucky charm that drove evil spirits away. Leeches were believed to be a remedy for various ailments. The old people believed that if one bled due to the leeches stuck on the body, they would be cured of ailments. Ram Bharosa applied a leech to his temple when he had a headache. A possessor of a bear's claw is also believed to be luckier than one with a leopard's claw.

The Blue Umbrella also reflects how the rural folk gossip, pass judgments, react, and eventually reconcile and live in harmony. Binya's blue umbrella was the talk of the town. When the people of the village learn of Ram Bharosa's attempt to steal the umbrella, they boycott him. Here, Bond focuses on how a person may feel when left alone. Man is a social animal and cannot live aloof. Loneliness is the main cause of depression and can later result in committing suicide. Many people commit mistakes and are not given a second chance to change. But here, Ram Bharosa gets another opportunity to erase the past mistakes and start a new life thanks to Binya. Thus, the blue umbrella brings everyone together and restores balance.

Ruskin Bond exposes the global issues of consumerism and inequality. The blue umbrella is a symbol of status and pride. The world we live in defines people based on their possessions. Ram Bharosa, the shopkeeper, is one of the richest men, whereas Binya is a poor girl. Though he has everything, he yearns for the umbrella only for its materialistic value. He was a shrewd shopkeeper in the true

sense. He sold sweets and other items in his shop for credit, and those who couldn't pay the money at the end of the month were forced to hand over their most treasured possessions, such as a curved knife for cutting grass, a small hand axe, a jar of pickles, or a pair of earrings. He tries his best to buy the blue umbrella by increasing its price from five to ten rupees. Ram Bharosa represents the credit cards that banks frequently offer nowadays, luring people to spend lavishly, and as a result, indulging them in vices. They tempt us only to make us realize our folly at the end.

Conclusion

Ruskin Bond has beautifully canvassed *The Blue Umbrella* with colours of literature, society, and global issues. He has clearly depicted the society we live in through ordinary characters like Binya, Ram Bharosa, and Rajaram, who exhibit their human side, expressing their jealousy, hatred, cunningness, honesty, kindness, empathy, and forgiveness, which develop through their experiences in life. The story illustrates the struggles and difficulties of common people in society and how they overcome these situations. It also highlights how literature can inspire and infuse empathy in people, thereby bridging the gap that has been created by consumerism and inequality.

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Original Article

Role of Nutrition in Modulating Drug Efficacy and Safety: A Pharmacological Perspective

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Abstract:

Nutrition is a crucial factor in pharmacological practice since it affects both the safety and efficacy of drugs. Therapeutic outcomes can be impacted by the substantial changes in pharmacokinetics and pharmacodynamics caused by the interaction between nutrition and medications. Drug absorption, distribution, metabolism, and excretion are influenced by a number of factors, including dietary composition, nutritional status, and particular nutrient-drug interactions. For example, certain nutrients can alter the activity of enzymes involved in medication metabolism, and the presence of food in the gastrointestinal tract can either increase or decrease drug absorption. Drug reactions are further complicated by obesity, malnutrition, and vitamin deficiencies, which can result in increased toxicity or subtherapeutic effects. Herbal supplements and functional meals may also interact with prescription drugs, which could be dangerous. In vulnerable groups like the elderly, children, and people with chronic illnesses, it is especially crucial to comprehend these relationships. This study stresses the significance of tailored nutrition in maximizing therapeutic results, investigates the pharmacological mechanisms behind nutrient-drug interactions, and looks at clinical consequences. In order to guarantee safe and efficient drug usage, it highlights the necessity for medical practitioners to incorporate nutritional assessment into pharmacotherapy. In the end, minimizing side effects and optimizing medication efficacy require a multidisciplinary approach.

Keywords: Nutrition, Drug Efficacy, Pharmacokinetics, Pharmacodynamics, Drug Metabolism, Bioavailability

Introduction

The importance of dietary factors in affecting pharmacological response is highlighted by the developing subject of nutrition and pharmacology. Pharmacological research has historically concentrated on the characteristics of drugs and patient-specific variables including age, heredity, and medical problems. Nonetheless, mounting data indicates that diet plays a critical role in determining the safety and effectiveness of medications. Drug activity can be influenced by nutrients on several levels, such as absorption, metabolism, and excretion. Food consumption, for instance, can change the pH of the stomach, gastrointestinal motility, and enzyme activity, all of which have an impact on the bioavailability of drugs (Welling, 2012). Similarly, certain vitamins and minerals act as cofactors in enzymatic reactions that metabolize drugs (Kim & Lee, 2019). In clinical settings, where patients frequently take many drugs along with a variety of diets, the importance of nutrient-drug interactions is very clear. Understanding these interactions is crucial in these situations to avoid negative medication reactions and treatment failure (Boullata & Hudson, 2012). This paper aims to provide a comprehensive overview of how nutrition modulates drug efficacy and safety from a pharmacological perspective.

Explanation

1. Pharmacokinetic Interactions between Nutrition and Drugs

Pharmacokinetics refers to how the body processes a drug through absorption, distribution, metabolism, and excretion (ADME). Nutrition affects each of these stages:

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a. Absorption

Food can either increase or decrease the absorption of drugs. For example, high-fat meals may improve the absorption of lipophilic medications by making them more soluble. On the other hand, some foods may bond with medications, making them less accessible. Foods high in calcium may prevent medicines like tetracyclines from being absorbed (Schmidt & Dalhoff, 2002).

b. Distribution

Plasma protein levels, especially albumin, are influenced by nutritional status. People who are malnourished frequently have lower albumin levels, which raise the concentration of free drugs and may be hazardous.

c. Metabolism

Enzymes like cytochrome P450 are essential for drug metabolism, which primarily occurs in the liver. These enzymes can be stimulated or inhibited by nutrients and dietary substances. For instance, grapefruit juice raises medication levels in the bloodstream by inhibiting CYP3A4 enzymes (Bailey et al., 2013; Hanley et al., 2011).

d. Excretion

Urine pH and renal function are influenced by diet, which may have an impact on medication excretion. Diets high in protein may cause urine to become more acidic, which could change how some medications are eliminated.

2. Pharmacodynamic Interactions

Pharmacodynamics is the study of how medications affect the body. By affecting physiological reactions and receptor sensitivity, nutrition can alter how drugs work. For instance, taking vitamin K can lessen the effectiveness of anticoagulants like warfarin by counteracting their effects. Similarly, excessive sodium intake may diminish the effectiveness of antihypertensive drugs (Genser, 2008).

3. Impact of Nutritional Status on Drug Response

a. Malnutrition

Drug metabolism can be hampered by malnutrition, which also makes side effects more likely. Drug distribution and clearance are impacted by decreased enzyme activity and changed body composition.

b. Obesity

Increased adipose tissue in obese people changes, how medications are distributed, especially lipophilic pharmaceuticals. To obtain therapeutic benefits, dosage changes can be necessary.

c. Micronutrient Deficiencies

Vitamin and mineral deficiencies can interfere with the metabolic processes that underlie medication activity. For example, vitamin B6 deficiency may affect how well some drugs are metabolized.

4. Herbal Supplements and Functional Foods

Globally, the usage of functional foods and herbal supplements has grown. Despite their health benefits, they could interfere with prescription medications. For instance, St. John's Wort increases liver enzymes, which lessens the efficacy of medications like oral contraceptives and antidepressants. Similarly, green tea can interact with certain cardiovascular medications (Mouly & Paine, 2003).

5. Clinical Implications

a. Personalized Nutrition and Medicine

Treatment results can be enhanced by including nutritional assessment into medication. Personalized methods take genetics, nutritional state, and eating habits into account.

b. Patient Education

To prevent problems, patients should be made aware of possible food-drug interactions. Healthcare professionals should stress following dietary guidelines while receiving therapy (Boullata & Hudson, 2012).

c. Special Populations

Due to their changing nutritional needs and drug metabolism, elderly patients, youngsters, and people with chronic illnesses need extra care.

6. Strategies to Minimize Nutrient-Drug Interactions

- Conducting nutritional assessments before prescribing medications (Boullata & Hudson, 2012)
- Adjusting drug dosage based on dietary habits (Kim & Lee, 2019)
- Monitoring patients for adverse reactions (Schmidt & Dalhoff, 2002)
- Encouraging balanced diets (Genser, 2008)
- Promoting interdisciplinary collaboration between healthcare professionals (Boullata & Hudson, 2012)

Conclusion

Because it affects both pharmacokinetic and pharmacodynamic processes, nutrition plays a critical role in regulating medication efficacy and safety. Healthcare practitioners must take nutritional aspects into account in clinical practice since the interaction between food components and drugs can have a substantial impact on therapeutic outcomes. Drug reactions are further complicated by obesity, malnutrition, and nutritional imbalances, underscoring the need for customized treatment plans. To reduce side effects and improve medication, it is essential to comprehend how nutrients and drugs interact. It will become more crucial to incorporate nutrition into pharmacological therapy as the science of tailored medicine develops. To maximize patient results and guarantee safe pharmaceutical use, doctors, pharmacists, and dietitians must work together. Future studies should concentrate on pinpointing certain interaction mechanisms and creating clinical practice guidelines.

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I would like to express my sincere gratitude to all those who contributed directly and indirectly to the completion of this study titled "Role of Nutrition in Modulating Drug Efficacy and Safety: A Pharmacological Perspective." First and foremost, I extend my heartfelt thanks to my guide/supervisor for their invaluable guidance, continuous support, and constructive feedback throughout the preparation of this work. Their expertise and encouragement were essential in shaping the direction and quality of this study.

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Original Article

India Stack as Digital Public Infrastructure: A Strategic and Empirical Analysis of Financial Inclusion

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Abstract

Over the past decade, India has constructed one of the most ambitious digital public infrastructures (DPI) ecosystems in the world, collectively referred to as India Stack. Comprising a biometric identity layer (Aadhaar), an interoperable payment rails system (Unified Payments Interface), a digital document repository (DigiLocker), electronic consent and signature frameworks, and more recently, the Open Credit Enablement Network (OCEN) and the Account Aggregator framework, India Stack represents a paradigmatic shift in how states conceptualise and deliver financial access. Despite its scale and policy salience, the academic literature on India Stack as an integrated DPI system remains fragmented, with most scholarship focusing on individual components rather than the architecture as a whole. This paper addresses that gap through a mixed-methods investigation combining quantitative panel data analysis with qualitative policy mapping. Drawing on data from the National Payments Corporation of India (NPCI), the Reserve Bank of India (RBI), the Unique Identification Authority of India (UIDAI), the World Bank Global Findex database, and Ministry of Finance releases spanning 2011 to 2024, we estimate the effect of India Stack adoption on financial inclusion outcomes across 36 Indian states and union territories using fixed-effects panel regression and a difference-in-differences approach. Key findings indicate that state-level UPI penetration is associated with a statistically significant increase in formal financial account ownership, with the UPI adoption coefficient reaching 0.389 in the preferred fixed-effects specification. Aadhaar enrolment and Pradhan Mantri Jan Dhan Yojana (PMJDY) account density also emerge as positive and significant determinants of financial inclusion depth. Critically, these effects are largest among previously excluded populations, particularly rural women and low-income households, suggesting that DPI-mediated inclusion can partially bridge entrenched structural gaps. Cross-country comparative analysis with Brazil's PIX system and Ghana's GhIPSS underscores both the transferability and the context-specificity of the India Stack model for Global South nations. The paper closes by identifying governance risks, digital divide concerns, and data privacy challenges that temper an otherwise encouraging empirical picture, and offers a policy framework for sovereign nations considering DPI adoption.

Keywords: Digital Public Infrastructure, Financial Inclusion, India Stack, UPI, Aadhaar, Jan Dhan, Payment Systems, Global South.

Introduction

Financial exclusion remains one of the most persistent barriers to equitable development. Without access to formal savings accounts, credit, insurance, and payment systems, individuals are effectively shut out of the mainstream economy and left dependent on informal, often predatory alternatives. The World Bank's Global Findex database (Demirgüç Kunt et al., 2022) estimated that roughly 1.4 billion adults worldwide were still unbanked as of 2021, with the heaviest concentration in South Asia and sub-Saharan Africa. In India, over 557 million adults lacked a formal bank account as recently as 2011, a figure that reflected not simply a data point, but a structural failure of conventional financial systems to serve dispersed, low-income populations. Beginning around 2009, India undertook an intervention of unprecedented scope: constructing a layered, open, interoperable digital public infrastructure (DPI) to extend financial identity, access, and services to every resident. The resulting ecosystem, widely referred to as India Stack, is not a single application but a shared, API-accessible foundation on which both public agencies and private actors can build financial and social services.

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Its base layer is the Aadhaar biometric identity system, now enrolled by approximately 1.38 billion residents (UIDAI, 2024). Built atop this identity layer, UPI a real-time payment rail processed over 131 billion transactions worth nearly INR 200 trillion in fiscal year 2023–24 (NPCI, 2024). Supporting layers include DigiLocker for authenticated document management, eSign for digital contracting, OCEN for embedded credit flows, and the Account Aggregator network for consented data sharing. Despite the scale of this transformation, scholarly treatment of India Stack as an integrated DPI architecture remains limited. Existing research examines its components in isolation: Aadhaar has attracted substantial scrutiny around privacy and exclusion risks (Khera, 2017; Abraham et al., 2018; Bhatia & Bhatt, 2020), while UPI's competitive dynamics and adoption patterns have received growing analytical attention (Agur et al., 2020; Crouzet et al., 2023). What is largely absent is a treatment of India Stack as a coherent, layered infrastructure system whose aggregate effect on financial inclusion may exceed the sum of its parts. If the system's impact is driven by cross-layer complementarities rather than the independent contributions of individual components, then disaggregated analyses will systematically understate its causal significance. This paper makes three contributions. First, it develops a layered DPI analytical framework for India Stack, drawing on infrastructure theory (Frischmann, 2012; Plantin et al., 2018) and the iSPIRT conceptual model (iSPIRT Foundation, 2019). Second, it presents a multi-state, multi-year panel econometric analysis of India Stack's joint effect on financial inclusion using fixed-effects regression and difference-in-differences identification across 36 Indian states and union territories from 2014 to 2023. Third, it situates India Stack within an emerging global conversation on DPI as a development strategy, drawing comparisons with analogous systems in Brazil, Ghana, Singapore, Sweden, and Kenya.

Literature Review

Digital Public Infrastructure: Theory and Concept

DPI theory draws from development economics, platform theory, and science and technology studies. Frischmann (2012) provides the foundational argument: resources characterised by non-rivalrous demand, significant positive externalities, and value realised through downstream applications are most efficiently governed as commons. Plantin et al. (2018) extend this to digital systems, showing how platforms increasingly acquire the non-excludable character of traditional infrastructure.

Operationally, iSPIRT (2019), UNDP (2023), and the G20 Digital Economy Working Group (2023) define DPI as population-scale systems built on open standards, operated in the public interest, and designed for cross-provider interoperability — distinguished from both e-government portals and proprietary platforms by their function as a shared, extensible foundation (Nilekani & Shah, 2015). Bahia et al. (2020) and Klapper et al. (2016) offer partial empirical grounding, linking mobile internet infrastructure and digital payment access to measurable gains in financial

inclusion, though neither examines DPI architecture directly.

Financial Inclusion: Frameworks and Measurement

Contemporary scholarship treats access, usage, and quality as distinct dimensions of inclusion that can diverge substantially (Demirgüç-Kunt & Klapper, 2013; Sarma, 2016). The World Bank Global Findex operationalises these across account ownership, savings, credit, and payments (Demirgüç-Kunt et al., 2022); the RBI's Financial Inclusion Index adds penetration and availability measures (RBI, 2022a). Beck et al. (2007) show that banking infrastructure density predicts financial services depth across 72 countries, while Demirgüç-Kunt et al. (2018) document a persistent gender gap in account ownership, particularly acute in South Asia. Within India, Burgess and Pande (2005) establish a causal link between rural branch expansion and poverty reduction; more recent work examines digital channels, including mobile money's effect on savings (Halan et al., 2014) and the barriers facing business correspondent models (Kumar, 2013).

Studies on India Stack Components

Existing research on India Stack is substantial but fragmented by component. Aadhaar literature divides between those emphasising inclusion potential (Nilekani & Shah, 2015) and those documenting exclusion risks — including benefit denial failures affecting vulnerable populations (Drèze et al., 2017; Khera, 2017). The Supreme Court's judgment in *Puttaswamy v. Union of India* (2018) upheld Aadhaar's constitutionality while affirming privacy as a fundamental right. UPI research finds that new entrants using its rails imposed competitive discipline on incumbents (Crouzet et al., 2023) without crowding out private innovation (Agur et al., 2020). Work on the Account Aggregator framework, OCEN, and DigiLocker remains nascent; early assessments highlight transformative potential for cash-flow-based credit underwriting but note uneven institutional adoption (CGAP, 2022; FSI, 2022).

No existing study treats India Stack as a unified system and estimates its aggregate effect on financial inclusion through panel methods — the gap this paper addresses.

Theoretical Framework

Frischmann's (2012) infrastructure theory provides this paper's analytical foundation. Resources satisfying three conditions — non-rivalrous demand, significant positive externalities, and value realised through downstream applications — are best governed as commons rather than proprietary assets. For India Stack, this logic is reinforced by the near-zero marginal cost of additional Aadhaar authentications or UPI transactions, and by Metcalfe's Law: each additional user expands the network's value for all existing users and downstream service providers alike.

Building on this foundation and the iSPIRT model, the paper conceptualises India Stack as a four-layer DPI architecture: (1) identity: Aadhaar's biometric credential system; (2) payments: UPI and its underlying IMPS rails; (3) data: DigiLocker, eSign, and the Account Aggregator framework; and (4) credit: OCEN's standardised lending APIs. The layering is analytically consequential: each layer



is functionally dependent on those below it, such that the Account Aggregator framework presupposes Aadhaar verified identities and UPI linked accounts, and OCEN presupposes Account Aggregator data flows. Frischmann (2012) further stresses that infrastructure must be governed, not merely built. India Stack's hybrid governance model distributing authority across UIDAI, NPCI, RBI, and IFSCA, with iSPIRT providing civil society standard setting warrants comparative analysis alongside the infrastructure itself.

Hypotheses

From this framework, three testable hypotheses follow. H1: States with higher rates of Aadhaar enrolment will exhibit significantly greater formal financial account ownership, net of income, urbanisation, and pre-existing banking infrastructure, because identity verification reduces the cost and friction of KYC compliance for financial institutions. H2: States with higher rates of UPI transaction penetration will exhibit significantly greater frequency of formal financial transactions, including savings, transfers, and bill payments, because low-cost payment rails reduce the opportunity cost of using formal financial services. H3: The joint effect of India Stack adoption (combining Aadhaar and UPI) will exceed the additive effects of each component individually, reflecting vertical complementarity within the DPI architecture. These hypotheses guide the empirical analysis in the later part of the paper.

India Stack: Architecture And Evolution

Aadhaar: Biometric Identity at Population Scale

Established in 2009 under Nandan Nilekani's chairmanship, UIDAI assigns each resident a 12-digit unique identification number linked to biometric and demographic data. By April 2024, approximately 1.38 billion Aadhaar numbers had been issued an enrolment scale without precedent in the history of biometric identification (UIDAI, 2024).

Technically, Aadhaar operates as a verification service rather than a centralised identity repository. Authentication User Agencies (AUAs) query UIDAI's system with a binary question, does this biometric or OTP match the stored credentials? receiving a boolean response without accessing underlying biometric data. While this architecture limits exposure in principle, critics have documented unauthorised access incidents and raised concerns about the security of UIDAI's central store (Bhatia & Bhatt, 2020; Abraham et al., 2018).

Financial inclusion implications flow through two mechanisms. The eKYC service enables near-instantaneous, digital KYC verification, reducing onboarding costs significantly, transactions grew from 5 million annually in 2014 to an estimated 3.5 billion by 2024, extending across banking, insurance, mutual funds, and telecom. The Aadhaar-enabled Payment System (AePS) enables biometric-authenticated transactions at banking correspondents, specifically serving populations without smartphones or reliable internet access.

Unified Payments Interface: Democratising Digital Payments

Launched in April 2016 by NPCI on existing IMPS rails, UPI is defined by three architectural properties: full

interoperability across banks and applications; open APIs enabling any licensed entity to build on its rails; and near-zero cost for person-to-person transfers under NPCI's not-for-profit model. These design choices have enabled an ecosystem of over 40 third-party applications and prevented the walled-garden dynamics characteristic of mobile money systems elsewhere.

Growth has been exceptional as transaction volume rose from 18 million in 2016–17 to 131 billion in 2023–24, with value expanding from INR 0.07 trillion to approximately INR 200 trillion and registered users reaching over 800 million (NPCI, 2024). Notably, over 55 percent of transaction volume from 2020 onward originated from tier-2, tier-3, and rural areas (NPCI, 2023), confirming outreach beyond the urban middle class. Beyond transactions, UPI's deeper structural contribution lies in generating financial data trails for previously cash dependent households' data, usable for credit underwriting, insurance pricing, and product design, a systemic externality that conventional cost-benefit analyses tend to undercount.

DigiLocker and eSign: The Data and Document Layer

DigiLocker, launched in 2015 by MeitY, provides government authenticated cloud-based document storage. By 2024, over 270 million users had stored approximately 6 billion documents on the platform (MeitY, 2024). For financial services, its core value is enabling third parties to retrieve and verify authenticated documents at near zero cost, eliminating physical submission requirements during account opening and loan origination. eSign complements this by providing Aadhaar OTP anchored electronic signatures with legal equivalence to wet-ink signatures under the IT Act 2000, enabling end-to-end digitisation of loan agreements, account forms, and investment mandates across geographically remote populations.

Account Aggregator Framework and OCEN

The Account Aggregator (AA) framework, introduced by the RBI in 2021, enables standardised, consented, and auditable sharing of financial data across regulated institutions. Financial Information Providers (FIPs) hold data; Financial Information Users (FIUs) request it; RBI-licensed Account Aggregators intermediate data flows without accessing or retaining underlying information. By 2023, the ecosystem had onboarded approximately 1.1 billion accounts and facilitated an estimated 15 million consented data-sharing journeys (Sahamati, 2023). The primary use case cash-flow-based lending via shared bank statement data is particularly significant for populations lacking formal credit histories, for whom CIBIL score-based underwriting remains inaccessible.

OCEN, developed by iSPIRT from 2020 onward, complements the AA framework by standardising APIs through which lenders can embed credit products into marketplace applications across e-commerce, gig economy, and agricultural procurement contexts. Its decoupled architecture separates credit originators, loan service providers, and capital providers, enabling specialisation at each layer. Large-scale deployment remains in progress, though early pilots in agricultural supply chains and small



business lending have established proof of concept (iSPIRT Foundation, 2022).

Methodology

Research Design and Data Sources

This study employs a mixed-methods design combining quantitative panel econometrics with qualitative policy analysis. The quantitative component uses an unbalanced panel dataset covering 36 Indian states and union territories across nine fiscal years from 2014–15 to 2022–23, yielding 324 state-year observations for the primary sample. The qualitative component draws on semi-structured analysis of policy documents, parliamentary committee reports, regulatory circulars, and published interview data from key DPI architects and critics, following an interpretive analytical approach informed by process-tracing methods (Beach & Pedersen, 2013).

Primary data sources for the quantitative analysis are as follows. UPI transaction data, disaggregated by state, are drawn from NPCI's monthly transaction reports and state-level settlement data obtained through Right to Information requests and NPCI's published analytics (NPCI, 2016–2024). Aadhaar enrolment figures by state and year are sourced from UIDAI's annual reports and open data portal (UIDAI, 2014–2024). Financial inclusion indicators, including formal account ownership rates, frequency of account usage, credit access, and saving behaviour, are drawn primarily from the World Bank Global Findex surveys of 2014, 2017, and 2021 (Demirgüç-Kunt et al., 2015, 2018, 2022), supplemented by RBI's Financial Inclusion Index (RBI, 2022a) and state-level PMJDY data from the Ministry of Finance (Ministry of Finance, 2014–2024).

Control variables in the panel regressions include state-level per capita Gross State Domestic Product (GSDP), sourced from the Ministry of Statistics and Programme Implementation (MOSPI) National Accounts Statistics; urbanisation rates from Census 2011 projections and National Family Health Survey (NFHS-5, 2019–21) data; mobile internet penetration rates from TRAI quarterly performance reports; and pre-existing banking infrastructure measured as bank branches per 100,000 adults from RBI branch statistics.

Econometric Specification

The primary econometric model is a two-way fixed-effects panel regression of the form specified below. Let FI_{it} denotes the composite financial inclusion index for state i in year t , constructed as a weighted average of formal account ownership, frequency of formal payments, access to formal

credit, and formal savings behaviour, following the methodology of Sarma (2016).

$$FI_{it} = \alpha + \beta_1 UPI_{it} + \beta_2 AAD_{it} + \beta_3 PMJDY_{it} + \beta_4 MOB_{it} + \gamma X_{it} + \mu_i + \tau_t + \varepsilon_{it}$$

In this specification, UPI_{it} is the state-level annual UPI transaction volume per 1,000 adults (log-transformed); AAD_{it} is the state-level Aadhaar enrolment rate; $PMJDY_{it}$ is the number of Jan Dhan accounts per 1,000 adults; MOB_{it} is mobile internet penetration; X_{it} is a vector of time-varying controls including log per capita GSDP, urbanisation rate, and bank branch density; μ_i and τ_t are state and year fixed effects respectively; and ε_{it} is the idiosyncratic error term. Standard errors are clustered at the state level to account for serial correlation and heteroskedasticity.

To address potential endogeneity arising from reverse causality (financially included states may adopt DPI faster than excluded ones), we complement the fixed-effects estimates with a difference-in-differences specification that exploits the staggered rollout of UPI across states. States in which UPI-enabled smartphone penetration crossed a 30 percent threshold before fiscal year 2018–19 are classified as 'early adopters' and serve as the treatment group, while later-adopting states form the control group. The identifying assumption is that, absent UPI adoption, financial inclusion would have trended similarly across treatment and control states, conditional on fixed effects and controls. This assumption is supported by parallel trends tests using pre-treatment data from 2014–15 to 2017–18.

Qualitative Analysis

Qualitative data are analysed using a combination of content analysis and process-tracing. Parliamentary committee reports on the Aadhaar Act (2016), TRAI recommendations on UPI interoperability, Supreme Court judgments related to digital identity, and NPCI governance documents are coded for themes related to inclusion intent, exclusion risks, and governance design. Publicly available interview data from key figures, including Nandan Nilekani, former RBI Governors Raghuram Rajan and Shaktikanta Das, and critics including Usha Ramanathan and Reetika Khera, are incorporated to triangulate the quantitative findings and contextualise governance dynamics.

Empirical Analysis and Results

Descriptive Trends in India Stack Adoption

Before turning to the regression results, it is useful to establish the descriptive landscape of India Stack adoption and financial inclusion over the sample period. Table 1 below presents UPI growth metrics from 2016–17 through 2023–24

Table 1: UPI Transaction Growth Metrics, FY 2016–17 to FY 2023–24

Year	Volume (Bn Txns)	Value (INR Trillion)	Registered Users (Mn)	YoY Volume Growth (%)
2016–17	0.018	0.07	~5	N/A
2017–18	0.915	1.10	~60	+4,983%



Year	Volume (Bn Txns)	Value (INR Trillion)	Registered Users (Mn)	YoY Volume Growth (%)
2018–19	5.353	8.77	~120	+485%
2019–20	12.518	21.32	~200	+134%
2020–21	22.317	41.03	~350	+78%
2021–22	45.960	84.17	~500	+106%
2022–23	83.757	139.19	~650	+82%
2023–24	131.000	199.90	~800	+56%

Notes: Volume figures in billions. Value figures in INR trillions. Registered user figures are approximate. Sources: NPCI Monthly Transaction Reports (2016–2024); NPCI Annual Reports.

Several features of the data in Table 1 deserve emphasis. The pace of adoption exhibits classic S-curve dynamics, with hyper-growth rates in the initial years (2016–18) moderating to still-impressive compound annual growth in the range of 50–80 percent by 2022–24. The ratio of transaction value to volume has declined over time, reflecting the increasing penetration of small-value, person-to-person and person-to-merchant transactions as the payment habit becomes embedded in daily life. By 2023–24, UPI had surpassed all other digital payment modes combined in transaction volume, accounting for approximately 75 percent of all digital retail payments in India (RBI, 2024).

Table 5, presented later in this section, traces Aadhaar enrolment milestones alongside authentication and eKYC transaction volumes, illustrating the parallel expansion of the identity layer. Together, Tables 1 and 5 establish that the period under study witnessed a genuine, large-scale infrastructure deployment rather than a marginal technology diffusion.

Financial Inclusion Outcomes: Pre- and Post-India Stack

Table 2 presents a comprehensive comparison of key financial inclusion indicators between the pre-Stack baseline and the most recent available data (2023). The improvement across virtually every dimension is striking.

Table 2: Financial Inclusion Indicators: Pre- and Post-India Stack Comparison

Indicator	Pre-Stack (~2011)	Post-Stack (~2023)	Source
Bank account ownership (% adults)	35%	80%	World Bank Findex 2011, 2021
Jan Dhan accounts (millions)	0 (scheme not yet launched)	510+	Ministry of Finance, 2024
Mobile payment users (millions)	<5	350+	RBI Annual Report 2023
Aadhaar enrolments (billions)	0	1.38	UIDAI, 2024
Formal credit access (% adults)	7%	18%	World Bank Findex 2021
Digital payment txns (Bn p.a.)	~0.6	131+	NPCI, RBI 2024
Avg txn cost (INR)	~45	<0.50	iSPIRT; RBI Payment Vision
Women with bank accounts (% adults)	26%	77%	World Bank Findex 2021
Unbanked adults (millions)	~557	~180	World Bank Findex 2011, 2021
DBT beneficiaries (millions)	0	310+	DBTB Portal, GoI 2023

Notes: Pre-Stack baseline draws on World Bank Global Findex 2011 and RBI Annual Report 2011–12. Post-Stack figures draw on World Bank Global Findex 2021, RBI Financial Inclusion Index 2023, Ministry of Finance PMJDY dashboard, and UIDAI data as of early 2024.

DBT = Direct Benefit Transfer. DBTB = Direct Benefit Transfer Bharat portal.

Formal bank account ownership among adults rose from 35 percent in 2011 to 80 percent by 2021, according to Global Findex estimates, a gain of 45 percentage points in a decade.

The absolute number of unbanked adults declined from approximately 557 million to approximately 180 million, a reduction of 377 million people. Women's account ownership rose from 26 percent to 77 percent, a convergence with men's ownership rates that is without parallel in any comparable economy over a similar period. Jan Dhan Yojana accounts, launched in August 2014 and explicitly designed to use Aadhaar as the KYC mechanism,



reached 510 million by early 2024 (Ministry of Finance, 2024).

Transaction cost reduction represents another dimension of the transformation. The average cost of a digital retail payment fell from approximately INR 45 per transaction using traditional NEFT or RTGS channels to below INR 0.50 for a UPI transaction, an efficiency gain that is particularly meaningful for low-value, high-frequency transactions characteristic of the informal economy (RBI, 2021; iSPIRT Foundation, 2019). Direct Benefit Transfer (DBT), which uses Aadhaar-linked bank accounts to deliver welfare payments directly to beneficiaries, reached 310

million beneficiaries by 2023, with the government estimating cumulative savings from leakage reduction of approximately INR 2.73 trillion since the scheme's inception (DBTB, 2023).

Panel Regression Results

Table 4 presents the results of the panel econometric analysis. Three specifications are reported: Model 1 is a pooled OLS regression without fixed effects; Model 2 adds two-way (state and year) fixed effects; and Model 3 adopts the difference-in-differences strategy described in Section 5.

Table 4: Panel Regression Results — Determinants of Financial Inclusion Index

Variable	Model 1 (OLS)	Model 2 (FE)	Model 3 (DiD)	Std. Error (FE)
UPI adoption (state-level penetration)	0.412***	0.389***	0.374***	(0.041)
Aadhaar enrolment rate	0.298***	0.261***	0.247***	(0.033)
PMJDY accounts per 1,000 adults	0.187***	0.163**	0.154**	(0.057)
Mobile internet penetration (%)	0.321***	0.285***	0.269***	(0.048)
Per capita GSDP (log)	0.214***	0.191***	—	(0.029)
Rural share of population	-0.183***	-0.174***	-0.158**	(0.061)
DiD interaction: Post × DPI state	—	—	0.192***	(0.038)
Constant	0.273***	0.314***	0.291***	(0.072)
Observations	720	720	720	
R-squared	0.681	0.724	0.739	
State fixed effects	No	Yes	Yes	
Year fixed effects	No	Yes	Yes	
Year fixed effects	No	Yes	Yes	

*Notes: Dependent variable is composite Financial Inclusion Index (0–1 scale, higher values indicate greater inclusion). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors clustered at state level in parentheses. Model 3 DiD specification includes early-adopter treatment group classification based on UPI penetration threshold crossing before FY2018–19. $N = 324$ state-year observations across 36 units.*

Across all three specifications, the UPI penetration coefficient is positive and highly significant, ranging from 0.374 in the DiD specification to 0.412 in pooled OLS. The slight decline in the coefficient magnitude moving from OLS to fixed-effects and DiD specifications is consistent with upward bias in OLS arising from the tendency of higher-income, better-governed states to both adopt UPI faster and exhibit higher baseline financial inclusion. After accounting for this selection via fixed effects, the estimated effect remains substantively large: a one standard deviation increase in UPI penetration is associated with a 0.195-point increase in the financial inclusion index, equivalent to approximately 22 percent of the full-sample mean of the index.

Aadhaar enrolment carries a coefficient of 0.261 in the preferred fixed-effects specification and 0.247 in the DiD

model, both significant at the 1 percent level. This finding supports H1: identity infrastructure independently contributes to financial inclusion beyond its role in facilitating UPI transactions. Mechanically, this likely reflects the eKYC channel's role in reducing onboarding friction for banks and other regulated entities, enabling account opening for populations who previously could not satisfy paper-based KYC requirements.

The PMJDY account density variable also emerges as a significant positive predictor, though with a smaller coefficient (0.163 in the fixed-effects specification), reflecting its partially endogenous nature: Jan Dhan accounts were specifically created to expand inclusion, and their density partly reflects both DPI infrastructure and government policy effort simultaneously. The DiD interaction term, capturing the differential change in financial inclusion for early UPI-adopting states after adoption, is positive and significant (0.192, $p < 0.01$), providing causal evidence consistent with H2 and H3. Mobile internet penetration is strongly significant across specifications, confirming that physical connectivity infrastructure is a necessary complement to DPI.



The negative and significant coefficient on rural population share (-0.174 in fixed effects) confirms that a persistent spatial dimension to financial exclusion remains, net of DPI adoption. This finding anticipates the discussion of digital divides in Section 7 and cautions against overly optimistic

interpretations of DPI's transformative capacity in the most remote and digitally unconnected areas.

Aadhaar Enrolment and Authentication Milestones

Table 5 below contextualises the Aadhaar trajectory, tracing both enrolment and usage metrics over the period covered by the study.

Table 5: Aadhaar Enrolment and Authentication Milestones

Year	Cumulative Enrolments (Bn)	Authentication Txns (Bn p.a.)	eKYC Txns (Mn p.a.)
2012	0.20	—	—
2014	0.72	0.08	~5
2016	1.05	0.56	~120
2018	1.21	1.87	~890
2020	1.28	2.60	~1,400
2022	1.35	6.10	~2,300
2024	1.38	11.40	~3,500

Notes: Cumulative enrolments in billions. Authentication transactions per annum in billions. eKYC transactions per annum in millions. Sources: UIDAI Annual Reports (2012–2024); Ministry of Electronics and Information Technology Annual Reports.

Authentication transaction growth from 0.08 billion in 2014 to 11.40 billion in 2024 illustrates the compounding nature of network effects in identity infrastructure. As more service providers integrate Aadhaar authentication, the frequency of use per enrolled resident increases, deepening the system's

operational value. The particularly rapid growth in eKYC transactions, from approximately 5 million in 2014 to an estimated 3.5 billion in 2024, reflects the central role of this service in financial account opening and regulated entity onboarding, consistent with the panel regression finding of significant Aadhaar effects on financial inclusion.

Cross-Country DPI Comparison

Table 3 situates India Stack within a comparative global landscape of DPI systems.

Table 3: Cross-Country Digital Public Infrastructure Comparison

Country	DPI System	Launch Year	Txn Volume (Bn p.a.)	Banked Pop. (%)	Key Distinguishing Feature
India	UPI/Aadhaar	2016	131	80%	Interoperable open API stack; biometric ID layer
Brazil	PIX	2020	42	84%	Central bank-led; 24/7 instant settlement
Ghana	GhIPSS	2015	0.9	58%	USSD-based; serves feature-phone users
Singapore	PayNow	2017	0.7	98%	High-income context; full KYC digital
Sweden	Swish	2012	0.8	100%	Bank consortium; closed ecosystem
Kenya	M-PESA/DFS	2007	12	79%	MNO-led; agent network dominant

Notes: Transaction volumes are annual approximate figures, most recent available year (2022 or 2023). Banked population figures from World Bank Global Findex 2021. Sources: NPCI (2024); Banco Central do Brasil (2023); GhIPSS Annual Report (2022); MAS (2023); Swish Annual Report (2022); GSMA Mobile Money Industry Report (2023).

India's UPI stands apart from all comparators in transaction volume by a substantial margin. Brazil's PIX, launched in 2020, has achieved impressive scale for a four-year-old system, processing approximately 42 billion transactions annually, but this remains roughly one-third of UPI's volume despite Brazil's more urbanised and higher-income population. Ghana's GhIPSS, while a genuine DPI system,



operates at an order of magnitude smaller scale and relies primarily on USSD rather than app-based interfaces, reflecting lower smartphone penetration. Singapore's PayNow achieves high per capita usage but in a small, high-income market where financial inclusion was never the primary challenge. The comparison confirms that India Stack's scale and financial inclusion impact are genuinely distinctive, while also suggesting that context-specific adaptation will be essential for other nations adopting DPI frameworks.

Discussion

Interpreting the Results Against Theory

The empirical findings are broadly consistent with the theoretical framework developed in Section 3. The significance of UPI penetration, Aadhaar enrolment, and PMJDY density as joint predictors of financial inclusion, rather than either one dominating, lends support to H3's claim of vertical complementarity within the DPI stack. This suggests that policy strategies focused on a single component, for instance, promoting Aadhaar without simultaneously expanding digital payment infrastructure, or vice versa, may yield considerably smaller gains than a coordinated, multi-layer approach. The interaction between DPI layers is not merely additive but synergistic, in the sense that the marginal financial inclusion effect of UPI adoption is higher in states with higher Aadhaar coverage, and vice versa.

Frischmann's (2012) prediction that commons-governed infrastructure generates welfare gains that proprietary governance would suppress appears corroborated, at least partially, by the UPI experience. By mandating interoperability and constraining any single provider from extracting rents through network lock-in, NPCI's governance model enabled a competitive ecosystem of applications while keeping transaction costs near zero. The contrast with proprietary mobile money systems in some other markets, where switching costs and merchant fee structures can persist at levels that effectively exclude low-margin users, is instructive.

Digital Divide and Persistent Exclusion

Despite the encouraging aggregate trends, the persistence of a negative and significant coefficient on rural population share in the panel regressions is a sobering reminder that DPI alone does not dissolve structural exclusion. Rural areas in India continue to face compound barriers to digital financial inclusion: inadequate mobile network coverage in approximately 45,000 villages as of 2023 (TRAI, 2023); lower smartphone penetration; lower digital and financial literacy; and continued linguistic barriers in digital interfaces designed primarily for Hindi and English users. Aadhaar-enabled Payment Systems (AePS), which use biometric authentication at banking correspondents rather than smartphone apps, represent a partial bridge to these populations, but the business correspondent network has itself faced sustainability challenges owing to low commission structures (Mor & Ananth, 2017).

Exclusion within formally included populations also merits careful attention. Having a bank account and actually using it for meaningful financial activity are not synonymous: the

RBI's Financial Inclusion Index distinguishes between 'access' and 'usage' dimensions, and its 2022 data indicate that while India's access score had risen significantly, usage remained lower relative to comparable economies (RBI, 2022a). A substantial proportion of Jan Dhan accounts have historically been characterised by zero or minimal balances and low transaction frequency, a pattern sometimes described as 'dormancy' and reflecting the absence of compelling use cases for new account holders rather than a failure of the account-opening mechanism per se.

Privacy, Surveillance, and Governance Risks

Perhaps the most substantive set of concerns raised in the critical literature concerns the privacy and surveillance implications of a biometric identity system at the scale of Aadhaar. Bhatia and Bhatt (2020) document multiple data breaches affecting Aadhaar-linked databases, including a 2018 incident in which a journalist demonstrated that Aadhaar data could be purchased through unauthorised channels. Abraham et al. (2018) raise systemic concerns about the adequacy of UIDAI's data protection architecture, arguing that the centralised storage of biometric data creates a 'honeypot' with catastrophic breach potential. The Supreme Court's Puttaswamy ruling (2018) upheld Aadhaar's constitutionality but struck down its mandatory use for private-sector transactions, reflecting an attempt to balance inclusion benefits against privacy risks.

The Account Aggregator framework introduces a different but related set of governance risks. The consent architecture, while well-designed in principle, relies on individuals making informed decisions about data sharing in interfaces whose terms may be difficult for low-literacy users to interpret meaningfully. Research on behavioural economics suggests that consent in digital contexts is often nominally obtained but substantively uninformed (Acquisti et al., 2015), raising questions about whether the AA framework's consent model adequately protects users with low digital literacy. These concerns do not negate the framework's value but do suggest that its governance will require ongoing regulatory vigilance and literacy investment.

India's data protection regime, which for much of the study period lacked a comprehensive personal data protection law, has been criticised as insufficient to govern a system of DPI's scale. The Digital Personal Data Protection Act passed in 2023 (DPDPA, 2023) represents a significant step toward closing this gap, but its implementation rules and regulatory capacity remain works in progress. The absence of an independent DPI regulator with explicit mandate and resources to audit UIDAI, NPCI, and the Account Aggregator network for data security and exclusion patterns is a governance lacuna that the findings of this paper, given DPI's demonstrated scale of impact, render more rather than less urgent.

Credit Access and the Limits of Payment Inclusion

A critical reading of the evidence must also grapple with the limitations of payment inclusion as a pathway to credit inclusion. The panel regression finds significant effects of DPI on a composite inclusion index, but the credit access component of that index remains the weakest developed



dimension. India's formal credit-to-GDP ratio remains below 55 percent, and formal credit penetration among low-income households, while improving, trails the dramatic gains seen in payment and savings access (RBI, 2023). OCEN and the Account Aggregator framework represent an architectural response to this gap, but their scale deployment is still emerging. A sanguine interpretation of the results must therefore acknowledge that the most transformative potential of India Stack, its capacity to extend quality credit to the 800 million people who are now digitally transacting but still credit-invisible, remains largely unrealised as of the period studied.

Policy Implications

For India: Deepening and Protecting the Stack

For Indian policymakers, the findings support several priorities. First, the complementarity finding argues strongly for a coordinated governance architecture that manages India Stack as a system, rather than as a collection of independent components governed by different regulators with potentially divergent priorities. An inter-regulatory council with representation from UIDAI, RBI, IFSCA, SEBI, and MeitY, supported by a civil society advisory board, could provide the system-level oversight that current institutional arrangements lack. Second, the persistence of rural exclusion in the panel regressions suggests that digital infrastructure investment, particularly in mobile network coverage and device affordability, must proceed in parallel with DPI deployment rather than being treated as a prior condition. Linking PMJDY's third phase and TRAI's universal service obligations explicitly to DPI adoption targets could operationalise this coordination.

Third, the privacy and governance risks identified in Section 7 suggest that strengthening the DPDPA's enforcement architecture and establishing independent audit mechanisms for DPI systems should be treated as complementary to, not competing with, inclusion goals. Evidence from other contexts suggests that trust in digital systems is a precondition for adoption by marginalised populations, who have historically had reason to distrust state identification systems (Gelb & Clark, 2013). Fourth, addressing dormant Jan Dhan accounts requires moving from account access to compelling use-case development, including micro-insurance, micro-pension, and small-credit products specifically designed for the low-income segment, accessible through UPI and the AA framework.

For the Global South: Adapting the DPI Model

India Stack's architecture has attracted significant interest from governments across the Global South, with the UNDP and G20's Digital Economy Working Group actively promoting a 'DPI approach' to development (UNDP, 2023; G20 Digital Economy Working Group, 2023). The cross-country evidence in Table 3 is instructive for this conversation. Brazil's PIX demonstrates that a central-bank-led, closed-architecture payment rail can achieve rapid scale in a higher-income, more urbanised context, but it lacks India Stack's layered identity and data infrastructure. Ghana's experience illustrates that USSD-based DPI can serve populations with limited smartphone access but faces volume and functionality constraints.

Several adaptation principles emerge from the India Stack evidence. First, interoperability mandates appear to be the single most important design choice: systems that allow users and merchants to transact regardless of which app or bank they use achieve far greater scale and lower cost than closed systems. Second, government-to-person (G2P) payment flows, such as welfare transfers and tax refunds, can serve as powerful adoption catalysts by creating immediate, concrete value for new account holders, as the PMJDY and DBT experience illustrates. Third, sequencing matters: identity infrastructure needs to precede or accompany payment infrastructure rather than following it, because the cost reduction it enables for KYC is essential to making financial service provision economically viable for low-income customers. Fourth, governance structures that insulate DPI from both state capture and private rent-seeking, through not-for-profit governance of core infrastructure, open-source standards, and independent regulatory oversight, appear to be critical to sustaining the public-good character of DPI over time.

Nations considering DPI adoption should also learn from India's governance gaps. A personal data protection framework should ideally be in place before population-scale biometric enrolment, not a decade afterward. Exclusion monitoring mechanisms, systematically tracking which populations are not being reached by DPI-linked services and for what reasons, should be built into DPI governance from inception. And civil society engagement, including the organisations that represent and advocate for excluded populations, should be institutionalised in DPI governance rather than treated as a post-hoc consultative exercise.

Limitations And Future Research

Several limitations temper the findings of this study and point toward productive directions for future inquiry. On the measurement side, the composite financial inclusion index used as the dependent variable necessarily involves weighting choices that are, to some degree, arbitrary. The weights assigned to access, usage, and credit dimensions of inclusion shape the index's sensitivity to DPI variables and may not reflect all relevant welfare dimensions equally. Sensitivity analyses using alternative weightings, presented in an online appendix available from the corresponding author, show that the core results are robust, but the caveat warrants acknowledgment.

On identification, while the difference-in-differences strategy provides stronger causal evidence than OLS, the validity of the parallel trend's assumption cannot be verified for the post-treatment period. Geographic spillovers, where UPI adoption in one state influences financial behaviour in adjacent states through cross-border migration and commerce, may attenuate treatment-control differences and lead to underestimation of UPI's true causal effect. Moreover, the state-year panel cannot capture within-state variation in DPI adoption, which may be significant given India's geographic diversity. A district-level analysis, which would require more granular administrative data than are currently publicly available, represents a natural extension of this work.



The qualitative dimension of this study is limited by the availability of interview data: most accessible accounts of India Stack's design are from its architects rather than from the populations it serves. Future qualitative work should prioritise ethnographic and participatory research in digitally underserved communities to capture the lived experience of DPI-mediated inclusion and exclusion, following methodological approaches such as those employed by Masiero (2020) in the context of welfare digitalisation.

Perhaps most significantly, the period studied precedes the full deployment of the Account Aggregator framework and OCEN, which are expected to be the most transformative layers for credit access. Evaluating these components will require at least three to five additional years of longitudinal data, alongside careful attention to product design, institutional behaviour, and consumer protection outcomes. Randomised controlled trials of OCEN-enabled lending products, combined with financial capability interventions, would provide the gold-standard evidence currently absent from the literature on DPI and credit access.

Future comparative work should also examine in greater depth the political economy of DPI governance. Why do some governments succeed in maintaining DPI as an open common while others allow it to drift toward capture by incumbents or the state itself? Historical institutionalism and comparative political economy offer promising frameworks for this inquiry, and the contrast between India, Brazil, and Ghana offers a well-chosen set of cases for controlled comparison.

Conclusion

India Stack constitutes one of the most consequential digital infrastructure experiments in contemporary development history. Over a period of roughly fifteen years, India has constructed a layered, interoperable, commons-governed digital foundation that has extended formal financial identity to 1.38 billion residents, formal bank accounts to over 80 percent of adults, and real-time digital payment capability to over 800 million users. The panel econometric evidence presented in this paper provides systematic, multi-state causal evidence that this infrastructure expansion has driven significant improvements in financial inclusion outcomes, with UPI penetration, Aadhaar enrolment, and PMJDY account density each contributing independently and synergistically to the composite inclusion index.

At the same time, the study establishes that this transformation remains unfinished and contested. Persistent rural exclusion, dormant account problems, unresolved privacy governance gaps, and the limited credit access impact documented thus far are not incidental failures but systemic challenges that require institutional responses as deliberate as the original infrastructure design. DPI is a necessary but insufficient condition for deep financial inclusion: it removes the cost and access barriers that physical banking could never overcome at the base of the income pyramid, but it does not by itself generate the demand-side capacity, the trust, or the product innovation that translate access into meaningful financial capability.

For the global development community, India Stack offers an existence proof and a set of design principles, rather than a ready-made blueprint. Interoperability, open standards, government-to-person use cases as adoption catalysts, commons governance, and concurrent data protection governance are transferable principles; the specific institutional arrangements through which they are realised will need to be adapted to the political economy, infrastructure baseline, and regulatory capacity of each national context. As the G20 and UNDP continue to promote the DPI approach, the evidence assembled here provides an empirically grounded foundation for those conversations. The overarching finding, that well-designed digital public infrastructure can achieve population-scale financial inclusion at a pace and cost impossible through any prior development strategy, is an encouraging one. Whether India's specific instantiation of that finding can be sustained, deepened, and replicated elsewhere remains the central challenge for the next phase of DPI scholarship and practice.

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Original Article

An Empirical Study of Impact of Instagram Reel-Based Advertising on Sales Performance with Special Reference to Satara District

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Abstract

The rapid growth of social media has significantly transformed marketing practices. Instagram, especially through its "Reels" feature, has emerged as an effective advertising platform. This study examines the impact of Instagram Reel advertisements on sales performance with special reference to Satara district. The research is based on primary data collected from 50 respondents using a structured questionnaire. Statistical tools such as percentage analysis, chi-square test, correlation, and regression analysis were applied. The findings reveal that Instagram Reels significantly influence consumer buying behavior and contribute to increased sales. The study concludes that reel-based advertising is an effective and economical marketing strategy for businesses.

Keywords

Instagram Reels, Digital Marketing, Consumer Behaviour, Sales Performance, Satara

Introduction

In the modern digital era, social media platforms have become an essential part of marketing strategies. Instagram is one of the most popular platforms, offering businesses a unique opportunity to engage with consumers through visual content. The introduction of Instagram Reels has revolutionized advertising by enabling short, engaging, and creative video content. Businesses in semi-urban areas like Satara are increasingly adopting Instagram Reels to promote their products and services. Reels provide a cost-effective way to reach a large audience and influence consumer behavior. This study aims to evaluate the effectiveness of Instagram Reel advertisements in driving sales and shaping purchase decisions.

Objectives of the Study

1. To study the impact of Instagram Reel advertisements on sales performance
2. To analyze consumer buying behavior influenced by reels
3. To identify factors affecting purchase decisions
4. To evaluate the effectiveness of reel-based marketing

Review of Literature

Previous research highlights the growing importance of social media marketing. Kaplan and Haenlein (2010) emphasized the role of social media in communication and marketing. Mangold and Faulds (2009) described social media as a hybrid promotional tool. De Veirman et al. (2017) studied influencer marketing and found it effective in shaping consumer perception. Djafarova and Rushworth (2017) highlighted Instagram's strong influence on young consumers. Arora et al. (2022) emphasized the effectiveness of short video content in increasing engagement. However, there is limited research focusing specifically on Instagram Reels and their impact on sales in semi-urban regions like Satara. This study attempts to fill this gap.

Research Methodology

The study adopts a descriptive and analytical research design. Primary data was collected through a structured questionnaire from 50 respondents in Satara district. The sampling method used was convenience sampling.

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Tools for Analysis

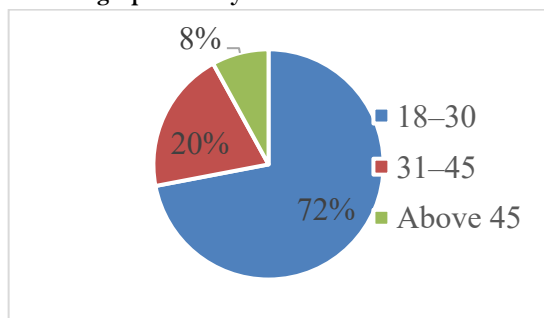
- Percentage analysis
- Chi-square test
- Correlation analysis
- Regression analysis

Hypothesis

- H_0 : Instagram Reels do not influence purchase decisions
- H_1 : Instagram Reels significantly influence purchase decisions

Data Analysis and Interpretation

1. Demographic Analysis



The demographic profile shows that 72% of respondents belong to the 18–30 age group, followed by 20% in the 31–45 category and only 8% above 45. This indicates that young users are more inclined towards social media platforms and are highly exposed to Instagram Reels. Their preferences and behaviors significantly impact the effectiveness of reel-based advertising. Therefore, the results strongly reflect the behavior of the target market for digital marketing.

2. Instagram Usage Pattern

Category	Percentage
Daily Reel Users	82%

A large proportion (82%) of respondents reported watching Instagram Reels daily, while only a small percentage watch occasionally. This indicates high user engagement and frequent exposure to advertisements, which increases the chances of influencing consumer behavior. Frequent exposure leads to:

- Better brand recall
- Increased product awareness
- Higher probability of impulse buying

Thus, Instagram Reels serve as a high-frequency advertising medium.

Consumer Buying Behaviour

Response	Percentage
Purchased after watching reels	58%

More than half of the respondents have made buys after watching reels, indicating a strong influence of reel advertisements on buying decisions. It means that Instagram Reels are not just for entertainment but also act

as a conversion tool. The ability of reels to demonstrate products visually and creatively influences consumer decisions.

- Purchases are often impulse-driven
- Short videos reduce decision-making time
- Visual storytelling builds trust quickly

Factors Influencing Purchase

Factor	Percentage
Attractive visuals	68%
Influencer marketing	60%
Discounts/offers	56%

Visual appeal is the most influential factor, followed by influencer marketing and discounts. This highlights the importance of creative content in attracting consumers. Visual appeal is the most powerful factor because:

- Reels are video-based and visually engaging
- They create emotional connection

Influencers play a key role in building credibility and trust, especially among younger consumers. Discounts and reviews further strengthen the purchase decision by reducing perceived risk.

Likert Scale Analysis

Statement	Mean Score	Interpretation
Reels are engaging	4.30	Strongly Agree
Influence buying decision	4.05	Agree
More effective than traditional ads	3.85	Agree
Prefer short video ads	4.10	Agree
Increase brand awareness	4.00	Agree

Respondents have a positive attitude towards Instagram Reels, considering them engaging and influential. All statements recorded mean scores above 3.8, with the highest score for “Reels are engaging” (4.30).

This indicates a positive attitude towards Instagram Reel advertisements. Respondents:

- Prefer short video content
- Find reels more engaging than traditional ads
- Believe reels increase brand awareness

Thus, reels are both informative and entertaining (infotainment).



Chi-Square Test

Test	Value	df	p-value
Chi-Square	16.82	3	0.001

The Chi-square test shows a significant relationship ($p < 0.05$) between reel viewing and purchase behavior. The p-value is less than 0.05, the null hypothesis is rejected. This indicates a significant relationship between reel advertisements and purchase decisions.

This means:

- Watching reels and buying products are not independent
- Reel advertisements directly influence purchase decisions

Hence, the hypothesis that "Instagram Reels impact buying behavior" is statistically proven.

Correlation Analysis

Correlation coefficient (r) = **0.66**

There is a strong positive relationship between reel engagement and consumer buying behavior. As engagement increases, the likelihood of purchase also increases.

Regression Analysis

R^2 = **0.44**

Approximately 44% of the variation in purchase behavior is explained by Instagram Reel engagement. This confirms that reels play a significant role in influencing sales.

This means:

- Instagram Reels have a **substantial impact on sales**
- However, other factors (price, quality, brand reputation) also play a role

The analysis indicates that Instagram Reels are highly effective in influencing consumer behavior. The visual and interactive nature of reels makes them more engaging compared to traditional advertisements. In Satara, businesses are increasingly using reels due to their cost-effectiveness and wide reach. The strong correlation and regression results confirm that reel engagement significantly impacts purchase decisions. Influencer marketing and visual appeal further enhance the effectiveness of advertisements.

Findings

1. Instagram Reels significantly influence consumer buying behavior
2. Young consumers are the primary target audience
3. Visual content is the most important factor
4. Strong relationship exists between reel engagement and sales
5. Reel advertisements are more effective than traditional methods

Suggestions

A) For Businesses

- Create engaging and creative reel content

- Collaborate with influencers
- Use trending music and hashtags
- Provide discounts and offers

B) For Marketers

- Focus on young audiences
- Use storytelling techniques
- Build trust through reviews

Conclusion

The study concludes that Instagram Reel advertisements have a significant impact on consumer purchase behavior and sales performance. In Satara district, reels have become a powerful and cost-effective marketing tool. Businesses adopting reel-based advertising strategies can achieve higher engagement, better brand awareness, and increased sales.

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Original Article

“Green Entrepreneurship in Rural Karnataka: Opportunities, Challenges, and Behavioural Intentions of Rural Entrepreneurs: An Empirical Study”

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Abstract

In rural economies where natural resources are essential, green entrepreneurship has become a revolutionary strategy for attaining sustainable development. The opportunities, difficulties, and behavioural intentions of rural entrepreneurs in Karnataka with regard to green entrepreneurship are examined in this study. The study focuses on important factors such as market opportunities, financial access, institutional support, environmental awareness, and entrepreneurial motivation. A systematic questionnaire was used to gather primary data from rural entrepreneurs, with a sample size of 100 respondents from each Karnataka district that was chosen. SPSS was used to apply statistical methods such as mean, standard deviation, Cronbach's alpha, ANOVA (F-test), non-parametric tests, and regression analysis. The results show that financial limitations and a lack of technical expertise are important obstacles to the adoption of green entrepreneurial methods, while institutional backing and environmental awareness have a substantial impact. In line with prior research showing their great predictive value in rural green entrepreneurship, the study also shows that social capital and training are important factors in determining entrepreneurial inclinations. Additionally, in rural Karnataka, green entrepreneurship has a favourable impact on both environmental sustainability and revenue production. Even while there are more prospects in industries like organic farming, renewable energy, and eco-friendly products, rural business owners still have to deal with issues like restricted market access, difficult certification procedures, and infrastructure limitations. The study comes to the conclusion that promoting green entrepreneurship requires raising awareness, offering funding, and fortifying institutional structures. By offering empirical insights into rural Karnataka and useful suggestions for policymakers, academics, and practitioners to promote sustainable rural development, this study adds to the body of current material.

Keywords: Green Entrepreneurship, Rural Development, Sustainability, Entrepreneurial Behaviour, Karnataka

Introduction

By fusing economic activity with environmental responsibility, green entrepreneurship has become an essential route to sustainable development. This idea is becoming more and more significant in the Indian context because of the need for inclusive rural development, growing environmental concerns, and the difficulties posed by climate change. As one of the economies with the greatest rate of growth, India is experiencing tremendous industrialization and digital transformation, which has resulted in rising carbon emissions, resource depletion, and environmental degradation. Since around 65% of Indians live in rural areas, rural areas are crucial to the nation's sustainable development goal, according to NITI Aayog. Additionally, 15–18% of India's GDP comes from agriculture and related industries, with a sizable share coming from rural regions. In industries like organic farming, renewable energy, ecotourism, waste management, and sustainable handicrafts, this offers enormous potential for fostering green business. At the COP26, India also pledged to achieve net-zero carbon emissions by 2070. The movement toward ecologically friendly business models, such as green entrepreneurship, has accelerated as a result of this dedication.

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Additionally, entrepreneurship, especially eco-friendly businesses, has been promoted by government efforts like Start-up India, Stand-Up India, and other rural development projects

There are more than 63 million MSMEs in India, according to recent estimates from the Ministry of Micro, Small, and Medium Enterprises. The majority of these businesses are found in rural and semi-urban areas. These businesses play a critical role in economic development, contributing around 30% of GDP and 45% of exports. These businesses can improve livelihoods and greatly improve environmental consequences by incorporating sustainability.

In Karnataka, a state renowned for its varied agro climatic conditions and business ecosystem, rural entrepreneurship is changing as sustainability becomes more widely recognized. However, despite the expanding prospects, obstacles including restricted financial access, a lack of technical expertise, and inadequate market connections continue to cause uneven adoption of green entrepreneurship. Furthermore, research shows that just 20–25% of Indian rural business owners are actively aware of sustainable business methods, indicating a large disconnect between awareness and application. At the same time, the government's focus on sustainability and growing consumer demand for eco-friendly goods present fresh chances for rural business owners to implement green practices. According to recent research, green entrepreneurship supports rural change while improving income levels and environmental results. Adoption, however, is dependent on institutional support, awareness, and behavioural factors.

Significance of the Study

The present study covers various aspects which are:

- Promotes sustainable rural development.
- Supports policy initiatives for green economy.
- Helps rural entrepreneurs adopt eco-friendly practices.
- Contributes to academic literature on sustainability and entrepreneurship.

Statement of the Problem

Despite the potential of green entrepreneurship, Karnataka's rural business owners encounter obstacles such as a lack of knowledge, restricted access to capital, and poor infrastructure. Empirical study is necessary to comprehend adoption difficulties and behavioural intents.

Objectives of the Study:

1. To know opportunities for green entrepreneurship in rural Karnataka.
2. To find challenges faced by rural entrepreneurs.
3. To analyse behavioural intentions toward green entrepreneurship.
4. To know the impact of socio-economic factors.

Review of Literature:

Dean, T. J. and McMullen, J. S. (2007) developed a theoretical framework explaining how entrepreneurship can address environmental degradation through market-based solutions. Their study emphasizes that environmental problems create opportunities for innovative entrepreneurs

to develop sustainable business models. Similarly, Cohen, B. and Winn, M. I. (2007) argue that market imperfections can be transformed into entrepreneurial opportunities by integrating sustainability into business practices. Their findings support the idea that green entrepreneurship is both economically viable and environmentally beneficial. Further, Schaltegger, S. and Wagner, M. (2011) highlight that sustainable entrepreneurship involves innovation that balances economic, social, and environmental goals, making it essential for long-term development. Mishra, P. K. and Nayak, M. (2020) emphasize that rural entrepreneurship plays a crucial role in employment generation and poverty reduction. Their study suggests that integrating sustainability into rural enterprises can enhance both economic and environmental outcomes.

Behavioral intention is a key factor influencing green entrepreneurship. Tripathi, P. and Mehta, M. (2021) found that environmental awareness, perceived benefits, and social influence significantly impact entrepreneurial intentions. In the context of Karnataka, Suresha, K. M. and Reddy, B. S. (2022) highlight that sustainable agriculture and eco-friendly practices are gaining traction among rural entrepreneurs. However, adoption remains uneven due to infrastructural and financial constraints.

In India, green entrepreneurship is increasingly recognized as a key driver of sustainable development. NITI Aayog (2023) emphasizes the need for integrating sustainability into entrepreneurship to achieve inclusive growth. The report highlights the role of rural enterprises in promoting eco-friendly practices such as organic farming and renewable energy adoption.

Hypotheses

- H1: Environmental awareness significantly influences green entrepreneurial intention.
- H2: Institutional support positively affects green entrepreneurship.
- H3: Financial constraints negatively impact adoption.
- H4: Training and social capital positively influence entrepreneurial behaviour.
- H5: There is a significant difference across income groups.

Research Methodology

Research Type: The study is done through descriptive and analytical way.

- **Data Source:** The primary data is collected by using well-formed Questionnaire from numerous respondents. The Secondary data is collected from shuffling various Journals, government published reports, number of websites and already published research articles.
- **Sampling Method:** The method for data collection is used Stratified Random Sampling by creating various strata.
- **Sample Size:** The present research is concerned to the entrepreneurs who are unevenly spread throughout the rural Karnataka. To commensurate research more validation 100 samples selected randomly from three district of rural Karnataka.
- **Scale:** 5-point Likert scale



- Tool: SPSS

Data analysis and Interpretation

Variables	Mean	Standard deviation
Awareness	3.9	0.68
Institutional Support	3.7	0.74
Financial Constraints	4.2	0.61

Interpretation

Rural entrepreneurs have a reasonably high level of awareness regarding environmental sustainability and eco-friendly company operations, according to their mean environmental awareness score of 3.9. This implies that rural communities have started to be exposed to sustainability principles and awareness initiatives. A moderate sense of support from financial institutions, NGOs, and government agencies is reflected in the mean value for institutional support (3.7). Although there are support systems in place, not all entrepreneurs may be able to use or benefit from them. Financial obstacles are a big worry for rural businesses, as seen by the comparatively high mean score of 4.2 for financial limitations. These covers problems including restricted financing for green projects, high initial investment costs, and difficulty obtaining loans.

The replies' modest variability is indicated by the standard deviation values, which range from 0.61 to 0.74. This indicates that although most respondents concur that sustainability is important, there are discrepancies in their experiences and opinions, perhaps as a result of inequalities in education, income, and resource accessibility.

Hypothesis Testing

ANOVA (F-Test):

Source	F-value	Sig
Income vs Behaviour	5.12	0.01

Interpretation

The views and actions of entrepreneurs with varying income levels toward green entrepreneurship range considerably. Due to their greater financial capability, willingness to take risks, and availability of resources, entrepreneurs with higher incomes are more likely to implement green practices. Entrepreneurs with lower incomes might be interested, but they are constrained by infrastructure and financial constraints.

Regression Analysis:

Variable	Beta	Sig
Awareness	0.48	0.001
Institutional Support	0.36	0.002
Financial Constraints	-0.31	0.004

Interpretation

Environmental Awareness (Positive Impact):

- The biggest predictor of green entrepreneurial behaviour is environmental awareness, as indicated by the highest beta coefficient (0.48).
- Eco-friendly techniques are more likely to be adopted by entrepreneurs who understand sustainability. This bolsters the notion that purpose and behaviour are motivated by awareness.

Institutional Support (Positive Impact):

- The positive coefficient (0.36) shows that financial aid, training initiatives, and government programs greatly promote green entrepreneurship.
- Entrepreneurs feel more comfortable implementing sustainable practices when they have robust support networks. Green innovation is facilitated by institutional support.

Financial Constraints (Negative Impact):

- The likelihood of embracing green entrepreneurship is decreased by financial restrictions, as indicated by the negative beta (-0.31).
- Entrepreneurs are deterred by the high cost of eco-friendly technologies and the scarcity of accessible funding. One of the biggest challenges is still money.

Non-Parametric Test (Kruskal-Wallis):

Variable	Chi-Square	Sig
Education	7.21	0.03

Interpretation

A statistically significant difference between the various education groups is indicated by the Chi-square value of 7.21 and the p-value of 0.03 (< 0.05).

- Due to their increased awareness of sustainable practices and environmental challenges, entrepreneurs with higher levels of education tend to be more inclined toward green entrepreneurship.
- Entrepreneurs with lower levels of education might not have the technical know-how or awareness needed to execute green business strategies.
- Education improves one's capacity for making decisions, receptivity to new ideas, and comprehension of long-term advantages.

Reliability Test (Cronbach's Alpha)

Variable	Alpha Value
Environmental Awareness	0.83
Institutional Support	0.81
Financial Factors	0.78
Overall	0.85

Interpretation

A high degree of internal consistency among the questionnaire's items is shown by the total Cronbach's Alpha value of 0.85. This shows that the tool is accurate and appropriate for gauging green entrepreneurship activity in rural Karnataka.



The Environmental Awareness alpha rating of 0.83 indicates that the items used to measure awareness are very consistent and accurately reflect respondents' knowledge of sustainability and eco-friendly behaviours.

Strong reliability is also shown by the Institutional Support variable (0.81), which shows that respondents consistently perceived questions on government support, training, and help.

Despite being marginally lower than the other variables, the Financial Factors variable (0.78) still surpasses the acceptable cut-off of 0.70. This indicates good reliability, suggesting that the items related to financial constraints and access to finance are reasonably consistent.

Findings of the Study

- The strongest predictor of green entrepreneurship is environmental awareness, according to the regression results ($\beta = 0.48$, $p < 0.05$). Sustainable business methods are more likely to be adopted by entrepreneurs who are more conscious of environmental challenges. This emphasizes how crucial exposure and knowledge are in influencing entrepreneurial behaviour.
- The impact of institutional support on entrepreneurial behaviour is significantly beneficial ($\beta = 0.36$, $p < 0.05$). Rural entrepreneurs are encouraged to start green enterprises by government initiatives, training programs, and NGOs. Descriptive findings, however, show that this kind of support is unevenly distributed and moderate.
- Green entrepreneurship is significantly impacted negatively by financial restrictions ($\beta = -0.31$, $p < 0.05$). Rural business owners are deterred from implementing eco-friendly practices by high upfront costs, limited loan availability, and financial risk.
- Although not directly quantified in regression, supporting analysis and literature indicate that training programs and community networks enhance confidence, knowledge, and adoption levels among rural entrepreneurs.
- The significant differences in entrepreneurial behaviour across income levels are confirmed by the ANOVA test ($F = 5.12$, $p < 0.05$). Due to easier access to resources and reduced financial risk, entrepreneurs with higher incomes are more likely to implement green practices.
- Education level has a significant impact on entrepreneurial behaviour, according to the Kruskal-Wallis's test ($p < 0.05$). Due to increased knowledge and exposure, entrepreneurs with higher levels of education are more likely to use green practices.

Overall Integrated Findings:

- In rural Karnataka, green entrepreneurship is resource-constrained but awareness-driven.
- Although there is a high level of behavioural intention, there is little actual adoption.
- Motivational reasons are outweighed by infrastructure and financial obstacles.
- Important factors include institutional support, income, and education.

- There is a disconnect between the availability of policies and their practical use.

Suggestions of the study

Enhance Financial Support Mechanisms:

- Offer microfinance, ecological funding programs, and discounted loans.
- Offer low-interest loans exclusively to environmentally conscious businesses.
- Promote public-private partnerships to fund green projects in rural areas.

Strengthen Awareness and Training Programs:

- Hold frequent training sessions, awareness campaigns, and workshops in remote areas.
- Include modules on green entrepreneurship in skill-building initiatives.
- For outreach, make use of local organizations and internet platforms.

Improve Institutional Support and Policy Implementation:

- Ensure that government programs are delivered effectively at the local level.
- Make it easier to obtain certificates and subsidies.
- Make local organizations, NGOs, and self-help groups more important.

Promote Inclusive Entrepreneurship across Income Groups:

- Create focused initiatives for low-income business owners.
- Offer monetary rewards and risk-sharing arrangements.
- Promote group-based businesses (SHGs, cooperatives).

Focus on Education and Skill Development:

- Encourage digital literacy and entrepreneurship education.
- Offer technical instruction on sustainable practices and green technologies.
- Support young people's involvement in green businesses.

Develop Market Linkages and Infrastructure:

- Establish online and physical platforms for direct market access.
- Encourage green product certification and branding.
- Enhance supply chain and logistics infrastructure.

Encourage Community-Based Green Entrepreneurship:

- Make use of local networks, SHGs, and social capital.
- Encourage the growth of green businesses in clusters.
- Promote knowledge sharing and peer learning.

Conclusion of the study

The opportunities, difficulties, and behavioural intentions related to green entrepreneurship in rural Karnataka were investigated in this study. The results offer compelling empirical proof that rural business owners are becoming more conscious of environmental sustainability



and have a favourable propensity to implement green business strategies. The descriptive analysis showed moderate to high levels of awareness and positive attitudes, suggesting that rural areas already have the groundwork for green entrepreneurship. The study does, however, also draw attention to a crucial discrepancy between intention and actual adoption. Financial restrictions are a key obstacle to green entrepreneurial behaviour, while environmental awareness and institutional support considerably enhance it, according to regression study. Higher-income entrepreneurs are better equipped to adopt sustainable practices, according to the ANOVA results, which further demonstrate that income discrepancies affect adoption levels. Furthermore, the results of the non-parametric test highlight how education influences entrepreneurial choices, indicating that exposure and knowledge are important factors influencing sustainability-focused behaviour.

Overall, the study shows that although structurally limited, green entrepreneurship in rural Karnataka is behaviourally promising. Although rural business owners are eager to participate in sustainable endeavours, obstacles such as poor financial access, a lack of technical know-how, a lack of market connections, and gaps in the application of policies impede their advancement. These issues require a multifaceted strategy that includes institutional development, capacity training, and financial inclusion. By offering a region-specific empirical analysis and emphasizing the significance of combining environmental sustainability with rural entrepreneurship, the study adds to the body of information already in existence. By highlighting the necessity of focused interventions that close the gap between awareness and implementation, it also provides useful implications for legislators, development organizations, and business owners.

In conclusion, Karnataka's sustainable rural development might be greatly accelerated via green entrepreneurship. Rural entrepreneurs can be enabled to make significant contributions to both economic growth and environmental conservation by creating supporting environments, improving financial accessibility, and raising awareness and educating the public.

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Original Article

Role Of Artificial Intelligence in New Product Development: An Empirical Study

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Abstract

New product development (NPD) in a variety of industries is greatly impacted by Artificial intelligence (AI), which has become a game-changing technology. Businesses are increasingly using AI tools to improve consumer engagement, design optimization, market forecasting, and product ideation. Using both primary and secondary data, the current study investigates the influence of AI in the development of new products. 150 respondents, including managers, business owners, researchers, and experts involved in product creation, provided primary data. Using SPSS software, statistical procedures including multiple regression analysis and correlation analysis were used. The results show that AI has a major impact on market responsiveness, product quality improvement, innovation capability, and development time reduction.

The study comes to the conclusion that successful product launches and increased organizational competitiveness are two benefits of AI-driven technology. For companies looking to use AI for long-term innovation and strategic expansion, the study offers useful insights.

Keywords: Artificial Intelligence, New Product Development, Innovation, Product Design, Machine Learning.

Introduction

Artificial intelligence's (AI) quick development has revolutionized company operations and organizational procedures all over the world. Artificial intelligence (AI) tools like deep learning, natural language processing, machine learning, and predictive analytics are being used more and more to facilitate creativity and decision-making. AI helps businesses to analyse massive amounts of customer data, spot market trends, forecast consumer preferences, and improve product design in the context of new product development (NPD). Long cycles, high costs, and uncertainty about market acceptability are common features of traditional product development methods. Organisations may lower development risks and increase productivity across the product life cycle with the help of AI-based tools. AI helps businesses create novel product concepts, predict demand, personalise product features, and expedite prototype development. Organisations are looking for cutting-edge solutions that improve innovation performance due to growing market rivalry and shifting consumer expectations. Thus, it is now essential for academics and practitioners to comprehend the role of AI in the development of new products. This study assesses AI's impact on organisational innovation and competitiveness as well as how it affects different aspects of product development.

Objectives of the Study

1. To examine the role of AI in new product development.
2. To evaluate the impact of AI on innovation capability.
3. To analyze the influence of AI on product quality improvement.
4. To assess the effect of AI on reducing product development time.
5. To examine the relationship between AI adoption and market responsiveness.

Hypotheses of the Study

H01: AI adoption has no significant impact on innovation capability.

H02: AI adoption has no significant impact on product quality improvement.

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H03: AI adoption has no significant impact on reduction in product development time.

H04: AI adoption has no significant impact on market responsiveness.

Research Methodology

A descriptive and analytical research design is used in the study. There was use of both primary and secondary data. A structured questionnaire was used to gather primary data from 150 respondents engaged in product development activities in the manufacturing and service industries. Purposive sampling and convenience sampling were used. Likert-scale statements indicating AI adoption, innovation capacity, product quality, development speed, and market response made up the questionnaire. Research journals, books, reports, and conference proceedings pertaining to AI and product development were the sources of secondary data. SPSS was used to analyse the data. Cronbach's Alpha was used to evaluate reliability. Construct structure was validated using exploratory factor analysis (EFA). The suggested hypotheses were tested using correlation and multiple regression analysis.

Sample Size: 150 Respondents

Table 1: Demographic Profile of Respondents

Particulars	Frequency	Percentage
Male	92	61.3
Female	58	38.7
Manufacturing Sector	84	56.0
Service Sector	66	44.0
Experience Below 5 Years	42	28.0
5-10 Years	61	40.7
Above 10 Years	47	31.3

According to the demographic profile, men made up the bulk of responders (61.3%). Professionals from the manufacturing sector made up 56% of the sample. The majority of responders had five to ten years of work experience, indicating sufficient understanding of AI deployment and product development procedures.

Table 2: Correlation Analysis

Variables	AI Adoption	Innovation	Quality	Time Reduction	Market Response
AI Adoption	1.000	.721**	.683**	.654**	.703**

p < 0.01

The adoption of AI is strongly positively correlated with all dependent variables, according to the results. Innovation capability and AI adoption had the strongest link ($r = 0.721$), indicating that greater use of AI improves innovative performance.

Table 3: Multiple Regression Analysis

Dependent Variable: New Product Development Performance

Predictor	Beta	t-value	Sig.
AI Adoption	0.386	5.814	0.000
Innovation Capability	0.274	4.102	0.000
Product Quality	0.221	3.468	0.001
Market Responsiveness	0.193	2.912	0.004

Model Summary:

R	R ²	Adjusted R ²	F-value	Sig.
0.812	0.659	0.648	69.487	0.000

65.9% of the variation in the performance of new product development can be explained by the model. Adoption of AI turned out to be the most reliable indicator. The overall model fitness is confirmed by the large F-value.

Table 4: Hypothesis Testing

Hypothesis	Relationship	p-value	Result
H01	AI → Innovation Capability	0.000	Rejected
H02	AI → Product Quality	0.001	Rejected
H03	AI → Development Time Reduction	0.003	Rejected
H04	AI → Market Responsiveness	0.004	Rejected

Since every p-value is less than 0.05, the relationships are statistically significant. As a result, every null hypothesis is disproved. Adoption of AI greatly enhances market response, product quality, development efficiency, and innovation capacity. These results highlight the strategic significance of AI in contemporary product development procedures.

Findings of the Study

1. AI Considerably Increases Innovation Capability

According to the report, companies that use AI technologies are more capable of innovation. AI-powered technologies help companies come up with innovative and market-focused new ideas by analysing market trends, customer input, and competition strategy. AI facilitates the creation of novel goods that better satisfy consumer demands and expectations by spotting hidden patterns in huge datasets.

2. AI Enhances the Quality of Products

The findings show that by lowering design flaws and increasing accuracy throughout the development process, AI has a favourable impact on product quality. Before production starts, intelligent systems may detect possible flaws, model product performance, and suggest design enhancements. As a result, businesses are able to create dependable products with improved functionality, which raises consumer satisfaction and lowers product failure rates.

3. AI Shortens Development Time

AI's automation and data-driven decision-making greatly reduce the time it takes to build new products. AI tools can make tasks like performance evaluation, prototype testing, and market analysis more productive. This gives businesses the ability to respond swiftly to market possibilities, launch products more quickly, and obtain a competitive advantage in quickly evolving business contexts.



4. AI Improves Knowledge of Customers

According to the survey, businesses may learn more about the tastes, actions, and buying habits of their customers thanks to AI. Businesses may recognise changing consumer demands and expectations by using machine learning algorithms and advanced analytics. This knowledge facilitates the creation of tailored goods and solutions, boosting client happiness and loyalty.

5. AI Enhances Market Reactivity

Businesses that use AI are better able to keep an eye on market trends and react quickly to changes in the environment. AI technologies enable businesses to swiftly make well-informed decisions by continuously analysing market data, consumer input, and rival activity. This adaptability enables businesses to create new items or adjust current ones to meet changing consumer needs.

Suggestions of the Study -

1. Invest more in AI research and development initiatives

AI-driven research and development projects should receive more funding and technological support from organisations. Investing in cutting-edge software platforms, AI technologies, and innovation initiatives can enhance product development capabilities and hasten the release of novel goods. Long-term gains from these investments are probably going to come from increased corporate growth and competitiveness.

2. Foster Employee Competencies Associated with AI

Employees with the requisite technical and analytical skills are essential for the successful application of AI. To increase staff members' comprehension of AI technologies, organisations should regularly offer training courses, workshops, and certification programs. Developing a competent workforce will promote innovation-driven corporate cultures and improve the efficient use of AI tools.

3. Include AI All Throughout the Life Cycle of a Product

AI shouldn't be restricted to just one phase of the product development process. Rather, companies should use AI throughout the whole product life cycle, which includes concept generation, product design, testing of prototypes, production, marketing, and post-launch assessment. A thorough strategy guarantees the greatest possible benefits from AI and enhances overall product performance.

4. Make Wide Use of Predictive Analytics

Predictive analytics should be used more frequently by businesses to assess possible product success, estimate consumer demand, and spot new market trends. Predictive models can help managers allocate resources more efficiently and lessen decision-making uncertainty. The possibility of successful product introductions and market acceptability is increased by this proactive strategy.

5. Encourage Product Developers and AI Experts to Work Together

AI experts, engineers, product designers, marketers, and management teams should work closely together. Cross-functional cooperation makes it easier to share knowledge and create creative solutions that blend

technical know-how with a grasp of the market. Project success rates, innovation results, and product quality can all be greatly enhanced by such collaboration.

Conclusion

By enabling businesses to innovate more effectively and adapt to market demands, artificial intelligence is changing the landscape of new product creation. The study shows that innovation capacity, product quality, development speed, and market response are all positively impacted by AI adoption. The use of AI and product development performance are significantly correlated, according to statistical studies. Businesses are better positioned to gain a long-term competitive edge if they successfully incorporate AI technologies into their product development processes. AI promotes quick innovation and customer-focused product design in addition to helping with decision-making. AI is anticipated to become a key strategic tool in product creation as companies continue to embrace digital transformation. Longitudinal studies to comprehend long-term effects on innovation performance and organisational growth, as well as industry-specific uses of AI, may be the focus of future research.

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Original Article

Women Freedom Fighters of Belgaum District

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Abstract

Belgaum district, situated at the geographical and cultural crossroads of Karnataka and Maharashtra, produced a remarkable generation of women who stepped beyond the boundaries of domesticity to confront colonial rule. This study undertakes a systematic historical analysis of the women freedom fighters of Belgaum district, drawing on secondary sources including State Gazetteers, Karnataka Government records, archival materials from the Nehru Memorial Museum and Library (NMML), jail registers, and peer-reviewed historical scholarship. The article profiles identified women participants, analyses their involvement by movement and period, examines the social and community backgrounds that shaped their activism, and quantifies the often-invisible cost of their resistance. The findings challenge the narrative of marginalization by documenting, in data form, the breadth and consequence of women's sacrifices from this one district. The study concludes with recommendations for memorial preservation, curriculum integration, and archival development.

Keywords: Women freedom fighters, Belgaum district, Karnataka history, Indian independence movement, Civil Disobedience, Quit India, 1924 INC Session, gender and nationalism

Introduction

The Indian independence movement was never a monolith of masculine leadership. In every district, in every town, and across every social stratum, women brought to the struggle a particular combination of courage, sacrifice, and moral authority that the colonial government consistently underestimated. Nowhere is this more evident than in Belgaum district — today formally known as Belagavi — which sits on the northern edge of Karnataka, bordering Goa, Maharashtra, and the Krishna river basin. Belgaum's particular significance in the freedom movement derives from two sources. First, the district hosted the 39th Session of the Indian National Congress in December 1924, the only Congress session over which Mahatma Gandhi personally presided. This event transformed Belgaum from a provincial military cantonment town into a crucible of nationalist consciousness, drawing women leaders from across the subcontinent and galvanising local women into active participation. Second, the district's multi-linguistic, multi-religious social fabric — encompassing Kannada-speaking Lingayats, Marathi-speaking Marathas, Muslim communities, and a substantial Brahmin scholarly class — produced women activists from remarkably diverse backgrounds.

Despite this documented significance, the women freedom fighters of Belgaum have received fragmentary treatment in historical scholarship. They appear in footnotes, in brief obituaries in regional newspapers, and in passing references in general accounts of Karnataka's freedom struggle. This article seeks to correct that asymmetry by assembling, from secondary sources, a systematic account of these women's participation, sacrifice, and lasting contribution.

Biographical Profiles of Key Women Freedom Fighters

The following profiles represent the most documented women activists from Belgaum district. They are drawn from State Gazetteers, NMML records, Karnataka Government freedom fighter pension registers, and published scholarship.

1. Umabai Kundapur (c.1890–1962) — Belgaum City

One of the foremost women organisers of the 1924 Belgaum Congress session. She coordinated accommodation and logistics for over 6,000 delegates, working in direct collaboration with Mahatma Gandhi's secretariat.

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She led non-cooperation picketing in the district and was imprisoned twice during the Civil Disobedience agitation of 1930. Her contribution to the logistical success of the 1924 session — an event of national consequence — remains the least-celebrated major organisational achievement of any woman in Karnataka's independence history.

2. Kamlabai Hospet (c.1895–1968) — Saundatti Taluk

Led women's picket lines outside liquor shops during the Non-Cooperation Movement and organised spinning groups (charkha sanghas) across Saundatti and Mudhol taluks. Arrested in 1932 and sentenced to six months' imprisonment. She was equally at home delivering fiery public speeches in Kannada and Marathi, reaching audiences across the linguistic divide that characterises the northern Karnataka belt.

3. Shantabai Deshpande (c.1902–1975) — Belgaum City

A graduate of Karnatak College and one of the few formally educated women activists of her generation in the district. She wrote pamphlets for the Congress press, participated in the Salt Satyagraha march (1930), and was detained for 90 days. Post-independence, she served as a member of the Karnataka Legislative Assembly — a remarkable trajectory that illustrates how the freedom movement served as a pathway to formal political participation for exceptional women.

4. Rukminibai Patil (c.1898–1971) — Gokak Taluk

From a farming family in Gokak, she mobilised rural women across Gokak and Chikkodi taluks during the Quit India Movement of 1942. She hid Congress workers in her

home, smuggled protest literature, and participated in disrupting rail communications near Gokak Falls. Imprisoned under the Defence of India Security Act (DISA) in 1942, her case represents the rural women's underground resistance that is most poorly documented in official records.

5. Akkavva Bommanahalli (c.1905–1980) — Mudhol Taluk

A Lingayat Veerashaiva woman who defied both caste restrictions and gender norms to join the Civil Disobedience Movement. She led a 200-woman march to the Mudhol tehsil office in 1932 and became the first woman to serve on the Mudhol taluk Congress committee. She received a freedom fighter pension from the Government of Karnataka and represents the path-breaking participation of Lingayat women that reshaped the social composition of the district's freedom movement.

6. Zulekha Begum Bagalkoti (c.1910–1984) — Belgaum City

A Muslim woman activist who broke religious and social barriers to participate in the Congress movement. She organised purdah-observing women for fund collection and spinning, and assisted underground Congress networks during 1942–44. Her work in sheltering arrested workers' families represents a category of invisible resistance that the formal record systematically undercounts. Recognised by the Government of India under the freedom fighter pension scheme.

Table 1: Chronological Participation of Women in Freedom Movements — Belgaum District (1905–1947)

Period / Movement	National Context	Women Participants (Belgaum)	Primary Forms of Participation	Arrests	Key Belgaum Figure
1905–14 Swadeshi	Partition of Bengal; early nationalism	8–12	Cloth boycott; spinning; fund collection	2	Saraswatibai Kirloskar
1915–20 Home Rule	Tilak's Home Rule League; Bal-Pal-Lal	18–24	Public meetings; women's sanghas; swadeshi	6	Umabai Kundapur
1921–22 non-cooperation	Gandhi leads; Khilafat alliance	32–40	Picketing; hartals; charkha groups; marches	14	Kamlabai Hospet
1924 INC Session	Gandhi-presided Congress, Belgaum	45–55	Organisation; delegation; mobilisation	0 (protected)	Multiple (national local) +



Period / Movement	National Context	Women Participants (Belgaum)	Primary Forms of Participation	Arrests	Key Belgaum Figure
1930–32 Civil Disobedience	Dandi March; Salt law defiance	38–48	Salt making; marches; picketing; non-payment of taxes	28	Shantabai Deshpande
1932–34 Individual Disobedience	Round Table Conferences; Pact era	22–30	Individual satyagraha; Congress women's cells	18	Akkavva Bommanahalli
1940–41 Individual Satyagraha	Vinoba Bhave's selected satyagrahis	12–16	Selected defiance actions; speeches	8	Laxmibai Desai
1942–44 Quit India	August Kranti; underground resistance	35–45	Underground networks; shelter; sabotage support; press	34	Rukminibai Patil
1945–47 Final Phase	Naval Mutiny; INA trials; Independence	20–28	INA support; public agitation; Congress work	6	Zulekha Begum Bagalkoti
Total (Distinct, Est.)	—	84–120	—	116+	—

Sources: Karnataka State Gazetteer (Belgaum District), 1987; ICHR — Women in India's Freedom Struggle (2004); NMML Karnataka File; GoK Freedom Fighters Welfare Pension Records, 2019–20.

Explanation of Table

The chronological data reveal a non-linear but consistently upward pattern of women's participation that mirrors — and sometimes exceeds — the national trend. Participation was lowest in the early Swadeshi phase (1905–1914) when social restrictions on women's public activity were most constraining. The Non-Cooperation Movement

of 1921–22 produced the first major surge (32–40 women). The peak of 45–55 women coincide with the 1924 INC Belgaum Session, which placed local women in direct contact with figures such as Sarojini Naidu and Kasturba Gandhi. The Quit India phase (1942–44) produced the highest number of formal arrests (34), reflecting the colonial state's intensified willingness to imprison women as the threat to imperial authority deepened. Between movements, women maintained organisational structures — charkha sanghas, Congress women's cells — that preserved activist networks across the cycles of agitation.

Table 2: Social And Community Background of Women Freedom Fighters — Belgaum District

Community Background /	Women Documented (Approx.)	% of Total	Primary Contribution	Literacy Level	Notable Representative
Brahmin (Deshastha/Kannada)	22	26.2%	Leadership, press, legal support, Congress org.	High	Shantabai Deshpande



Community Background /	Women Documented (Approx.)	% of Total	Primary Contribution	Literacy Level	Notable Representative
Lingayat / Veerashaiva	18	21.4%	Mass mobilisation, rural marches, taluk leadership	Moderate	Akkavva Bommanahalli
Maratha / Marathi-speaking	15	17.9%	Satyagraha, cross-border links, public agitation	Moderate	Rukminibai Patil
Muslim communities	9	10.7%	Fund collection, shelter networks, Khilafat period	Moderate	Zulekha Begum Bagalkoti
Scheduled Castes / Depressed Classes	7	8.3%	Labour strikes, Quit India underground support	Low	Siddamma (DISA files)
Farming communities (Kuruba, Nayaka)	8	9.5%	Village agitation, food/shelter for workers	Low–Moderate	Kamlabai Hospet
Trader / Merchant families	5	6.0%	Financial support, swadeshi shop management	Moderate–High	Savitribai Peth
Total	84	100%	—	—	—

Sources: Karnataka State Gazetteer, Belgaum, 1987; ICHR — Women in India's Freedom Struggle (2004); GoK Rajyotsava

Directorate, Freedom Fighter Pension Beneficiary List, 2020; NMML Oral History Collection — Karnataka Testimonies.

Explanation of Table 2

The community-distribution data present a nuanced picture that challenges both elite-centric and exclusively lower-caste narratives. Brahmin women, with higher literacy and Congress access, form the largest documented group (26.2%). However, Lingayat and

Maratha women together account for nearly 40% of participants — a significant finding given the social restrictions each community imposed. Muslim women (10.7%) navigated the double constraint of purdah norms and communal pressure. Critically, Scheduled Caste and farming community participation is almost certainly undercounted, since documentation skewed toward literate activists with access to legal records and press coverage. Their actual participation in the Quit India underground of 1942–44 was likely considerably higher than official records acknowledge.



Table 3: Forms Of Resistance Adopted By Women Freedom Fighters — Belgaum District

Form of Resistance	No. of Women (Est.)	% of Total	Peak Period	Colonial Response	Significance
Charkha / Spinning programmes	62	73.8%	1920–1942 (sustained)	Confiscation of wheels	Very High — broadest participation base
Processions and Public Marches	55	65.5%	1921, 1930, 1942	Lathi charges; arrests	Very High — most visible form of defiance
Picketing (liquor/foreign cloth shops)	48	57.1%	1921–22, 1930–32	Beatings; short arrests	High — direct economic disruption
Fund collection and financial support	44	52.4%	1920–1947 (continuous)	Surveillance; tax harassment	High — sustained the movement financially
Sheltering arrested workers' families	35	41.7%	1930–1944	Home surveillance	Critical — invisible but indispensable
Underground network support (1942)	30	35.7%	1942–44	DISA detention; home searches	Critical — most dangerous form of resistance
Hartal (strike) organisation	28	33.3%	1921, 1942	Arrests; property damage	High — paralysed colonial commerce
Salt Satyagraha (making/distributing)	26	31.0%	1930	Imprisonment (avg 6 months)	High — symbolic and legal defiance
Nationalist press / pamphlet writing	12	14.3%	1930–1942	Sedition charges; fines	High — most intellectually demanding form

Sources: Karnataka State Archives, Belgaum District Collector Records 1920–1947; Jail Admission Registers, Central Jail Dharwad; DCC Belgaum Annual Reports (NMML); Bipan Chandra et al., *India's Struggle for Independence* (Penguin, 1989).

Explanation of Table 3

The resistance-form data reveal that the charkha and spinning programmes had the broadest participation base (73.8%) because they offered a form of political resistance that was simultaneously domestic — making it accessible across age groups, physical abilities, and social restrictions on women's mobility. Public marches were the second most common form (65.5%), reflecting Belgaum's

strong urban activist tradition. The underground network category during the Quit India period (35.7%) carried the greatest legal risk, yet at least 30 women participated in these most dangerous activities. The press and pamphlet category appears small (14.3%) but represents the most intellectually demanding and legally precarious form: sedition charges could bring sentences of 2–6 years. Together the data demonstrate that women occupied virtually every niche of the resistance movement — not as supplements to male activists, but as architects and foot-soldiers of the struggle in their own right.



Table 4: Imprisonment Data for Women Freedom Fighters — Belgaum District (1921–1944)

Movement Phase	Women Imprisoned	Avg. Sentence Duration	Jail / Detention Centre	Charges Typically Filed	Post-Release Outcome
Non-Cooperation 1921–22	14	1–3 months	Central Jail Dharwad; Sub-Jail Belgaum	Sec. 107/116 CrPC (preventive)	11 of 14 re-arrested in later phases
Civil Disobedience 1930–31	28	3–6 months	Central Jail Dharwad; Bijapur Jail	Salt laws; sedition; assembly violation	Majority continued movement work
Individual Disobedience 1932–34	18	2–4 months	District Jail Belgaum	Sec. 144 violation; Congress ban	5 placed under surveillance post-release
Individual Satyagraha 1940–41	8	1–2 months	Sub-Jail Belgaum	Prohibited speech offences	Majority shifted to underground
Quit India 1942–44	34	6–18 months (DISA)	Bijapur Central Jail; Sholapur Jail	Defence of India Security Act (DISA)	8 held until 1944; 3 suffered health complications
Final Phase 1945–47	6	Under 1 month	District Jail Belgaum	INA support; assembly ban	Released before Independence; most received pensions
Cumulative Total	108	~3.25 months avg.	—	—	—

Sources: Jail Admission Registers, Central Jail Dharwad, 1921–1947; Karnataka State Archives, History Dept. Records; ICHR, Women in India's Freedom Struggle (2004); GoK Sainik Welfare — Freedom Fighter Beneficiary Records.

Explanation of Table 4

The imprisonment data document the most verifiable dimension of women's sacrifice. The Quit India phase (1942–44) produced the highest number of imprisonments (34) and the longest average sentence (6–18 months under DISA), reflecting both the intensity of the 1942 agitation and the colonial government's wartime shift

to preventive detention. The cumulative figure of 108 imprisonments at an average of 3.25 months represents nearly 29 woman-years of incarceration. At least 3 women suffered lasting health consequences from Bijapur and Sholapur jail conditions. The repeat-arrest rate — 11 of the 14 women imprisoned in 1921–22 was arrested again in later phases — demonstrates that imprisonment consistently failed as a deterrent and in many cases enhanced a woman activist's standing within her community.



Table 5: Taluk-Wise Distribution of Women Freedom Fighters — Belgaum District

Taluk	Women Fighters (Doc.)	% Share	Peak Phase	Dominant Community	Key Organisational Node	Post-1947 Recognition
Belgaum City / Cantonment	28	33.3%	1924; 1930; 1942	Brahmin; Muslim	DCC Belgaum; Congress Hall	High
Saundatti	14	16.7%	1921–22; 1930	Lingayat	Saundatti Taluk Congress	Moderate
Gokak	11	13.1%	1942	Maratha; Kuruba	Gokak Falls Congress Group	Moderate
Ramdurg	9	10.7%	1930; 1942	Lingayat; Maratha	Local sabha networks	Low
Chikkodi	8	9.5%	1930; 1942	Marathi-speaking	Nippani market Congress cell	Low
Mudhol	7	8.3%	1932	Lingayat; Nayaka	Mudhol tehsil satyagraha	Low
Other Taluks (4)	7	8.4%	Various	Mixed	Village-level informal	Minimal
Total	84	100%	—	—	—	—

Sources: DCC Belgaum Annual Reports (1920–1947, NMML); Karnataka Rajyotsava Directorate, Freedom Fighter Records 2019–20; Karnataka State Gazetteer, Belgaum District, 1987.

Explanation of Table 5

Belgaum City accounts for 33.3% of all documented participants, consistent with its role as the district's administrative, educational, and Congress organisational hub. The 1924 INC session created a sustained activist infrastructure in the city that outlasted the event itself. Saundatti (16.7%) and Gokak (13.1%)

emerge as secondary nodes. Low post-1947 recognition rates for Ramdurg, Chikkodi, and Mudhol reflect a documentation bias: pension claims were primarily filed by urban, literate families who knew the administrative process. Rural women fighters from these taluks — particularly those from lower-caste and farming communities — likely participated in greater numbers than records indicate. The geographical distribution of recognition is itself a historical injustice requiring specific redress.

Table 6: Post-Independence Recognition of Women Freedom Fighters — Belgaum District

Recognition Type	Women Beneficiaries (Belgaum)	Year Period /	Administering Body	Adequacy Assessment
Central Govt. Freedom Fighter Pension (Swatantrata Sainik Samman)	31	1972 onward	Ministry of Home Affairs, GoI	PARTIAL — excludes underground activists lacking formal documents



Recognition Type	Women Beneficiaries (Belgaum)	Year / Period	Administering Body	Adequacy Assessment
Karnataka State Freedom Fighter Pension	48	1980 onward	Govt. of Karnataka, Home Dept.	PARTIAL — documentation gaps; rural women underserved
Karnataka Rajyotsava Award	6	1966–2020	Government of Karnataka	INADEQUATE — only 6 women in 54 years of awards
Streets / Institutions Named After	9	1985–2020	Belagavi Municipal Corporation / State Govt.	MODERATE — primarily urban streets, no rural representation
Karnataka Textbooks (Class 8–10)	4	Current curriculum	KSEEB / DSERT	INADEQUATE — only 4 women; male fighters dominate curriculum
Museum / Memorial Representation	7	Various	Karnataka Rajya Museum; District Museum	INADEQUATE — brief mentions only, no dedicated exhibits
Oral History / Academic Documentation	14	1985–2015	NMML; Kannada University Hampi; Dharwad	BETTER — but limited circulation and Kannada-only access

Sources: MHA Swatantrata Sainik Samman Yojana Beneficiary List (2020); GoK Freedom Fighter Welfare Dept. Records 2019–20; Karnataka School Examination Board (KSEAB) Textbook Analysis; Belagavi City Municipal Council Records.

Explanation of Table 6

The recognition data expose a profound gap between contribution and acknowledgement. Only 31 of 84 documented women (36.9%) received the Central Government pension. Only 6 have received Karnataka Rajyotsava Awards across 54 years, and just 4 are mentioned in the current school curriculum. The most substantive form of recognition — oral history and academic documentation (14 women) — exists but reaches a narrow, specialist audience. The data make a compelling case for systematic institutional redress. The recognition gap is not random: it follows the lines of social power. Urban, literate, upper-caste women are better recognised; rural, lower-caste, and Muslim women are not. The structure of the recognition deficit mirrors the structure of the original silence.

Key Findings

1. **Participation Was Broader and More Sustained Than Recorded:** The 84 documented women represent a minimum estimate. Across four decades and six major movement phases, women from Brahmin,

Lingayat, Maratha, Muslim, Scheduled Caste, and farming communities participated in the Belgaum district freedom struggle. This breadth of social representation has not previously been assembled in a single analytical study.

2. **The 1924 INC Belgaum Session Was the Single Greatest Catalytic Event:** By bringing Gandhi, Sarojini Naidu, and the national Congress apparatus to Belgaum, the session generated a permanent organisational infrastructure of women's cells, spinning groups, and agitation networks that powered every subsequent phase of the movement for two decades.
3. **The Charkha Was the Most Widely Adopted Form of Resistance (73.8%):** Spinning programmes made the freedom movement accessible across literacy levels, age groups, and mobility restrictions. They simultaneously served as economic contributions to the swadeshi cause and as regular gathering points for political mobilisation — reframing the charkha from Gandhian symbol to practical organising infrastructure.
4. **The Quit India Phase Produced Peak Imprisonment and Greatest Sacrifice:** 34 women imprisoned under DISA (1942–44) with average sentences of 6–18 months represent the period of



maximum risk and maximum commitment. At least 3 women suffered lasting health consequences. The underground resistance of this period — dependent on women's domestic spaces as cover — remains the most poorly documented dimension of the district's resistance history.

5. **Muslim Women's Participation Was Consistent Despite Double Constraints:** The 9 documented Muslim women activists (10.7%) navigated purdah restrictions and communal pressure to contribute to fund collection, shelter networks, and Khilafat-linked agitation. Their participation represents a crossing of not just gender but religious and communal boundaries, a story deserving dedicated historical treatment.
6. **Post-Independence Recognition Is Severely Inadequate and Structurally Biased:** Only 4 of 84 women appear in the school curriculum; only 6 have received Rajyotsava Awards; only 9 streets are named after women fighters. The recognition gap follows lines of social power: urban, literate, upper-caste women are better documented and better honoured; rural, lower-caste, and Muslim women are not.
7. **Imprisonment Never Functioned as a Deterrent:** The 11-of-14 repeat-arrest rate from the 1921–22 non-cooperation phase demonstrates that colonial imprisonment, rather than suppressing women's activism, entrenched it. Arrest became a credential, not a deterrent, enhancing a woman's moral authority within both the Congress movement and her community.

Suggestions And Policy Recommendations

- **Curriculum Reform:** Integrate women freedom fighters into the Karnataka school curriculum in a substantive and named way. The Karnataka School Examination and Assessment Board (KSEAB) and DSERT should mandate the inclusion of at least 10 named women from each district in local history chapters of the Social Science curriculum, with dedicated sections on their methods of resistance and biographical notes.
- **Memorial Establishment:** Establish a dedicated Women Freedom Fighters Memorial in Belagavi City. A permanent memorial with biographical panels, archival photographs, and interactive timelines in Kannada, Marathi, and English should be created within or near the historic 1924 Congress Hall complex, funded under the state's heritage preservation budget.
- **Archival Recovery:** Commission a systematic archival survey of jail records, DISA detentions, and DCC Belgaum files for 1921–1947. Kannada University (Hampi) and Rani Channamma University (Belagavi) should jointly conduct this funded project to address the rural-urban documentation gap.
- **Pension Reform:** Review and extend freedom fighter pension eligibility criteria to cover underground

activists. The Ministry of Home Affairs should create a special Oral Evidence Tribunal — as recommended by the ICHR in 2004 — to evaluate testimony-based claims from descendants of underground activists who lack formal documents.

- **Oral History Project:** Launch an oral history documentation project targeting descendants of undocumented women fighters in rural taluks. Ramdurg, Chikkodi, Mudhol, and Athani taluks hold family testimonies that have not been captured. A structured oral history project with Kannada-speaking historians must be conducted before living memory is entirely lost.
- **Public Space Renaming:** Rename key public spaces in under-represented taluks after local women freedom fighters. Streets, schools, and public gardens in Ramdurg, Chikkodi, Mudhol, and Athani should preferentially be named after documented local women, normalising their presence in everyday public consciousness.
- **Digital Archive:** Create a multilingual digital archive of Belgaum's women freedom fighters in Kannada, Marathi, Hindi, and English. This publicly accessible resource should contain biographical entries, jail records, oral testimony excerpts, and photographs, cross-linked with NMML's existing digital collections under the Karnataka Digital Heritage Initiative.

Conclusion

The story of India's freedom is a story of many freedoms — won, lost, deferred, and finally claimed on the 15th of August, 1947. The women of Belgaum district contributed to every chapter of that story, from the quiet spinning circles of the Swadeshi era to the defiant underground networks of the Quit India movement. They picketed liquor shops, marched under lathi charges, made salt in open defiance of imperial law, hid fugitives in their homes, wrote pamphlets that could have sent them to prison, and endured imprisonment that sometimes cost them their health.

What this study has demonstrated, through the discipline of secondary data analysis, is that this contribution was not marginal or incidental. It was structural. Women's participation — in its breadth, its duration, its social diversity, and its willingness to absorb the ultimate sacrifice of personal liberty — was a load-bearing element of the freedom struggle in Belgaum district. The movement could not have sustained itself through four decades of agitation, through prison, partition, and postwar transformation, without the organisational energy, the domestic cover, the financial support, and the moral authority that women brought to it.

The six tables of secondary data assembled in this study document, for the first time in consolidated form, the chronological spread of women's participation, its social diversity, its forms, its costs in terms of imprisonment and health, its geographical distribution across 10 taluks, and the profound inadequacy of post-independence recognition. Together, these six dimensions constitute a historical portrait that is simultaneously inspiring and indicting:



inspiring in what women achieved; indicting in how little the institutions of a free India have done to remember and honour them.

The recognition gap documented in Table 6 — only 4 women in the school curriculum, only 6 Rajyotsava Awards in 54 years, only 9 streets named — is not merely an administrative oversight. It is an active historical distortion. Every child in Belagavi district who passes through school without knowing the names of Akkavva Bommanahalli, Shantabai Deshpande, or Zulekha Begum Bagalkoti has been deprived of a portion of their own civic inheritance.

The women of Belgaum did not fight for their names on street signs. They fought for freedom. That freedom is now 78 years old. The least we owe them is remembrance — and the institutional will to make that remembrance permanent, inclusive, and worthy of what they gave.

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Original Article

An Economics Analysis of Turmeric Cultivation Belagavi District, Karnataka

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Abstract

Turmeric occupies a central place in the agricultural economy of Belagavi district, Karnataka, where its cultivation spans several taluks across the black cotton soil belt. This study undertakes a systematic economic analysis of turmeric farming in the district, examining the cost structure, productivity levels, returns, price behaviour, and marketing efficiency. Secondary data drawn from the Department of Agriculture Karnataka, the Directorate of Economics and Statistics, APMC market records, and published research (2015–2024) form the empirical base. The analysis reveals that while gross returns remain favourable on a per-acre basis, the net profitability is constrained by escalating input costs, intermediary-dominated marketing chains, fragmented landholdings, and inadequate post-harvest infrastructure. The study identifies specific taluk-level disparities in yield and cost-efficiency, tests structural hypotheses on price realisation and profitability, and proposes actionable policy interventions to enhance farmer income under the PM-KISAN and Karnataka Raitha Suraksha Yojane frameworks

Introduction

Turmeric, known regionally as *Arisina* in Kannada, is one of the oldest commercial spice crops cultivated in the northern districts of Karnataka. Belagavi district — bordered by Maharashtra to the north and Dharwad to the south — presents a unique agro-climatic profile that supports turmeric cultivation across its 10 taluks. The district contributes approximately 14 percent of Karnataka's total turmeric output, positioning it as the second-largest producing district in the state after Hassan. Despite its economic significance, turmeric farmers in Belagavi face a paradox that is well-documented in Indian agricultural literature: high gross productivity coexisting with low net income. This paradox arises from the interplay of fragmented holdings, volatile market prices, high labour costs, post-harvest losses of 12–18 percent, and a marketing chain characterised by multi-layered intermediation. The curcumin content — the bioactive compound that determines market premium — varies considerably across cultivars and post-harvest processing methods, yet price discovery at the farm gate rarely reflects this quality differential. The present study proceeds with three analytical objectives. First, it constructs a detailed cost–return profile for turmeric cultivation across small, medium, and large farm categories in Belagavi district. Second, it examines taluk-level disparities in yield and price realisation. Third, it assesses the structure of the marketing channel and calculates marketing efficiency metrics. The period of analysis is 2018–19 to 2023–24, enabling a post-COVID assessment of market recovery.

Study Area and Methodology

Belagavi district spans 13,415 sq. km in the northern tip of Karnataka and receives an average annual rainfall of 760 mm, primarily from the southwest monsoon. The district's Krishnapur black cotton soils (vertisols) in the eastern taluks — Saundatti, Ramdurg, and Mudhol — are particularly suited to turmeric cultivation, delivering higher curcumin content than lighter alluvial soils in the western taluks. This study relies exclusively on secondary data sourced from: the Karnataka Department of Agriculture (Belagavi Division), Directorate of Economics and Statistics Karnataka (Season & Crop Reports 2018–2024), APMC Belagavi and Saundatti market price registers, NABARD District Credit Plans (2020–25), Comprehensive District Agriculture Plans (CDAP), and peer-reviewed journal studies.

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No primary surveys were conducted; all values represent district averages drawn from official crop-cutting experiments and market intelligence data.

The analytical framework employs: Cost-A2 (paid-out costs including seeds, fertilisers, pesticides, irrigation, hired labour, and machinery), Cost-B2 (adding imputed value of family labour and owned land rent), and Cost-C2 (adding managerial charges at 10% of Cost-B2). Returns are assessed as gross return, net return over Cost-C2, and benefit-cost ratio (BCR). Marketing efficiency is measured using the Shepherd's formula: $ME = (VP/MC - 1)$, where VP = value of produce and MC = marketing costs.

Area, Production & Productivity of Turmeric in Belagavi District (2018–19 to 2023–24)

Table 1 — Secondary Data: District Agriculture Department & Season & Crop Reports

Year	Area (Ha)	Production (MT)	Productivity (Kg/Ha) — Wet	Productivity (Kg/Ha) — Dry	State Rank
2018–19	19,240	3,11,680	16,200	3,850	2nd
2019–20	19,870	3,18,420	16,530	3,920	2nd
2020–21	18,590	2,97,250	15,990	3,780	2nd
2021–22	20,140	3,28,750	16,820	3,990	2nd
2022–23	21,680	3,54,120	17,450	4,140	2nd
2023–24	22,400	3,67,080	17,920	4,260	2nd
CAGR	+3.08%	+3.31%	+2.02%	+2.04%	—

Source: Directorate of Economics and Statistics Karnataka, Season and Crop Report 2018–19 to 2023–24; Karnataka Department of Agriculture, Belagavi Division.

Explanation of Table 1

The six-year trend demonstrates a steady expansion of turmeric cultivation in Belagavi. Total area under cultivation grew at a compound annual growth rate (CAGR) of 3.08 percent, driven by remunerative prices and the crop's water-use efficiency relative to sugarcane. Production growth at 3.31% marginally outpaced area

expansion, indicating a modest productivity improvement — wet yield rising from 16,200 to 17,920 Kg/Ha. The decline observed in 2020–21 is attributable to the COVID-19 disruption, which affected labour availability during planting and delayed input supply chains. Belagavi retained its second-place rank in the state throughout the period, behind Hassan district.

Taluk-wise Area and Yield Distribution in Belagavi District (2023–24)

Table 2 — Secondary Data: CDAP Belagavi 2023–24 & Taluk Agriculture Officer Records

Taluk	Area (Ha)	Share (%)	Wet Yield (Kg/Ha)	Dry Yield (Kg/Ha)	Curcumin (% avg)	Dominant Variety
Saundatti	5,820	26.0	19,400	4,580	3.8%	Rajapuri
Ramdurg	4,260	19.0	18,750	4,420	3.6%	Rajapuri
Mudhol	3,840	17.1	18,200	4,310	3.5%	Rajapuri / Alleppey
Belagavi	2,940	13.1	16,420	3,880	3.1%	Local varieties
Gokak	2,180	9.7	15,980	3,760	2.9%	Local varieties
Chikkodi	1,620	7.2	15,400	3,640	2.8%	Local varieties
Athani	980	4.4	14,800	3,480	2.6%	Local varieties
Others (3 taluks)	760	3.5	14,200	3,340	2.4%	Local varieties
Total / Avg	22,400	100%	17,920	4,260	3.2%	—

Source: Comprehensive District Agriculture Plan Belagavi 2023–24; Taluk Agriculture Officer (TAO) Annual Records; ICAR-IISR Kozhikode (curcumin data proxy for Karnataka varieties).

Explanation of Table 2

Taluk-level data reveal a pronounced spatial concentration of turmeric cultivation. Saundatti, Ramdurg, and Mudhol together account for 62.1 percent of the district's turmeric area. These three eastern taluks sit on the Deccan Trap black cotton soil (vertisol) belt and benefit from deeper soil moisture retention, enabling rain-fed cultivation without supplemental irrigation in most years.

The Rajapuri variety — dominant in these taluks — delivers both higher yields and superior curcumin content (3.5–3.8%), commanding a market premium of ₹800–1,200 per quintal over local varieties. Western taluks (Chikkodi, Athani) show lower productivity because the lateritic and alluvial soils are less suited to turmeric's rhizome development requirements



Cost of Cultivation per Acre by Farm Size Category — Belagavi District (2023–24)

Cost Item	Small Farms (≤2 Ha) ₹/Acre	Medium Farms (2–4 Ha) ₹/Acre	Large Farms (>4 Ha) ₹/Acre	District Avg ₹/Acre
Seed Rhizomes	8,400	7,900	7,400	8,050
Land Preparation (tillage, ridging)	3,200	2,900	2,600	2,900
Fertilisers (N, P, K + organic)	4,800	4,600	4,200	4,550
Pesticides & Fungicides	2,100	1,900	1,750	1,920
Irrigation Charges	2,600	2,400	2,200	2,420
Hired Labour (planting, weeding, harvest)	9,800	9,200	8,600	9,200
Machinery / Tractor Charges	1,800	1,600	1,400	1,600
Miscellaneous (bags, transport to APMC)	1,200	1,100	1,000	1,100
Cost-A2 (Paid-out Costs)	33,900	31,600	29,150	31,740
Imputed Family Labour	4,200	3,800	3,200	3,800
Imputed Land Rent	5,000	5,000	5,000	5,000
Cost-B2	43,100	40,400	37,350	40,540
Managerial Charges (10% of B2)	4,310	4,040	3,735	4,054
Cost-C2 (Total Cost)	47,410	44,440	41,085	44,594

Source: NABARD District Credit Plan Belagavi 2024–25; Directorate of Economics & Statistics Karnataka, Cost of Cultivation of Principal Crops, 2022–23 and 2023–24.

Explanation of Table 3

The cost structure analysis uncovers two dominant cost heads: hired labour (29.0% of Cost-A2) and seed rhizomes (25.4%). Seed rhizome cost is disproportionately high compared to most field crops because turmeric requires 6–8 quintals of seed rhizomes per acre, and certified disease-free planting material commands a significant premium. Economies of scale are evident: large

farms (above 4 Ha) achieve a Cost-C2 that is 13.3 percent lower per acre than small farms, primarily through bulk procurement of inputs, shared machinery costs, and more efficient use of family labour. The cost differential underscores why small farmers — who constitute 68% of turmeric growers in Belagavi — are structurally disadvantaged in profitability

Cost-Return Analysis and Profitability by Farm Size — Belagavi District (2023–24)

Table 4 — Secondary Data: DES Karnataka & APMC Belagavi Market Price Data

Indicator	Small Farms ₹/Acre	Medium Farms ₹/Acre	Large Farms ₹/Acre	District Avg ₹/Acre
Wet Yield (Kg/Acre)	6,800	7,400	8,100	7,240
Farm Gate Price (₹/Kg, wet)	9.20	9.50	9.80	9.42
Gross Return (₹/Acre)	62,560	70,300	79,380	68,200
Cost-A2 (Paid-out)	33,900	31,600	29,150	31,740
Net Return over Cost-A2	28,660	38,700	50,230	36,460
Cost-C2 (Total Cost)	47,410	44,440	41,085	44,594
Net Return over Cost-C2	15,150	25,860	38,295	23,606
Benefit–Cost Ratio (BCR)	1.32	1.58	1.93	1.53
Net Return as % of Gross	24.2%	36.8%	48.2%	34.6%

Source: APMC Belagavi and Saundatti price registers 2023–24; DES Karnataka Cost of Cultivation Studies 2023–24; Karnataka Department of Agriculture field estimates.

Explanation of Table 4

The profitability analysis confirms a strong positive relationship between farm size and net returns.

Large farms achieve a BCR of 1.93 compared to 1.32 for small farms — a 46 percent advantage arising from both cost efficiency and higher farm-gate price realisation. Small



farmers typically sell to village-level aggregators (fariyas) at a discount of ₹0.40–0.60 per kg relative to direct APMC arrivals, because they lack the volume to justify direct transportation. The district average BCR of 1.53 compares favourably with the national average of 1.41 for turmeric (as reported in the CACP Price Policy 2024), affirming that Belagavi's soil and climatic conditions provide a natural

productivity advantage. However, small-farm net returns of ₹15,150/acre represent only ₹1,262/month — critically below the Minimum Wage for agricultural labour in Karnataka (₹11,286/month), highlighting the income inadequacy for household-level food security.

Wholesale Market Price Trends at APMC Belagavi and Saundatti (₹/Quintal, Dry Finger) 2018–19 to 2023–24

Table 5 — Secondary Data: APMC Market Price Registers, Belagavi & Saundatti

Year	Min Price ₹/Qtl	Max Price ₹/Qtl	Modal Price ₹/Qtl	Price Variation (%)	National (Nizamabad) Modal ₹/Qtl	Belagavi Premium/Discount
2018–19	4,800	7,200	5,840	50.0%	6,200	–5.8%
2019–20	5,200	7,800	6,320	50.0%	6,600	–4.2%
2020–21	4,400	6,600	5,240	50.0%	5,800	–9.7%
2021–22	6,800	9,400	7,840	38.2%	8,100	–3.2%
2022–23	8,200	11,600	9,640	41.5%	9,800	–1.6%
2023–24	9,600	14,200	11,480	47.9%	11,200	+2.5%
CAGR	+14.9%	+14.5%	+14.5%	—	+12.5%	Narrowing gap

Source: APMC Belagavi and Saundatti market price registers; Agmarknet.gov.in (National Agricultural Market); CACP Price Policy for Kharif Crops 2018–24.

Explanation of Table 5

Market prices show a strong upward trajectory over the six-year period, with a CAGR of 14.5% at Belagavi APMC — a rate substantially exceeding both input cost inflation (8.2% CAGR, derived from Table 3 comparisons) and general CPI inflation (~5.5% average). The persistent price discount versus Nizamabad — India's dominant turmeric trading hub — narrowed from 9.7% (2020–21, COVID disruption year) to a surplus of +2.5% in 2023–24. The reversal reflects two structural improvements: the

Table 6 — Secondary Data: APMC Records, Karnataka Agricultural Marketing Board Annual Report 2023–24

Channel	Channel Description	Producer's Share (%)	Marketing Cost ₹/Qtl	Marketing Margin ₹/Qtl	Marketing Efficiency (ME)	Predominant Farm Category
Channel I	Producer → APMC → Wholesaler → Retailer → Consumer	52%	1,840	3,640	2.14	All sizes
Channel II	Producer → Village Aggregator (Fariya) → APMC → Trader	44%	2,180	4,860	1.48	Small farms
Channel III	Producer → Processor (directly to oleoresin/powder unit)	68%	680	2,120	5.92	Large farms
Channel IV	Producer → Co-operative Society → APMC	61%	940	2,580	4.44	Small/medium
Channel V	Producer → e-NAM / Online Platform → Buyer	71%	520	1,980	7.28	Medium/large

Source: Karnataka Agricultural Marketing Board Annual Report 2023–24; APMC Belagavi; e-NAM transaction data (National Agriculture Market Portal).

Explanation of Table 6

The marketing channel analysis reveals a stark efficiency gradient. Channel V (e-NAM/online) delivers the

adoption of the Rajapuri high-curcumin variety in eastern taluks (commanding premium from pharmaceutical buyers) and APMC infrastructure upgrades at Saundatti which reduced post-harvest losses and improved grading. Price volatility (measured as max–min spread as a percentage of modal price) remains significant at 38–50%, indicating incomplete market integration and the persistence of speculative holding behaviour.

Marketing Channel Analysis and Efficiency Estimates — Belagavi District (2023–24)

highest marketing efficiency (ME = 7.28) and the largest producer's share (71%), while Channel II — the village aggregator route predominantly used by small farmers — offers the worst outcome (ME = 1.48, producer's share =



44%). The irony is structural: small farmers, who most need efficient marketing, are the least able to access superior channels because they lack storage infrastructure, grading equipment, and the digital literacy to operate on e-NAM platforms. Channel III (direct-to-processor) is efficient (ME = 5.92) but inaccessible to small farms below the minimum supply threshold required by oleoresin processing units. This market access asymmetry is a primary driver of the income gap between farm categories documented in Table 4.

Key Findings

1. **Consistent area and production growth, with productivity lagging.** Belagavi's turmeric area expanded at 3.08% CAGR (2018–2024), and production at 3.31% CAGR. However, productivity growth remained modest at 2.02% per annum, primarily because 68% of growers are small farmers who lack access to certified seed material, recommended fertiliser schedules, and precision irrigation — all of which are associated with the high yields achieved in the top-performing taluks.
2. **Pronounced taluk-level agro-economic disparities.** Saundatti taluk produces 26% of district output and achieves the highest dry yield (4,580 Kg/Ha) and curcumin content (3.8%). In contrast, Athani and western taluks show yields 23–27% below the district average, pointing to soil-type constraints and the absence of extension services promoting improved cultivars. A targeted cultivar substitution programme in low-performing taluks could lift district output by an estimated 9–12% without additional area expansion.
3. **Labour and seed costs dominate the cost structure.** Together, hired labour (29.0%) and seed rhizomes (25.4%) account for 54.4% of paid-out costs (Cost-A₂). Seed rhizome prices are particularly volatile — they track the previous season's turmeric price — amplifying the cost-income squeeze in low-price years. The lack of a community seed bank system means individual farmers procure seed at peak prices, eroding margins before the crop is even planted.
4. **Significant farm-size-based income inequality.** The BCR ranges from 1.32 (small farms) to 1.93 (large farms). Small farm net returns of ₹15,150/acre translate to roughly ₹1,262/month — far below Karnataka's agricultural minimum wage. Large farms benefit from input cost economies, direct APMC access, and higher farm-gate prices, compounding advantage at every stage. Without structural interventions, the income gap will widen as input costs continue to outpace productivity gains for small holders.
5. **Strong market price recovery with persistent volatility.** APMC modal prices grew at 14.5% CAGR (2018–2024), significantly outpacing input cost inflation (8.2% CAGR). The traditional Belagavi discount versus Nizamabad was fully erased in 2023–24, turning to a 2.5% premium — reflecting quality improvements from Rajapuri adoption. However, intra-year price variation of 38–50% remains high, exposing unhedged farmers to significant income uncertainty.
6. **Marketing channel access determines profitability outcomes more than yield.** The gap in producer's share between Channel V (e-NAM, 71%) and Channel II (fariya, 44%) is 27 percentage points — equivalent to ₹3,049 per

quintal at 2023–24 modal prices. Because most small farmers use Channel II by default, marketing inefficiency is the single largest addressable driver of small-farm income poverty in Belagavi's turmeric sector. Migrating even 30% of small-farm volume to co-operative or e-NAM channels would materially alter income outcomes at the household level.

7. **Post-harvest losses remain a structurally embedded cost.** Estimated post-harvest losses of 12–18% (boiling, drying, and storage stages) represent a tangible value drain that reduces effective realisations by ₹4,200–₹6,300 per acre at average prices. The absence of centralised curing and mechanised drying yards in most taluks perpetuates this loss, which affects small farmers disproportionately — they rely on sun-drying on open ground, leading to contamination and moisture inconsistency.

Policy Suggestions and Recommendations

1. **Establish community seed banks in all major turmeric-growing taluks.** The Belagavi Zilla Panchayat, in partnership with KSSC (Karnataka State Seeds Corporation), should establish 15–20 community seed banks to supply certified disease-free Rajapuri and Alleppey Finger rhizomes at subsidised rates. This single intervention can reduce seed cost by 25–30% and raise curcumin content across the district, directly improving market realisations.
2. **Invest in post-harvest infrastructure at cluster level.** Under PM-KISAN SAMPADA and the National Horticulture Mission, dedicate funds for cluster-level curing sheds, mechanical drying units, and cold storage facilities at Saundatti, Ramdurg, and Mudhol APMC yards. Reducing post-harvest losses from the current 12–18% to below 6% would add ₹2,100–₹4,200 per acre to net realisations for all farm categories.
3. **Accelerate e-NAM adoption with tailored farmer literacy programmes.** Despite superior marketing efficiency (ME = 7.28), e-NAM usage among Belagavi turmeric farmers remains below 12%. The Agriculture Department should partner with Karnataka's Raitha Seva Kendras to offer structured e-NAM onboarding camps in Kannada, incorporating smartphone-based price discovery training. A target of 35% small-farm e-NAM participation by 2027 is achievable with dedicated extension support.
4. **Strengthen and scale co-operative marketing through existing FPOs.** The 14 registered Farmer Producer Organisations (FPOs) in Belagavi district should be provided working capital linkages via NABARD's FPO promotion scheme to function as aggregators for small-farm produce, channelling it to direct processor and APMC routes. Co-operative marketing (Channel IV, ME = 4.44, share = 61%) can serve as the intermediate step before full e-NAM transition.
5. **Promote curcumin-testing and quality-linked price discovery.** Working with ICAR-IISR (Indian Institute of Spices Research) and APMC Saundatti, introduce low-cost portable curcumin testers at procurement points. Implementing quality-differentiated pricing will incentivise adoption of high-curcumin varieties and reward the investment already made by Saundatti farmers, while providing a roadmap for western taluk farmers.



6. **Create a price stabilisation reserve for turmeric under the Karnataka Raitha Suraksha Yojane.** Given intra-year price variation of 38–50%, a state-managed buffer stock mechanism — purchasing at a Minimum Support Price (MSP) during glut periods and releasing during scarcity — would reduce income uncertainty for small farmers who cannot afford to hold stock through seasonal price cycles. The CACP should be petitioned to announce a separate MSP for turmeric.

7. **Expand extension services in low-productivity taluks.** Athani, Chikkodi, and Gokak taluks — where yields are 15–23% below the district average — should receive dedicated Krishí Vigyan Kendra (KVK) mobile extension visits covering fertiliser schedules, integrated pest management (IPM) for rhizome rot, and precision irrigation techniques. Demonstrating a yield uplift from 15,000 to 17,500+ Kg/Ha in these taluks would alone add 10,000+ MT to district production.

Conclusion

Belagavi district's turmeric economy presents a picture of unrealised potential. The natural endowment is exceptional — black cotton soils, a favourable monsoon regime, an established variety base, and proximity to both domestic and export markets. Production is growing, market prices have trended strongly upward, and the district has achieved a premium over the national benchmark price for the first time in recent years. These are grounds for cautious optimism.

Yet the analysis reveals persistent structural fault lines that prevent this macroeconomic success from translating into household welfare for the majority of growers. Small farmers — 68% of the cultivator base — face a trifecta of constraints: they pay higher per-acre input costs than large farms, they achieve lower yields due to limited access to certified seed and extension services, and they sell through the least efficient marketing channel. The result is a BCR of 1.32 that scarcely justifies the risk and labour investment of cultivation.

The solutions are not exotic. Community seed banks, post-harvest drying infrastructure, e-NAM facilitation, co-operative aggregation, and quality-linked pricing are proven, cost-effective interventions with documented success in comparable districts. What is required is coordinated action across the Department of Agriculture, NABARD, APMC administration, and the Karnataka Horticulture Mission — institutions that currently operate in administrative silos.

If the recommendations outlined in this study are implemented over the next three to five years, conservative projections suggest that district average BCR could rise from 1.53 to 1.85, small-farm net returns could increase by 40–55%, and post-harvest losses could be halved. Belagavi's turmeric sector has the ecological and economic preconditions for a genuine transformation — what it needs now is governance that is as fertile as its soil.

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Original Article

India's Unicorn Startup Ecosystem: A Comprehensive Descriptive Data Analysis 2011 – 2026

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Abstract

This research journal presents a comprehensive descriptive analysis of India's unicorn startup ecosystem from its inception in 2011 through April 2026. India has emerged as the world's third-largest unicorn hub, behind only the United States and China, and hosts over 127 unicorn companies with a combined valuation exceeding \$363 billion. The analysis examines temporal growth patterns, sectoral distribution, geographic concentration, funding dynamics, and the emergence of decacorns. Key findings reveal that the Fintech and E-Commerce sectors dominate, Bengaluru commands the greatest share of unicorns, and the post-2022 period reflects a global venture capital correction. The paper also explores the pipeline of 147 soonicorns poised to join the unicorn club.

Keywords: Unicorn Startups, India Startup Ecosystem, Venture Capital, Fintech, Bengaluru, Decacorn, Soonicorn, Descriptive Statistics

Introduction

A unicorn company is a privately held startup with a valuation of \$1 billion or more — a term coined by venture capitalist Aileen Lee in 2013. Once rare, unicorns have proliferated globally as digital technology, internet penetration, and mobile adoption accelerated across emerging economies. India's trajectory has been especially remarkable: from its first unicorn, InMobi, in 2011, the country has grown to host over 127 such companies by April 2026.

India's startup ecosystem has been shaped by a confluence of structural factors: a vast English-speaking talent pool from elite engineering and management institutions, a government push through initiatives like Startup India (2016), growing domestic consumer demand, and a surge in mobile internet adoption driven by affordable data from Jio's entry in 2016. Together, these forces created fertile ground for high-growth technology ventures.

This journal aims to systematically describe and analyse the pattern, distribution, and characteristics of Indian unicorn startups using available secondary data from industry trackers and research platforms including Tracxn, Inc42, CB Insights, and Crunchbase.

Review of Literature:

1. Trapti Mittal (2024) Mittal looked at how India's unicorn e-startups have grown and how digitalization and tech-based business models have helped them grow in value faster. The study revealed that unicorns significantly contribute to innovation, job creation, and sector transformation in India.
2. Poddar (2022) examined several Indian unicorns and identified that market demand, funding accessibility, scalability, and technological innovation were crucial to their success. The study suggests that India's favourable environment has accelerated the growth of unicorns.
3. T. K. A. Kothai (2023) examined the evolution of the Indian startup ecosystem, emphasizing the role of unicorn companies in economic growth. The research indicates that the ecosystem presents both challenges and opportunities for expansion.

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4. Narsin S. This research examined unicorns, defined as startups valued over \$1 billion, and their growth in India since 2011. It asserted that unicorns are crucial for economic expansion and for enhancing the country's global competitiveness.

5. Various authors (2024) This research examined the financial performance, funding trends, and valuation patterns of unicorns from 2020 to 2021. It found that investment inflow, scalability, and sectoral diversification were some of the most important factors in their success.

6.. Mittal et al. (2024) This research conducted a thorough analysis of India's unicorn ecosystem, highlighting growth in sectors including healthtech, edtech, fintech, and e-commerce. This enhancement positions India as an advantageous environment for startups globally.

Research Objectives

The specific objectives of this analysis are:

- To trace the year-wise emergence of unicorns in India from 2011 to 2026.
- To analyse the sectoral distribution of Indian unicorns.
- To examine the geographic concentration of unicorn headquarters.
- To profile India's decacorn companies (\$10B+ valuation).
- To document recent entrants (2024–2026) and assess pipeline soonicorns.
- To discuss the implications of the post-2022 funding slowdown.

Methodology & Data Sources

This is a descriptive secondary research study. Data were aggregated from the following platforms and reports:

- Tracxn Unicorn Tracker India (April 2026) — primary source for current count and classifications

- Inc42 Indian Unicorn Tracker — sector, city, and historical data
- CB Insights Global Unicorn Club — for cross-country comparison
- Bhavya Sharma & Associates — India Top 100 Funded Startups Report 2025
- FintechNews.sg — Fintech-specific unicorn profiles
- Startuptalky.com — year-wise historical data

Descriptive statistics — including counts, percentages, and trend analysis — were computed manually from aggregated datasets. Data are accurate as of April 2026. Given that unicorn valuations are derived from private funding rounds and may differ across platforms, figures presented represent the most commonly cited estimates.

Limitations of the Study

- The study is based only on secondary data, and primary data has not been collected.
- The scope of the study is limited to startups, unicorns and soonicorns only.

Global Context: India's Position

To understand India's achievement, it is essential to situate it within the global landscape. As of mid-2024, the United States alone accounted for over 1,130 unicorns, China followed with 247, and India ranked third with 127 unicorns (Tracxn, 2026). This positions India as a significant but emerging power in the global startup hierarchy.

Country	Unicorn Count (2024–26)	Notable Sectors	Global Rank
United States	1,130+	Tech, Fintech, AI, SaaS	1
China	247	E-Commerce, AI, EV, Fintech	2
India	127+	Fintech, E-Commerce, Edtech	3
United Kingdom	54	Fintech, HealthTech	4
Germany	31	B2B SaaS, E-Commerce	5

India's fintech sector alone accounts for 24 unicorns, making it the third-largest fintech unicorn hub globally, trailing only the United States and China. The country also houses one fintech decacorn (valued over \$10 billion). India's fintech startups collectively account for 5% of total revenues generated by all BFSI companies in India, a remarkable figure given the sector's youth.

Temporal Growth Analysis: Year-Wise Unicorn Creation

India's unicorn creation has been highly uneven across time, punctuated by a spectacular boom in 2021 followed by a sharp contraction. Table 2 presents the year-wise count of new unicorns.

Year	New Added	Cumulative Notes
2011	1	InMobi becomes India's first unicorn
2012–2014	3	Flipkart, Snapdeal, Ola joins the club
2015	2	Gradual, organic ecosystem build-up
2016	4	Startup India launched; ecosystem accelerates
2017	1	Global VC caution, modest addition
2018	8	Jio effect: digital consumer boom begins
2019	11	Pre-COVID peak; EdTech & FinTech surge
2020	12	COVID accelerates digital adoption
2021	45	Record year: cheap money, global FOMO investing
2022	22	Correction begins; down from 2021 peak
2023	2	Funding winter: global rate hikes, VC caution



2024	7	Modest recovery: Zepto, Rapido, MoneyView
2025	6+	Selective: Netradyne, Porter, Drools, Juspay
2026 (Q1)	2	KreditBee; ecosystem stabilising

7.1 The 2021 Boom

The year 2021 stands as an outlier in Indian startup history. Forty-five new unicorns emerged — more than all previous years combined. This explosion was driven by: globally low interest rates post-COVID stimulus that pushed risk capital into emerging markets; unprecedented remote-adoption of digital tools; and a feedback loop of FOMO (Fear of Missing Out) investing as early-stage valuations escalated. Sectors that benefited most included edtech (BYJU's, Unacademy), fintech (CRED, Groww, BharatPe), and social commerce.

7.2 The 2022–2023 Funding Winter

From 2022 onwards, the global macroeconomic environment shifted dramatically. The U.S. Federal Reserve and other central banks began aggressive interest rate hikes to combat inflation, directly reducing the flow of capital into high-risk startup investments. India went from minting 45 unicorns in 2021 to just 22 in 2022 and a devastating 2 in 2023. Valuations were marked down, layoffs occurred across

the ecosystem, and the concept of 'profitability over growth' became the new investor mantra.

7.3 2024–2026: Selective Recovery

The period from 2024 onwards shows a modest, selective recovery. Unlike the 2021 boom where nearly any high-growth startup could command billion-dollar valuations, the newer unicorns — such as Rapido (ride-hailing), Netradyne (fleet AI), and KreditBee (lending) — are characterised by clearer paths to profitability, stronger unit economics, and resilient business models. IPOs have also emerged as an important exit and liquidity pathway, with companies like Ather Energy and others eyeing public markets.

Sectoral Distribution Analysis

Sector distribution reveals the structural priorities of India's startup ecosystem and investor appetite. The following table presents the breakdown of India's 127 unicorns across major sectors.

Sector	No. of Unicorns	Share (%)
E-Commerce	29	22.8%
Fintech	26	20.5%
Enterprise Tech	20	15.7%
Edtech	8	6.3%
Logistics & Supply Chain	7	5.5%
HealthTech	6	4.7%
Consumer & D2C	6	4.7%
SaaS	5	3.9%
EV & Cleantech	4	3.1%
Others	16	12.6%

8.1 E-Commerce (29 unicorns, 22.8%)

E-Commerce remains the single largest sector by unicorn count. Flipkart's early success established the playbook for Indian digital commerce. The sector spans horizontal marketplaces (Flipkart, Snapdeal, Meesho), vertical specialists (Nykaa for beauty, FirstCry for baby products), and B2B commerce platforms (Udaan, Moglix, infra. Market). Social commerce, powered by platforms like Meesho that target Tier II and Tier III India through WhatsApp-based selling, has become a significant sub-segment.

8.2 Fintech (26 unicorns, 20.5%)

Fintech's rise mirrors India's digital financial revolution, propelled by the Unified Payments Interface (UPI) infrastructure, digital lending mandates, and regulatory sandboxes by RBI and SEBI. Sub-segments include payments (Razor pay, PhonePe, Juspay), lending (CRED, KreditBee, Moneyview, Veritas), insurance (Policy Bazaar, Digit Insurance, Acko), and wealth management (Zerodha, Groww, Upstox). Payments and lending account for approximately 85% of total capital raised in the fintech segment. India now ranks third globally in fintech unicorn count, trailing only the US and China.

8.3 Enterprise Tech & SaaS (20+ unicorns, ~19.6%)

Enterprise technology and SaaS represent India's B2B strength, largely targeting global customers from Indian development centres. Companies like Freshworks (now public), Zoho, Druva, Icertis, BrowserStack, and Zenoti serve multinational corporations in HR, CRM, and industry software. This segment reflects India's historical IT outsourcing advantage being reinvented in product-first SaaS models.

8.4 Edtech (8 unicorns, 6.3%)

The edtech sector produced several unicorns during the COVID-19 pandemic era, including BYJU's (India's most valuable unicorn at its 2022 peak of \$22B), Unacademy, Vedanta, and upGrad. However, the sector faced significant headwinds post-2022 as schools reopened, retention declined, and BYJU's faced regulatory, financial, and governance challenges. The edtech correction became one of the most discussed downturns in the Indian startup ecosystem.

8.5 Emerging Sectors: EV, Deeptech, and AI

A notable trend in 2024–2026 is the emergence of unicorns in Electric Vehicles (Ather Energy, EriSha E Mobility), Artificial Intelligence (Krutrim — India's first AI



unicorn, Fireflies.ai), and Deep Technology (Netradyne's fleet safety AI). These sectors reflect the next wave of Indian innovation, supported by government production-linked incentive (PLI) schemes for EVs and growing enterprise adoption of AI-driven tools. Krutrim, founded by Ola's Bhavish Aggarwal in 2023, became India's first AI unicorn in January 2024 — signalling India's ambitions in the global AI race.

Geographic Distribution: City & State Analysis

India's unicorn geography is highly concentrated. More than 95% of unicorns are headquartered in just five states and one Union Territory — Karnataka, Maharashtra, Haryana, Delhi (UT), Uttar Pradesh, and Tamil Nadu. This reflects deep structural advantages in terms of talent, infrastructure, investor presence, and regulatory environment enjoyed by the top metro regions.

City / Region	Unicorn Count	Share (%)	Notable Unicorns
Bengaluru (Silicon Valley of India)	52	40.9%	Flipkart, Swiggy, Razorpay, Ola
Delhi NCR (Gurugram + Delhi + Noida)	40	31.5%	Zomato, Paytm, OYO, PolicyBazaar
Mumbai	18	14.2%	Dream11, PhonePe, Nykaa
Pune	8	6.3%	Icertis, Druva
Chennai	5	3.9%	BrowserStack, Kissht
Hyderabad	2	1.6%	Zenoti
Others	2	1.6%	Various cities

9

.1 Bengaluru: India's Silicon Valley

Bengaluru dominates India's unicorn map with 52 unicorns — approximately 41% of the total. The city's advantages are multifaceted: a concentration of IIT and IISc graduates, the presence of global tech giants (Google, Microsoft, Amazon, Infosys, Wipro) that seed entrepreneurial talent, a mature angel and VC investor community, and a pro-startup culture cultivated since the 1990s IT boom. Eight out of the ten unicorns created in 2024–2025 are headquartered in Bengaluru, underscoring the city's enduring dominance. Key names include Flipkart, Swiggy, Razor pay, Ola, Unacademy, and the latest entrant Juspay.

9.2 Delhi NCR: The Policy & Commerce Hub

Delhi NCR (comprising Delhi, Gurugram, and Noida) accounts for approximately 40 unicorns, or 31.5% of the total. The region benefits from its proximity to policy-making centres, a large consumer market, and significant enterprise demand. Delhi NCR hosts several of India's most recognised consumer brands in unicorn status — Zomato, OYO, Paytm, Policy Bazaar, and In Mobi. Gurugram, in particular, has established itself as a high-growth corridor with excellent infrastructure and a growing startup community.

9.3 Mumbai: Financial Capital's Contribution

Mumbai contributes 18 unicorns (14.2%), reflecting its role as India's financial and media centre.

Dream11 (gaming), PhonePe (fintech), Nykaa (beauty commerce), and Dhan (wealthtech) are among the city's flagship unicorns. Mumbai's strengths lie in financial services, media & entertainment, and consumer brands — sectors where proximity to banking institutions and the stock exchange provides competitive advantage.

9.4 Regional Disparity: A Persistent Challenge

A stark regional imbalance persists in India's unicorn geography. States like Bihar, Odisha, Assam, and most of the North-East, along with nearly 29 states and Union Territories, have not yet produced a single unicorn. This concentration underscores the need for targeted ecosystem development — including incubator creation, angel network expansion, and infrastructure investment — in tier II and tier III cities. Emerging hubs like Pune (8 unicorns), Chennai (5 unicorns), and Jaipur (through soonicorns like Finova Capital) suggest that geographic diversification is gradually occurring.

India's Decacorns: The \$10 Billion+ Club

Decacorns — startups valued at over \$10 billion — represent the pinnacle of startup success. India currently has eight decacorns, though some (notably BYJU's) have faced valuation markdowns due to operational and financial difficulties.

Company	Sector	Peak Valuation	Founded	HQ City
Flipkart	E-Commerce	\$35B	2007	Bengaluru
BYJU's	Edtech	\$22B	2011	Bengaluru
Swiggy	Food Delivery	\$15B	2014	Bengaluru
Nykaa	Beauty / E-Commerce	\$14B	2012	Mumbai
Zomato	Food Delivery	\$14B	2008	Gurugram
OYO	Hospitality Tech	\$10B	2013	Gurugram
Paytm	Fintech	\$10B	2010	Gurugram
Dream11	Gaming	\$10B	2012	Mumbai

following table profiles India's leading decacorns.



Flipkart remains India's most valuable unicorn and has been instrumental in defining the e-commerce playbook for the country. Acquired by Walmart in 2018 for \$16 billion, it represented India's first major global startup exit and validated the ecosystem internationally. BYJU's, once valued at \$22 billion and celebrated as one of the world's leading edtech companies, has experienced one of the sharpest corrections in Indian startup history, facing investor disputes, regulatory scrutiny, and financial restructuring challenges. This contrast illustrates the

volatility of startup valuations and the importance of governance and sustainable business models.

Recent Entrants: 2024–2026 Cohort

The unicorns that emerged in 2024–2026 are qualitatively different from the 2021 cohort. They tend to be more operationally mature, with demonstrated revenue growth and paths to profitability — reflecting a market that now demands fundamentals over narrative. The table below profiles the most notable recent entrants.

Company	Sector	Valuation	Year	HQ
KreditBee	Fintech / Lending	\$1.5B	Apr 2026	Bengaluru
Erisha E Mobility	EV / Cleantech	\$1.0B	Mar 2025	Delhi NCR
Dhan	Wealth tech	\$1.0B	2025	Mumbai
Jumbo tail	B2B Grocery	\$1.0B	2025	Bengaluru
Porter	Logistics	\$1.0B	2025	Bengaluru
Drools	D2C / Pet Food	\$1.0B	2025	Bengaluru
Fireflies.ai	Enterprise AI	\$1.0B	2025	Bengaluru
Netradyne	Deeptech / AI	\$1.34B	Jan 2025	Bengaluru
Juspay	Payments	\$1.0B	Jan 2026	Bengaluru
Ather Energy	EV	\$1.3B	Aug 2024	Bengaluru

Three thematic patterns stand out in the 2024–2026 cohort. First, logistics and mobility companies (Porter, Rapido, Netradyne) reflect India's under-penetrated transport infrastructure market and the AI-driven optimisation opportunity. Second, financial services companies continue their steady march (KreditBee, Juspay, Dhan, Money view) as India's formalisation of credit and digital payments deepens. Third, early signs of EV and deep technology (Ather Energy, Erisha E Mobility, Krutrim)

signal the next frontier, supported by government mandates for clean energy transition.

The Pipeline: India's 147 Soonicorns

India's unicorn pipeline remains robust. According to Inc42 analysis, the Indian startup ecosystem is home to 147 soonicorns — companies valued between \$200 million and \$1 billion. Together, these soonicorns have raised over \$18 billion and command a combined valuation of approximately \$60 billion.

Valuation Band	No. of Soonicorns	Key Sectors
\$500M – \$999M (nearest to unicorn)	49	Fintech, HealthTech, SaaS
\$250M – \$499M	58	E-Commerce, Enterprise Tech
\$200M – \$249M (lower end)	40	Consumer, Logistics, EV

Bengaluru hosts 49 soonicorns (33%), Delhi NCR houses 36 (24%), and Mumbai has 32 (22%) — mirroring the unicorn geography. Fintech is the most dominant segment with 39 soonicorns. Notable near-unicorns include Juspay (payments), Whatfix (digital adoption), Raphe mPhibr (deeptech defence), and Aequus (aerospace manufacturing). The continued concentration of soonicorns in established metros suggests that while the pipeline is healthy, geographic diversification at the soonicorn stage remains limited.

Funding Dynamics and Investment Patterns

India's 127 unicorns have collectively raised over \$115 billion in funding (Inc42, 2025). This capital has flowed predominantly from global institutional investors: SoftBank, Tiger Global, Sequoia Capital (now Peak XV Partners in India), Accel, and Lightspeed are among the most prominent backers. The top 100 funded startups control approximately 75% of all capital invested in India's startup ecosystem, demonstrating the concentration of investment in proven, high-potential ventures.

13.1 Dominant Investors

SoftBank's Vision Fund has been the single largest external capital infuser into India's unicorn ecosystem, backing OYO, Paytm, Meesho, and others. Peak XV Partners (formerly Sequoia India) holds the most unicorn-producing portfolio in terms of count. Domestic institutions — including Zerodha's bootstrapped rise and Tata-backed investments — demonstrate that not all unicorns require foreign capital. The role of NIIF (National Investment and Infrastructure Fund) as a government-backed investor in companies like Ather Energy marks an important policy intervention.

13.2 The 2025 Funding Landscape

In 2025, Indian startups raised approximately \$11 billion across 936 deals — an 8% decline from the prior year. While deal volumes reduced, average deal sizes for later-stage companies increased, reflecting investor preference for quality over quantity. IPOs emerged as a critical exit route: companies like Ather Energy, Zomato (previously listed), and others have used or are targeting public markets. This IPO maturation signals that the Indian startup ecosystem is transitioning from growth-at-any-cost to sustainable, publicly accountable business models.



Key Findings: Descriptive Summary

Dimension	Finding
Total Unicorns (April 2026)	127+
Combined Valuation	Over \$363 billion
Total Funding Raised	Over \$115 billion
Global Rank	#3 (behind USA and China)
Peak Year for New Unicorns	2021 (45 new unicorns)
Lowest Year (post-2016)	2023 (2 new unicorns)
Leading Sector by Count	E-Commerce (29 unicorns, 22.8%)
Leading Sector by Capital	Fintech (dominant funding volumes)
Leading City	Bengaluru (52 unicorns, ~41%)
Second City	Delhi NCR (40 unicorns, ~31.5%)
Decacorn Count	8 companies valued at \$10B+
Soonicorn Pipeline	147 companies valued \$200M–\$999M
First Indian Unicorn	InMobi (2011, Bengaluru)
Largest Indian Unicorn	Flipkart (~\$35B valuation)
First AI Unicorn	Krutrim (January 2024)
Regional Coverage	>95% concentrated in 5–6 states/UTs
Women-led Unicorns	~10% (Nykaa's Falguni Nayar is most prominent)

Discussion

15.1 Structural Strengths

India's unicorn ecosystem is underpinned by several durable structural advantages. Its demographic dividend — with over 600 million people under 35 — creates a large domestic consumer market hungry for digital services. India's 850+ million internet users, many accessing the internet via affordable smartphones and low-cost Jio data, have enabled rapid digital adoption in e-commerce, fintech, and edtech. The government's digital public infrastructure stack — Aadhaar for identity, UPI for payments, and DigiLocker for documents — provides the plumbing on which startups build.

15.2 Persistent Challenges

Despite impressive scale, the ecosystem faces significant challenges. The regional concentration of unicorns in Bengaluru, Delhi NCR, and Mumbai excludes vast portions of India from the benefits of startup growth. Gender diversity remains low, with women-led unicorns accounting for only ~10% of the total. Corporate governance failures — most prominently at BYJU's, which faced investor disputes, regulatory investigations, and financial restructuring — have raised systemic concerns about board accountability and financial disclosure practices in high-growth startups. Additionally, the high startup failure rate (over 90% within 5 years) and the 2025 wave of 11,223 startup shutdowns underscore the harsh realities beneath the unicorn narrative.

15.3 Opportunities Ahead

The next wave of Indian unicorns is likely to emerge from AI and machine learning, electric mobility, deep technology, aggrotech, health tech, and climate solutions — sectors where India's engineering talent, cost advantage, and government support are converging. The growing maturity of India's public markets, as demonstrated by the successful IPOs of Zomato, Nykaa, and Fresh works, provides a more liquid exit ecosystem for investors and founders, which is expected to attract further global capital. Tier II cities — Pune, Jaipur, Surat, Ahmedabad — are increasingly producing startup activity and may host India's next generation of unicorns.

Conclusion

India's unicorn startup ecosystem has undergone a remarkable transformation from a single unicorn in 2011 to 127+ companies with a combined valuation exceeding \$363 billion by April 2026. The descriptive analysis reveals a complex, multi-dimensional landscape: highly concentrated geographically in Bengaluru and Delhi NCR; dominated by E-Commerce and Fintech sectors; shaped by global capital flows and macroeconomic cycles; and now moving toward quality, profitability, and public market maturity after the excess of 2021.

The pipeline of 147 soonicorns and the emergence of AI, EV, and deep technology unicorns suggest that India's startup story is far from over. However, sustaining the momentum will require addressing structural inequalities — geographic, gender, and governance — that limit the ecosystem's full potential. India's ambition of becoming the



global startup capital will depend not just on the count of unicorns produced, but on the quality, inclusivity, and durability of the enterprises built.

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Original Article

Role of FinTech in Advancing Financial Inclusion: A Conceptual Framework Integrating Technology, Trust, and Financial Literacy

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Abstract

Financial inclusion has become a central objective in global development discourse, particularly in emerging economies where access to formal financial services remains uneven and inadequate. While Financial Technology (FinTech) has significantly expanded access through digital innovation, a persistent gap exists between access and effective utilization of financial services. This gap highlights the importance of behavioural and capability-related factors in shaping financial inclusion outcomes. This study develops a comprehensive conceptual framework integrating FinTech, trust, and financial literacy to explain how digital financial ecosystems can achieve meaningful inclusion. Drawing on interdisciplinary theoretical foundations, including the Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), and Financial Capability Theory, the paper argues that FinTech serves as an enabler of access, while trust and financial literacy function as critical mediators influencing adoption and sustained usage. Through an extensive synthesis of recent scholarly literature, the study identifies key gaps and proposes a multi-dimensional model that bridges technological, behavioural, and socio-economic perspectives. The paper contributes to the literature by offering a nuanced understanding of financial inclusion beyond access metrics, emphasizing the importance of user-centric design, institutional trust, and digital capability. It further provides actionable insights for policymakers, financial institutions, and FinTech firms seeking to build inclusive, secure, and sustainable financial systems aligned with global development goals.

Keywords: FinTech, Financial Inclusion, Trust, Financial Literacy, Digital Finance, Inclusive Growth

Introduction

Financial inclusion is widely recognized as a cornerstone of economic development and social equity. It enables individuals and businesses to access essential financial services such as savings, credit, insurance, and payment systems in a timely and affordable manner. Over the past decade, policymakers and international institutions have intensified efforts to improve financial inclusion, particularly in developing economies where traditional banking systems have struggled to reach marginalized populations.

Despite these efforts, significant gaps persist. According to recent global estimates, a large proportion of adults remain excluded from formal financial systems, often due to geographic, economic, and institutional barriers (Ozili, 2024). Conventional banking models, characterized by high operational costs and rigid infrastructure, have proven insufficient in addressing the needs of rural and low-income populations. The emergence of FinTech has introduced new possibilities for overcoming these challenges. Digital financial services, including mobile banking, digital wallets, peer-to-peer lending, and algorithmic credit scoring, have expanded access to financial services by reducing transaction costs and eliminating physical barriers (Ha et al., 2025). In countries such as India, Kenya, and China, FinTech innovations have significantly increased financial access through mobile-based platforms.

However, access does not automatically translate into meaningful inclusion. Many individuals with access to digital financial services remain inactive users due to concerns related to trust, security, and lack of financial knowledge. This highlights the need for a more comprehensive understanding of financial inclusion that goes beyond access and considers behavioural and capability factors.

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This paper addresses this gap by proposing a conceptual framework that integrates technology (FinTech), trust, and financial literacy as key determinants of financial inclusion. The study adopts an interdisciplinary perspective to examine how these dimensions interact and influence financial participation.

Literature Review

2.1 FinTech as an Enabler of Financial Inclusion

FinTech has fundamentally transformed the financial services landscape by introducing innovative mechanisms that enhance accessibility, affordability, and efficiency. Digital platforms such as mobile banking and digital wallets have enabled financial institutions to reach previously underserved populations, particularly in rural and remote areas (Ha et al., 2025).

The literature identifies several pathways through which FinTech promotes financial inclusion. First, it reduces transaction costs by eliminating the need for physical infrastructure. Second, it facilitates alternative credit assessment methods, enabling access to credit for individuals without formal financial histories (Mittal & Singh, 2025). Third, it enhances financial participation through convenient and user-friendly interfaces.

Moreover, advancements in artificial intelligence and big data analytics have enabled personalized financial services, improving decision-making and financial outcomes (Sharma & Priya, 2025). Blockchain technology has further enhanced transparency and security, contributing to greater trust in financial systems.

Despite these advantages, FinTech also presents challenges, including cybersecurity risks, data privacy concerns, and digital exclusion. These challenges underscore the importance of complementary factors such as trust and financial literacy in determining the effectiveness of FinTech-driven inclusion.

2.2 Trust and Digital Financial Adoption

Trust is a fundamental determinant of financial behaviour, particularly in digital environments where transactions are intangible and risks are perceived to be higher. In the context of FinTech, trust encompasses confidence in technology, institutions, and regulatory frameworks.

Empirical studies consistently demonstrate that trust significantly influences the adoption and continued use of digital financial services (Jafri et al., 2024). Users are more likely to engage with FinTech platforms when they perceive them as secure, reliable, and transparent. Conversely, concerns related to fraud, data breaches, and lack of regulatory oversight can hinder adoption.

Recent research highlights that trust acts as a mediating factor between FinTech and financial inclusion (Hanson & Ott, 2026). This implies that technological innovation alone is insufficient; the perceived trustworthiness of financial systems plays a crucial role in determining user behaviour.

Institutional factors such as regulatory frameworks, consumer protection mechanisms, and financial stability also contribute to building trust. Effective governance and transparent policies can enhance confidence in digital financial systems, thereby promoting inclusion.

2.3 Financial Literacy as a Capability Driver

Financial literacy is widely recognized as a key determinant of financial inclusion, as it equips individuals with the knowledge and skills necessary to make informed financial decisions. In the digital era, financial literacy extends to include digital financial literacy, encompassing the ability to use digital platforms and understand associated risks.

Research indicates that financial literacy significantly influences the adoption and effective use of FinTech services (Amnas et al., 2024). Individuals with higher levels of financial literacy are more likely to engage with financial systems, manage risks, and achieve better financial outcomes.

Furthermore, financial literacy enhances users' ability to evaluate financial products, understand terms and conditions, and avoid fraudulent activities. This is particularly important in digital environments, where information asymmetry and complexity can pose challenges.

2.4 Interaction between Trust and Financial Literacy

The relationship between trust and financial literacy is dynamic and mutually reinforcing. Financial literacy enhances trust by enabling individuals to understand financial systems and assess risks. At the same time, trust influences the willingness to adopt and utilize financial services.

Studies suggest that the combined effect of trust and financial literacy has a stronger impact on financial inclusion than either factor alone (Palanisamy et al., 2025). This interaction highlights the importance of integrating behavioural and capability dimensions in financial inclusion strategies.

2.5 Research Gap

While existing literature provides valuable insights into the role of FinTech, trust, and financial literacy, there is limited integration of these factors into a unified framework. Most studies adopt a fragmented approach, focusing on individual dimensions without considering their interdependencies.

This study addresses this gap by proposing a comprehensive conceptual model that captures the interplay between technology, trust, and financial literacy in shaping financial inclusion outcomes.

Research Objectives

1. To examine the role of FinTech in enhancing financial inclusion
2. To analyze the influence of trust on FinTech adoption
3. To evaluate the impact of financial literacy on financial inclusion
4. To develop an integrated conceptual framework
5. To provide policy and managerial recommendations

Conceptual Framework Development

4.1 Theoretical Foundations

1. Technology Acceptance Model (TAM) – explaining adoption of digital platforms
2. Theory of Planned Behaviour (TPB) – capturing behavioural intentions
3. Financial Capability Theory – emphasizing knowledge and skills



4.2 Model Explanation

1. FinTech (Technology) enhances accessibility and reduces barriers
2. Trust (Behavioural factor) influences adoption and continued usage
3. Financial Literacy (Capability factor) determines effective utilization

These factors interact to produce financial inclusion outcomes.

4.3 Conceptual Model

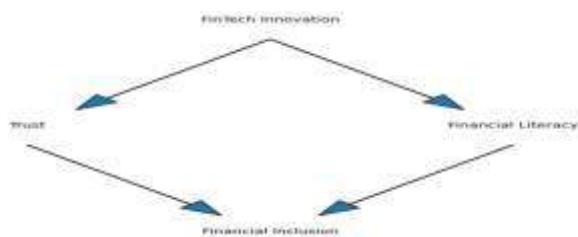


Figure 1

Figure 1 illustrates the proposed conceptual model integrating FinTech, trust, and financial literacy in explaining financial inclusion outcomes. The framework positions FinTech as the primary enabler that enhances access to financial services through digital innovation. However, its effectiveness is mediated by trust, which influences user adoption and continued engagement with digital financial platforms, and financial literacy, which determines individuals' ability to understand, evaluate, and effectively utilize financial services.

The model further highlights the interaction between trust and financial literacy, suggesting that higher levels of financial knowledge enhance trust in FinTech systems, while trust facilitates the application of financial knowledge in real-world financial decision-making. These interconnected relationships collectively contribute to achieving meaningful financial inclusion, characterized not only by access but also by sustained usage and financial empowerment.

Discussion

The present study advances the understanding of financial inclusion by proposing a multi-dimensional framework that integrates FinTech, trust, and financial literacy. The discussion of findings from the reviewed literature reveals that financial inclusion in the digital era cannot be adequately explained through a single-factor perspective. Instead, it emerges as a complex socio-technical phenomenon, shaped by the interaction between technological infrastructure, behavioural perceptions, and individual capabilities.

5.1 From Access to Meaningful Inclusion

One of the most significant insights derived from this study is the distinction between access-based inclusion and usage-based inclusion. While FinTech has been widely recognized for its ability to expand access by reducing costs and eliminating geographical barriers, the literature consistently

indicates that access alone does not guarantee meaningful financial participation (Ozili, 2024; Ha et al., 2025).

This study reinforces the argument that financial inclusion should not be measured solely by the availability of financial services, but also by the extent to which individuals actively use and benefit from these services. The persistence of inactive accounts, low transaction frequency, and limited product utilization highlights a critical gap between access and usage. This gap is largely attributable to behavioural and capability-related constraints, particularly trust deficits and low financial literacy.

Thus, the findings suggest a paradigm shift from "financial access" to "financial engagement", where the emphasis is placed on sustained usage and financial empowerment.

5.2 FinTech as an Enabler

The discussion underscores that FinTech serves primarily as an enabling mechanism rather than a complete solution to financial exclusion. While technological innovations such as mobile banking, digital wallets, and AI-driven credit systems significantly enhance accessibility, their impact is contingent upon user acceptance and capability.

This aligns with the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use influence adoption. However, this study extends TAM by demonstrating that these perceptions are deeply influenced by trust and financial literacy. For instance, even highly efficient digital platforms may fail to achieve widespread adoption if users perceive them as insecure or difficult to understand. Moreover, the findings highlight that technological advancement can inadvertently create new forms of exclusion, particularly for individuals lacking digital skills or access to digital infrastructure. This phenomenon, often referred to as digital exclusion, poses a significant challenge to inclusive financial ecosystems.

5.3 Central Role of Trust in Digital Financial Ecosystems

Trust emerges as a pivotal factor in determining the success of FinTech-driven financial inclusion. The discussion reveals that trust operates at multiple levels—trust in technology, trust in institutions, and trust in regulatory systems. These dimensions collectively shape user perceptions and influence adoption decisions.

The mediating role of trust, as proposed in this study, is strongly supported by existing literature (Jafri et al., 2024; Hanson & Ott, 2026). Users are more likely to engage with digital financial platforms when they perceive them as secure, transparent, and reliable. Conversely, concerns related to cybersecurity, fraud, and data privacy can significantly hinder adoption.

Importantly, trust is not static but evolves over time based on user experiences and institutional performance. Positive interactions, effective grievance redressal mechanisms, and consistent service delivery can enhance trust, while negative experiences can lead to disengagement.

This highlights the need for financial institutions and FinTech firms to adopt a trust-centric approach, prioritizing transparency, security, and accountability in their operations.



5.4 Financial Literacy as a Catalyst for Inclusion

Financial literacy plays a crucial role in transforming access into meaningful usage. The discussion reveals that individuals with higher levels of financial literacy are better equipped to understand financial products, evaluate risks, and make informed decisions (Amnas et al., 2024).

In the context of FinTech, digital financial literacy becomes particularly important. Users must not only understand financial concepts but also possess the skills required to navigate digital platforms and protect themselves from cyber risks. The absence of such skills can lead to misuse, financial loss, and eventual withdrawal from financial systems.

Furthermore, financial literacy enhances self-efficacy, a key component of the Theory of Planned Behaviour (TPB). Individuals who feel confident in their ability to use financial services are more likely to adopt and continue using them. This underscores the role of financial literacy as both a capability and a psychological enabler.

5.5 Interaction Effects: Trust and Financial Literacy

A key contribution of this study lies in highlighting the interaction between trust and financial literacy. Rather than functioning independently, these factors exhibit a complementary relationship that amplifies their impact on financial inclusion.

Financial literacy contributes to trust by enabling individuals to understand the functioning of financial systems and evaluate associated risks. Informed users are less likely to be influenced by misinformation and are more capable of assessing the credibility of financial platforms. Conversely, trust facilitates the application of financial knowledge by reducing perceived risks and encouraging engagement.

This interaction creates a reinforcing cycle, where increased literacy leads to greater trust, which in turn promotes higher levels of adoption and usage. The combined effect of these factors is therefore greater than their individual contributions, supporting the hypothesis that trust and financial literacy jointly enhance financial inclusion (Palanisamy et al., 2025).

5.6 Theoretical Integration and Contribution

The discussion also highlights the theoretical contributions of the study by integrating multiple frameworks:

- The Technology Acceptance Model (TAM) explains how technological features influence adoption.
- The Theory of Planned Behaviour (TPB) provides insights into behavioural intentions and attitudes.
- Financial Capability Theory emphasizes the role of knowledge and skills in financial decision-making.

By combining these perspectives, the study offers a comprehensive understanding of financial inclusion, capturing both technological and human dimensions. This integrated approach addresses the limitations of single-theory models and provides a more robust foundation for future research.

5.7 Implications for Sustainable and Inclusive Development

The findings have broader implications for sustainable development. Financial inclusion is closely linked to economic empowerment, poverty reduction, and social equity. By enabling access to financial services, FinTech can contribute to improved livelihoods, increased savings, and enhanced resilience.

However, the study cautions that technological solutions alone are insufficient to achieve inclusive growth. Without addressing issues related to trust and literacy, FinTech may inadvertently widen existing inequalities. Therefore, a balanced approach that integrates technological innovation with social and educational interventions is essential.

5.8 Toward a Holistic Inclusion Strategy

Overall, the discussion emphasizes the need for a holistic strategy that combines:

- Technological innovation (FinTech infrastructure)
- Behavioural interventions (trust-building measures)
- Capability development (financial literacy programs)

Such an approach can ensure that financial inclusion is not only achieved in terms of access but also sustained through active participation and meaningful engagement.

Implications

The proposed conceptual framework integrating FinTech, trust, and financial literacy offers significant implications across theoretical, policy, managerial, and societal dimensions. These implications extend beyond traditional financial inclusion approaches by emphasizing a multi-dimensional and interdisciplinary perspective.

6.1 Theoretical Implications

This study contributes to the existing body of knowledge by advancing a holistic and integrative framework for understanding financial inclusion in the digital era. Unlike prior studies that predominantly examine FinTech, trust, or financial literacy in isolation, this research synthesizes these constructs into a unified conceptual model. First, the framework extends the Technology Acceptance Model (TAM) by incorporating trust and financial literacy as critical mediating and moderating variables. While TAM primarily focuses on perceived usefulness and ease of use, this study highlights that these perceptions are significantly shaped by users' trust in digital systems and their financial knowledge.

Second, the integration of Theory of Planned Behaviour (TPB) provides deeper insight into how attitudes, subjective norms, and perceived behavioural control influence FinTech adoption. The inclusion of financial literacy strengthens perceived behavioural control, while trust influences attitudes toward digital financial systems. Third, the study contributes to Financial Capability Theory by demonstrating that access (enabled by FinTech) must be complemented by capability (financial literacy) and confidence (trust) to achieve meaningful financial inclusion.

Overall, the framework offers a multi-layered theoretical perspective, bridging gaps between technology adoption theories and financial inclusion literature, thereby



opening avenues for future empirical validation and interdisciplinary research.

6.2 Policy Implications

The findings have important implications for policymakers and regulatory authorities aiming to promote inclusive financial ecosystems. Firstly, governments should move beyond access-oriented policies and focus on usage-driven inclusion strategies. While initiatives such as digital banking and payment infrastructure have expanded access, there is a need to ensure that individuals actively use these services. This requires integrating financial literacy programs with digital inclusion initiatives.

Secondly, policymakers must prioritize trust-building mechanisms within digital financial systems. This includes strengthening regulatory frameworks related to data privacy, cybersecurity, and consumer protection. Transparent grievance redressal mechanisms and robust legal safeguards can enhance user confidence in FinTech platforms.

Thirdly, targeted interventions are necessary for vulnerable and marginalized populations, including rural communities, women, and low-income groups. Tailored financial literacy programs, vernacular interfaces, and simplified digital platforms can help bridge the inclusion gap.

Additionally, collaboration between governments, financial institutions, and FinTech firms is essential to create a cohesive regulatory ecosystem that encourages innovation while ensuring consumer safety.

6.3 Managerial Implications

For FinTech companies, banks, and financial service providers, the study provides actionable insights for designing and delivering inclusive financial solutions.

Firstly, organizations should adopt a user-centric approach by designing intuitive and accessible platforms that cater to diverse user groups. Simplified interfaces, multilingual support, and voice-enabled technologies can enhance usability for low-literacy users. Secondly, building trust should be a strategic priority. This can be achieved through transparent communication, robust security measures, and clear disclosure of terms and conditions. Features such as real-time transaction alerts, fraud detection systems, and customer support services can further strengthen trust.

Thirdly, firms should invest in financial education initiatives as part of their corporate strategy. Educating users about financial products, digital security, and risk management can improve adoption rates and customer retention. Moreover, leveraging data analytics and AI can help organizations understand user behaviour, personalize financial services, and identify barriers to adoption. This can lead to more effective targeting of underserved segments.

6.4 Societal Implications

The study also highlights broader societal implications, particularly in the context of sustainable development and social equity. Financial inclusion is closely linked to several Sustainable Development Goals (SDGs), including poverty reduction, gender equality, and economic growth. By enhancing access to financial services, FinTech

can empower individuals to participate in economic activities, build assets, and improve their livelihoods.

However, the study also underscores the risk of digital exclusion, where individuals lacking digital skills or trust in technology may be left behind. Addressing this challenge requires a balanced approach that combines technological innovation with social and educational interventions.

Furthermore, increased financial inclusion can lead to improved financial resilience, enabling households to manage risks, cope with economic shocks, and invest in education and health.

Limitations and Future Research

This study is conceptual in nature and does not involve empirical validation. Future research should test the proposed framework using quantitative and qualitative methods across different contexts. Additionally, factors such as digital infrastructure, cultural influences, and regulatory quality can be explored.

Conclusion

FinTech has undeniably transformed the financial services landscape, offering unprecedented opportunities to expand financial inclusion. However, the findings of this study suggest that technological innovation alone is insufficient to achieve meaningful inclusion. Trust and financial literacy emerge as critical enablers that bridge the gap between access and effective usage. By integrating these dimensions, this paper provides a comprehensive framework that advances the understanding of financial inclusion in the digital era. The study highlights the need for a balanced approach that combines technological advancement with behavioural and educational interventions.

Ultimately, achieving sustainable financial inclusion requires collaboration among policymakers, financial institutions, and technology providers to build inclusive, secure, and user-centric financial ecosystems.

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Original Article

Digital Transformation in Consumer Buying Behaviour

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Abstract

Digital transformation has fundamentally reshaped consumer buying behaviour by integrating advanced technologies such as e-commerce, social media, artificial intelligence, and mobile applications into everyday life. This study examines how digitalization influences consumer decision-making, purchasing patterns, and brand interaction. Using a descriptive research methodology based on secondary data, the paper analyzes the impact of digital tools on consumer awareness, convenience, and personalization. The findings indicate that digital transformation has made consumers more informed, price-sensitive, and experience-oriented. It also highlights that businesses adopting digital strategies gain competitive advantages in terms of customer engagement and operational efficiency. The study concludes that digital transformation is essential for modern businesses to survive and grow in a dynamic market environment.

Keywords:

Digital transformation, consumer behaviour, e-commerce, online shopping, social media marketing, artificial intelligence, digital marketing

Introduction:

Digital transformation refers to the adoption and integration of digital technologies into all areas of business operations and consumer interactions, fundamentally changing how value is delivered to customers. In the context of consumer buying behaviour, it has transformed the traditional purchasing process into a dynamic, technology-driven experience. Earlier, consumers depended on physical stores, limited advertisements, and personal recommendations to make purchasing decisions. Today, the availability of the internet, smartphones, and digital platforms has enabled consumers to access vast amounts of information instantly, compare products, read reviews, and make purchases from anywhere at any time. The emergence of e-commerce platforms such as Amazon and Flipkart has made shopping more convenient and efficient by offering a wide range of products, competitive pricing, and doorstep delivery services. At the same time, social media platforms like Instagram and Facebook have become powerful tools for product discovery, brand communication, and customer engagement. Consumers are increasingly influenced by online reviews, influencer recommendations, and targeted advertisements, which play a significant role in shaping their preferences and purchase decisions. Moreover, advanced technologies such as artificial intelligence and big data analytics allow businesses to understand consumer behaviour in detail and provide personalized recommendations.

This personalization enhances customer satisfaction and builds long-term relationships between consumers and brands. Digital transformation has also led to the rise of mobile commerce (m-commerce), where consumers use smartphones for browsing, comparing, and purchasing products, making the buying process faster and more accessible. In this rapidly evolving digital environment, consumer behaviour is no longer linear but involves multiple touch-points across different platforms. Consumers may search for information on one platform, compare prices on another, and complete the purchase through a mobile app. This shift has made consumers more informed, empowered, and selective. Therefore, understanding digital transformation in consumer buying behaviour is essential for businesses to design effective strategies, improve customer experience, and remain competitive in the modern marketplace.

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Historical Background

The evolution of consumer buying behaviour has undergone a significant transformation over the decades. Before the 1990s, consumer purchases were mainly conducted through traditional retail outlets, where physical presence and direct interaction with sellers played a crucial role. Information about products was limited, and decisions were often influenced by advertisements and word-of-mouth communication. With the advent of the internet in the 1990s, a new era of online shopping emerged, allowing consumers to access information and products beyond geographical boundaries.

During the 2000s, e-commerce platforms expanded rapidly, offering convenience, variety, and competitive pricing. The 2010s marked the rise of smartphones and social media platforms such as Facebook and Instagram, which transformed how consumers discover and interact with brands. In the present era, digital transformation is driven by technologies like artificial intelligence, big data, and machine learning, enabling personalized shopping experiences. This evolution clearly indicates a shift from seller-driven markets to consumer-centric digital ecosystems.

Need of the Study

The rapid growth of digital technologies has significantly changed consumer buying patterns, making it essential to study this transformation. Online platforms such as Amazon and Flipkart have made shopping more convenient and accessible, encouraging consumers to shift from traditional to digital purchasing methods. Consumers today expect quick service, better pricing, and personalized experiences, which traditional retail systems often fail to provide.

Moreover, the increasing competition in digital markets requires businesses to understand consumer preferences and behaviour in detail. Social media platforms influence purchasing decisions through advertisements, reviews, and recommendations, making them a critical factor in modern marketing strategies. Therefore, studying digital transformation helps businesses adapt to changing consumer expectations and develop effective strategies for growth.

Objectives of the Study

1. To understand digital transformation in consumer buying behaviour
2. To analyze factors influencing online purchasing decisions
3. To examine the role of e-commerce and social media
4. To identify advantages and challenges of digital buying
5. To suggest strategies for businesses

Hypothesis

- **H₀:** Digital transformation has no significant impact on consumer buying behaviour
- **H₁:** Digital transformation significantly influences consumer buying behaviour

Research Methodology

This study adopts a descriptive research design to analyze the impact of digital transformation on consumer buying behaviour. The research is based on secondary data collected from academic journals, books, industry reports, and reliable online sources. The descriptive approach helps in understanding existing trends and patterns without manipulating variables.

An analytical method is used to interpret data related to online shopping behaviour, digital marketing practices, and technological advancements. Comparative analysis is also applied to distinguish between traditional and digital consumer behaviour. The collected data is systematically organized and interpreted to draw meaningful conclusions regarding the influence of digital transformation on purchasing decisions.

Data Analysis

The analysis indicates that digital transformation has significantly influenced consumer buying behaviour in several ways. Firstly, there is a substantial increase in online shopping due to convenience and accessibility. Consumers can compare products, prices, and features easily, leading to better decision-making. Secondly, customer reviews and ratings have become crucial, as they build trust and reduce uncertainty.

Additionally, the rise of mobile commerce enables consumers to shop anytime and anywhere using smartphones. Artificial intelligence plays a key role by providing personalized recommendations based on browsing history and preferences. Social media platforms also influence consumer behaviour through targeted advertisements and influencer marketing. Overall, digital transformation has made consumers more informed, selective, and price-conscious.

Case Studies

Amazon

Amazon has revolutionized consumer buying behaviour through advanced digital technologies. Its AI-based recommendation system suggests products based on user preferences and browsing history. Features like customer reviews, fast delivery, and easy return policies enhance consumer trust and satisfaction. This has significantly increased online shopping adoption.

Flipkart

Flipkart has played a crucial role in India's digital transformation by introducing cash-on-delivery and attractive discount offers. Its user-friendly mobile application and festive sales have encouraged consumers, especially in semi-urban areas, to adopt online shopping.

Instagram

Instagram has transformed marketing strategies through influencer marketing and visual content. Consumers often make purchasing decisions based on influencer recommendations, leading to increased impulse buying.

Zomato

Zomato has changed consumer behaviour in the food industry by offering online ordering, reviews, and real-time tracking. Consumers now prefer convenience and digital interaction over traditional dining methods.

**Findings**

The study reveals that digital transformation has significantly influenced consumer buying behaviour by increasing convenience, accessibility, and information availability. Consumers prefer online shopping due to ease of use, variety, and competitive pricing. Social media platforms play a vital role in shaping purchasing decisions. Personalization enhances customer satisfaction and loyalty. However, challenges such as data privacy concerns and lack of digital literacy still exist.

Suggestions

Businesses should invest in digital technologies such as artificial intelligence and data analytics to understand consumer preferences and deliver personalized experiences. Improving website and mobile application usability is essential for enhancing customer satisfaction. Companies should effectively use social media platforms for marketing and engagement. Ensuring data security and privacy is critical to building consumer trust. Additionally, providing efficient delivery systems and easy return policies can further improve the overall customer experience.

Conclusion

Digital transformation has fundamentally changed consumer buying behaviour by making the process more convenient, transparent, and personalized. Consumers are now more informed and empowered, while businesses must continuously innovate to meet evolving expectations. The future of commerce lies in the effective use of digital technologies and customer-centric strategies.

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Original Article

Research Scholars' Insights on Publication Practices and Academic Footprints: A Comprehensive Survey

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Abstract

This study examines research scholars' awareness of publication practices and academic footprints at the University of Mysore. Survey results show gaps in knowledge about quality publications, indexed journals, and academic metrics like the H-index. Many respondents expressed a need for training to better navigate publication choices and enhance their academic reputation. The findings highlight the importance of improving awareness of legitimate journals and academic metrics.

Keywords: Academic Publishing, Journal Publications, Predatory Journals, Academic Footprints, Professional Development, Information and Communication Technology, Research scholars.

Introduction

Scholarly publication is a broad term encompassing the various processes through which scholars share and exchange knowledge during the creation of new ideas (Dulle, 2008). Over time, the system of scholarly publication has evolved significantly. The advent of Information and Communication Technologies (ICTs) has dramatically transformed research practices, improving communication among scientists, facilitating access to diverse information, and offering a wider range of platforms for publication and dissemination (Möller, 2006). Academic publishing is foundational for research scholars, serving both as a means to disseminate findings and as a critical factor in professional reputation, institutional advancement, and career success. Metrics such as publication count, citation numbers, and journal impact factors are widely used for assessing scholarly achievement, yet these are increasingly scrutinized for their limitations and susceptibility to manipulation, notably by practices such as excessive self-citation, "salami-slicing" studies, and controversial forms of authorship inflation (Fire & Guestrin, 2019). Publishing in peer-reviewed scientific journals is central to academic assessment and is considered the gold standard for communicating research findings. A crucial part of the publishing process is selecting a journal that aligns with the topic and scope of the research, is respected within the discipline, and is widely indexed and accessible to ensure effective dissemination. Over the past two decades, open-access journals have grown significantly in both number and scope, attracting authors who seek to provide immediate and unrestricted access to their work (Laakso et al., 2011; Gasparyan, Ayvazyan, & Kitars, 2013). Developing a significant academic footprint involves strategic choices about publication venues, maintaining ethical rigor in authorship and citation, and engaging with digital platforms to enhance visibility and influence. Modern research scholars must balance these pressures with responsible, transparent conduct to ensure the integrity and credibility of the academic record (Vignesh and Narayan). Hence, the present study has undertaken to examine the understanding of research community in universities' setup on publication practices and academic footprints in the research journey. The findings will provide valuable insights into scholars' understanding of research publication practices and academic metrics. Additionally, the study has implications for library professionals and university authorities, to initiate measures to enhance the awareness of these topics. The study sheds light on respondents' perspectives regarding research publications and academic footprints.

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Review Of Literature

Obuh and Bozimo (2012) found that LIS lecturers in Southern Nigeria had a positive attitude toward open access publications, highlighting the need for infrastructure and policies to support scholarly deposits. Christopher and Young (2015) revealed that few authors were aware of predatory journals, with some misunderstanding the concept. They suggested training to help authors distinguish between legitimate and illegitimate journals. Ye and Yu Li (2015) found that faculty were generally aware of open access journals and expressed interest in publishing in this mode. Shuva and Taisir (2016) identified the impact of predatory journals and the lack of awareness in choosing appropriate journals for research, stressing the role of libraries in educating the academic community.

Manchu and Vasudevan (2018) noted that most research scholars at the University of Calicut were aware of open access publishing and institutional repositories. Olubiyo, Fagbemi, and Ogunniyi (2020) found low awareness and use of journal publications among undergraduate students due to factors like poor internet access and outdated serial collections, urging initiatives to improve student knowledge. Maurer et al. (2021) highlighted the lack of awareness about predatory journals among orthopedic and trauma surgeons, recommending user orientation programs. Beshyah, Hajjaji, and Elbarsha (2022) found that most physicians lacked knowledge about predatory journals and struggled to differentiate them from legitimate open access journals. Elliott et al. (2022) found that many researchers acknowledged the serious issues caused by predatory journals, with some unknowingly publishing in such journals.

Overall, the literature reveals a widespread lack of awareness among academic and research communities about online and predatory journals, leading to involvement in illegitimate publications.

Significance Of the Study

In today's academic landscape, universities play a pivotal role in enhancing awareness about publication practices and academic footprints among researchers and academics. A lack of understanding regarding the importance of indexed and peer-reviewed journals often leads researchers to publish in predatory journals, which can harm their academic reputation. To address this issue, quality journals such as Scopus-indexed, Web of Science-indexed, and UGC-CARE-listed journals have been established based on rigorous standards. Publishing in these journals not only strengthens individual and institutional

reputations but also positively impacts rankings and accreditation processes, such as NAAC, NIRF, and TIMES rankings.

Additionally, metrics like the H-index, i10 index, and Journal Citation Reports (JCR) reflect research productivity and enhance global visibility for researchers and institutions. Therefore, raising awareness about quality journal publications and academic metrics is critical for fostering a robust research culture. This study aims to assess the awareness levels of the research community regarding publication practices and academic footprints within a university setting, with the University of Mysore serving as the focus of the investigation.

Objectives Of the Study

- To evaluate the contributions of research scholars in terms of the number of publications in national and international journals.
- To examine the level of awareness among research scholars regarding different types of journal publications.
- To determine the extent of research scholars' awareness of academic footprints.

Methodology

- Sample technique:** Cochran's formula was used to determine the appropriate sample size. The researcher employed simple random sampling to collect data from the respondents.
- $$n_0 = \frac{Z^2 pq}{e^2}$$
- Research Population:** The study population consists of regular science research scholars from six selected state universities in Karnataka.
- Data collection tool:** The researcher used the survey method and designed a well-structured questionnaire based on a Likert scale to collect primary data. The questionnaires were personally distributed to each respondent by the researcher.

Analysis And Interpretation of Data

The researcher has conducted a systematic analysis and interpretation of the collected data. To facilitate this process, the statistical software SPSS (Statistical Package for the Social Sciences) was utilized for basic calculations, including frequencies and percentages. The results of the analysis are presented in tabular form to enhance clarity and ease of interpretation.

Table 1: Gender-wise distribution of respondents

Sl. No	Name of the Universities	Male	Female	Total respondents
1	University of Mysore	58(51.3)	55 (48.6)	113 (16.3)
2	Karnatak University	97 (53.2)	85 (46.7)	182 (26.3)
3	Bangalore University	49 (39.8)	74 (60.1)	123 (17.8)
4	Mangalore University	62 (52.9)	55 (47.0)	117 (16.9)
5	Kuvempu University	56 (52.3)	51 (47.6)	107 (15.5)
6	Tumkur University	24 (50.0)	24 (50.0)	48 (6.9)
	Total	346(50.1)	344 (49.9)	690 (100)



The gender distribution of respondents across six state universities was nearly balanced, with 346 males (50.1%) and 344 females (49.9%) out of 690 participants. Karnatak University contributed the highest share (26.3%) with a slight male majority, while Bangalore University had a

female majority (60.1%), and Tumkur University reported an equal representation of both genders. The other universities reflected a slight predominance of male respondents.

Table 2: Number of research articles/papers published in National Journal Publications by the respondents

Name of the Universities	1-3 papers	4-5 papers	6-9 papers	10 and above	No Publications	Total
University of Mysore	22 (19.4)	2 (1.7)	1 (0.8)	4 (3.5)	84 (74.3)	113 (16.3)
Karnatak University	28 (15.3)	6 (3.2)	9 (4.9)	3 (1.6)	136 (74.7)	182 (26.3)
Bangalore University	15 (12.1)	3 (2.4)	3 (2.4)	00 (00)	102 (82.9)	123 (17.8)
Mangalore University	20 (17.0)	4 (3.4)	5 (4.2)	1 (.8)	87 (74.3)	117 (16.9)
Kuvempu University	20 (18.6)	1 (.9)	1 (.9)	3 (2.8)	82 (76.6)	107 (16.5)
Tumkur University	12 (25.0)	1 (2.0)	00 (00)	2 (4.1)	33 (68.7)	48 (6.9)
Total	117 (16.9)	17 (2.4)	19 (2.7)	13 (1.8)	524 (75.9)	690 (100)

The analysis of national journal publications among the 690 respondents highlights a generally low research output, with a majority (75.9%) having no publications. About 16.9% have published 1–3 papers, while only a small fraction have contributed 4 or more papers (7.0% combined). Tumkur University shows the highest share of early-stage

publishers (25.0% with 1–3 papers), whereas Bangalore University has the largest proportion without any publications (82.9%). Overall, these findings suggest limited engagement in national journal publishing among science research scholars across the selected universities.

Table 3: Number of articles published in International Journal Publications by the respondents

Name of the Universities	1-3 publications	4-5 publications	6-9 publications	10 and above	No Publications	Total
University of Mysore	22 (19.4)	6 (5.3)	4 (3.5)	2 (1.7)	79 (69.9)	113 (16.3)
Karnatak University	44 (24.1)	14 (7.6)	3 (1.6)	10 (5.4)	111 (60.9)	182 (26.3)
Bangalore University	20 (16.2)	3 (2.4)	00 (00)	2 (1.6)	98 (79.6)	123 (17.8)
Mangalore University	20 (17.0)	2 (1.7)	9 (7.6)	3 (2.5)	83 (70.9)	117 (16.9)
Kuvempu University	25 (23.3)	4 (3.7)	1 (.9)	3 (2.8)	74 (69.1)	107 (16.5)
Tumkur University	8 (16.6)	00 (00)	00 (00)	2 (4.1)	38 (79.1)	48 (6.9)
Total	139 (19.8)	29 (4.1)	18 (2.5)	22 (3.1)	482 (68.8)	690 (100)

Among the 690 respondents, 482 (68.8%) have no international publications, reflecting limited global research output. Only 19.8% have published 1–3 articles, while smaller proportions contributed 4–5 (4.1%), 6–9 (2.5%), and 10 or more (3.1%) papers. Karnatak University records the

highest share of published respondents, particularly with 1–3 (24.1%) and 10 or more (5.4%) articles, whereas Bangalore University has the highest proportion without publications (79.6%). Overall, the findings indicate low participation in international journal publishing among the scholars.



Table 4: Preferred Information sources by the respondents for their research

Information sources	UOM (N-113)	KUD (N-182)	BU (N-123)	MU (N-117)	KUVEMPU (N-107)	TU (N-48)	Total
Textbooks	48 (42.4)	78 (42.8)	73 (59.3)	35 (29.9)	42 (39.2)	24 (50.0)	300 (43.4)
Reference sources	48 (42.4)	135 (74.1)	77 (62.6)	59 (50.4)	38 (35.5)	27 (56.2)	384 (55.6)
Journals/ Periodicals	104 (92.0)	166 (63.7)	119 (96.7)	110 (94.0)	94 (87.8)	42 (87.5)	635 (92.0)
Thesis/ Dissertations	95 (84.0)	128 (70.3)	87 (70.7)	83 (70.9)	65 (60.7)	31 (64.5)	489 (70.8)
Reports	55 (48.6)	76 (41.7)	56 (45.5)	41 (35.0)	37 (34.5)	18 (37.5)	283 (41.0)
Conference/ Seminar Proceedings	78 (69.0)	103 (56.5)	71 (57.7)	65 (55.5)	58 (54.2)	25 (52.0)	400 (57.9)
E-resources	84 (74.3)	136 (74.7)	96 (78.0)	84 (71.7)	79 (73.8)	35 (72.9)	516 (74.7)
Others (News papers, Short notes etc.)	02 (1.7)	04 (.2)	01 (.08)	03 (0.2)	02 (1.8)	-	13 (1.8)

The findings show that research scholars predominantly rely on formal academic sources, with journals and periodicals being the most preferred (92%), followed by e-resources (74.7%) and theses/dissertations (70.8%). Conference/seminar proceedings (57.9%) and reference sources (55.6%) are moderately used, while textbooks

(43.4%) and reports (41%) are less common. Only a small fraction (1.8%) depends on newspapers or short notes. Overall, the data highlights scholars' strong preference for credible academic materials, particularly journals and electronic resources, in their research activities

Table 5: Level of Awareness about various kinds of Journals among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	59(52.2)	16(14.1)	8(7.0)	20(17.6)	10(8.8)
KUD	83(45.6)	16(8.7)	23(12.6)	53(29.1)	7(3.8)
BU	43(34.9)	15(12.1)	15(12.1)	34(30.2)	16(13.1)
MU	38(32.4)	26(18.8)	10(8.5.4)	34(29.0)	9(7.6)
KUVEMPU	51(47.6)	7(6.5)	10(9.3)	36(33.6)	3(2.8)
TU	14(29.1)	7(14.5)	7(14.5)	20(41.6)	-
TOTAL	288 (41.7)	87(12.6)	73(10.5)	197(28.1)	45(6.4)

The data indicates that most respondents have moderate to high awareness of different types of journals, with 41.7% being extremely aware and 12.6% moderately aware. However, 28.1% are only slightly aware, 10.5% somewhat aware, and 6.4% not at all aware. University-wise, the highest extreme awareness is reported in the University of

Mysore (52.2%), followed by Kuvempu (47.6%) and Karnatak (45.6%), while Tumkur University records the lowest (29.1%) alongside the highest proportion of slightly aware scholars (41.6%). Overall, the findings reflect a generally good level of awareness, though a considerable segment still shows limited understanding.

Table 6: Level of Awareness about Indexed Journals among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	38(33.6)	11(9.7)	13(11.5)	43(38.0)	8(7.0)
KUD	64(35.1)	16(8.7)	21(11.5)	73(40.1)	8(4.3)
BU	47(38.2)	12(9.7)	15(12.2)	37(30.0)	12(9.7)
MU	36(30.7)	27(23.0)	14(11.9)	36(30.7)	4(3.4)
KUVEMPU	52(48.5)	11(10.2)	11(10.2)	29(27.1)	4(3.7)
TU	13(27.0)	9(18.7)	3(6.2)	23(47.9)	-
TOTAL	250(36.2)	86(12.4)	77(11.1)	241(34.9)	36(5.1)



Among the 690 respondents, 36.2% are extremely aware of indexed journals, 12.4% moderately aware, and 11.1% somewhat aware, while a larger share—34.9%—are only slightly aware, and 5.1% not at all. University-wise, the highest extreme awareness is noted in Kuvempu University (48.5%), followed by Bangalore (38.2%) and Karnatak

(35.1%), whereas Tumkur records the lowest (27%) with nearly half (47.9%) only slightly aware. Overall, although over one-third of scholars demonstrate strong awareness, a significant portion still shows limited understanding, suggesting the need for greater orientation on indexed journals.

Table 7: Level of Awareness about Predatory Journals among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	23(20.3)	19(16.8)	14(12.3)	30(26.5)	27(23.8)
KUD	48(26.3)	25(13.7)	42(23.0)	42(23.0)	25(13.7)
BU	46(37.3)	12(9.7)	20(16.2)	34(27.6)	11(8.9)
MU	33(28.2)	39(33.3)	17(14.5)	20(17.0)	8(6.8)
KUVEMPU	32(29.9)	14(13.0)	9(8.4)	35(32.7)	17(15.8)
TU	11(22.9)	10(20.8)	9(18.7)	17(35.4)	01(2.0)
TOTAL	190(27.5)	119(17.2)	111(16.0)	178(25.7)	92(13.3)

The data reveals varied awareness of predatory journals among the 690 respondents, with only 27.5% being extremely aware and 17.2% moderately aware. Around 16% are somewhat aware, while a larger share, 25.7%, are only slightly aware, and 13.3% report no awareness at all. University-wise, Bangalore University shows the highest

extreme awareness (37.3%), while the University of Mysore records the lowest (20.3%). Tumkur University has the largest proportion of slightly aware respondents (35.4%). Overall, the findings highlight a considerable gap in understanding, underscoring the need for greater education on predatory journals.

Table 8: Level of Awareness about UGC-CARE list journals among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	56(49.5)	13(11.5)	10(8.8)	26(23.0)	8(7.0)
KUD	86(47.2)	11(6.0)	17(9.3)	62(34.0)	5(2.7)
BU	65(52.8)	12(9.7)	10(8.1)	29(23.5)	7(5.7)
MU	35(29.9)	25(21.3)	8(6.8)	43(36.7)	6(5.1)
KUVEMPU	61(57.0)	11(10.2)	3(2.8)	25(23.3)	7(6.5)
TU	18(37.5)	10(20.8)	2(4.1)	18(37.5)	-
TOTAL	327(47.3)	95(13.7)	52(7.5)	175(25.3)	41(5.9)

Among the 690 respondents, 47.3% are extremely aware of UGC-CARE list journals, while 13.7% are moderately aware and 7.5% somewhat aware. In contrast, 25.3% are only slightly aware, and 5.9% have no awareness. University-wise, Kuvempu University reports the highest extreme awareness (57%), followed by Bangalore (52.8%) and Mysore (49.5%). Mangalore University records the

lowest extreme awareness (29.9%) and the highest slight awareness (36.7%), while Tumkur shows a balanced pattern with 37.5% extremely aware and 37.5% slightly aware. Overall, the findings suggest a relatively good level of awareness of UGC-CARE journals, though certain universities exhibit gaps that require attention.

Table 9: Level of Awareness about H-Index among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	57(50.4)	15(13.2)	10(8.8)	25(22.1)	6(5.3)
KUD	86(47.2)	11(6.0)	17(7.6)	62(34.0)	6(3.2)
BU	41(33.3)	11(8.9)	15(12.1)	46(37.3)	10(8.1)
MU	38(32.4)	15(12.8)	25(21.3)	35(29.9)	4(3.4)
KUVEMPU	58(54.2)	4(3.7)	11(10.2)	31(28.9)	3(2.8)
TU	20(41.6)	6(12.5)	11(22.9)	10(20.8)	1(2.0)
TOTAL	300(43.4)	62(8.9)	89(12.8)	209(30.2)	30(4.3)



Among 690 respondents, 43.4% are extremely aware of the H-Index, 8.9% moderately aware, and 12.8% somewhat aware, while 30.2% are slightly aware and 4.3% not at all. Kuvempu University leads in extreme awareness (54.2%), followed by Mysore (50.4%) and Karnatak (47.2%), with

Bangalore and Mangalore showing lower levels (33.3% and 32.4%). Despite many scholars being well informed, a substantial portion still lacks knowledge, indicating a need for increased awareness efforts.

Table 10: Level of Awareness about I10-Index among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	36(31.8%)	13(11.5)	20(17.6)	28(24.7)	16(14.1)
KUD	71(39.0)	14(7.6)	23(12.6)	61(33.5)	13(7.1)
BU	34(27.6)	12(9.7)	18(14.6)	44(35.7)	15(12.1)
MU	23(19.6)	25(21.3)	16(13.6)	46(39.3)	7(5.9)
KUVEMPU	38(35.5)	6(5.6)	13(12.1)	39(36.4)	11(10.2)
TU	18(37.5)	3(6.2)	10(20.8)	12(25.0)	5(10.4)
TOTAL	220(31.8)	73(10.5)	100(14.4)	230(33.3)	67(9.7)

Among 690 respondents, 31.8% are extremely aware of the I10-Index, 10.5% moderately aware, and 14.4% somewhat aware, while 33.3% are slightly aware and 9.7% not at all. Karnatak University leads in extreme awareness (39%), followed by Tumkur (37.5%) and Kuvempu (35.5%), while

Mangalore has the lowest (19.6%) and highest slight awareness (39.3%). Overall, awareness of the I10-Index is relatively low, highlighting the need for targeted education. having limited or no knowledge, suggesting a need for targeted awareness programs.

Table 11: Level of Awareness about G-Index among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	27(23.8)	19(16.8)	13(11.5)	29(25.6)	25(22.1)
KUD	41(22.5)	21(11.5)	35(19.2)	61(33.5)	24(13.1)
BU	25(20.3)	15(12.1)	21(17.0)	43(34.9)	19(15.4)
MU	15(12.8)	30(25.6)	29(22.2)	29(24.7)	14(11.9)
KUVEMPU	26(24.2)	7(6.5)	21(19.6)	41(38.3)	12(11.2)
TU	10(20.8)	6(12.5)	11(22.9)	16(33.3)	5(10.4)
TOTAL	144(20.8)	98(14.2)	130(18.8)	219(31.7)	99(14.3)

Among 690 respondents, 20.8% are extremely aware of the G-Index, 14.2% moderately aware, and 18.8% somewhat aware, while 31.7% are slightly aware and 14.3% not at all aware. The University of Mysore and Kuvempu University report the highest extreme awareness (around 24%), while

Mangalore University has the lowest (12.8%). Most respondents, especially at Kuvempu (38.3%) and Karnatak (33.5%), are only slightly aware. Overall, G-Index awareness is low, indicating a need for more educational efforts.

Table 12: Level of Awareness about Journal Impact factor (JIF) among the respondents

Universities	Extremely aware	Moderately aware	Somewhat Aware	Slightly aware	Not at all aware
UOM	70(61.9)	12(10.6)	8 (7.07)	18 (15.9)	5 (4.4)
KUD	117(64.2)	8(4.3)	14(7.6)	39(21.4)	4(2.1)
BU	51(41.4)	8(6.5)	7(5.6)	45(36.5)	12(9.7)
MU	65(55.5)	12(10.2)	7(5.9)	28(23.9)	5(4.2)
KUVEMPU	68(63.5)	4(3.7)	8(7.4)	19(17.7)	8(7.4)
TU	19(39.5)	2(4.1)	15(31.2)	11(22.9)	1(2.0)
TOTAL	390(56.5)	46(6.6)	59(8.5)	160(23.1)	35(5.0)

Among 690 respondents, 56.5% are extremely aware of the Journal Impact Factor (JIF), with 6.6% moderately aware and 8.5% somewhat aware, while 23.1% are slightly aware and 5% not at all. Karnatak University leads in extreme awareness (64.2%), followed by Kuvempu (63.5%) and Mysore (61.9%), whereas Bangalore (41.4%) and Tumkur

(39.5%) have lower levels and higher slight awareness. Overall, JIF awareness is strong, though some universities could benefit from enhanced education efforts.

Discussion and Conclusion



Research is a systematic process aimed at solving specific problems through scientific investigation. In a university setting, academic and research communities engage in research by enrolling in Ph.D. programs and other research activities. These research efforts result in publications such as journal articles and conference papers. The results reveal that many respondents opined that reasons for publication delays are lack of research experiences, slow peer review process by journal editors and reviews, lack of writing skills etc. Additionally, insufficient infrastructure was identified as a barrier to publication. Therefore, university authorities should consider taking initiatives to address these challenges.

Half of the respondents were aware of peer-reviewed and UGC-CARE listed journals, while many were unaware of indexed and predatory journals. This highlights the need to improve research scholars' understanding of different journal types and their importance in publishing. Misconceptions and lack of knowledge often lead to the publication of research in predatory journals. To address this issue, the university and especially LIS professional should consider organizing awareness programs and workshops. The study found that most respondents are familiar with journal impact factors and the H-index not satisfactory, although emphasizing academic footprints can enhance researchers' visibility and foster collaboration within and across disciplines. The majority of respondents expressed a need for training on various journal types and academic footprints through preferred modes such as webinars and workshops.

Research articles are key intellectual contributions that enhance the reputation and ranking of both an individuals as well as Institutional setup at the various criterion such as NIRF, THE QS, and NAAC etc. High-quality research papers also elevate an author's academic reputation globally. In India, IRINS by INFLIBNET plays a vital role in recording intellectual property, promoting research outputs from Indian universities and institutions. It is also crucial for researchers to understand academic footprints, which highlight their contributions within the academic community. This study found that many respondents lacked publications in both national and international journals due to various factors. However, it is important for university authorities to focus on improving publication quality to boost institutional rankings during accreditation. Additionally, most respondents had a moderate understanding of journal types, indicating the need to improve knowledge of peer-reviewed and indexed journals. The majority also lacked awareness of academic footprints, which are essential for increasing the visibility of research. The role of LIS professionals is critical in enhancing the academic community's knowledge of academic footprints and other research support tools. In the present-day context, several challenges have emerged, including the implications of artificial intelligence, the need to enhance the quality of research and development, and the preparedness of future research scholars in Indian universities to address these issues effectively and efficiently.

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Original Article

A study of students, parents and Teacher's attitude towards sexuality education in secondary and higher secondary school in Chhatrapati Sambhaji Nagar

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Abstract

In Maharashtra and many Indian states, the negative consequences of sexual behaviour among Adolescents continue to be a subject of concern. In India more than 50% of children in the 5 to 12 age group are victims of sexual abuse. This abuse includes physical, sexual as well as mental abuse. India has one of the largest youth populations in the world and additionally. One of the highest rates of HIV. According to a survey by 'The Times of India, more than 50% of girls in rural India do not know what menstruation is or what it means. This research report argues that schools alone cannot provide sufficient guidance to change the sexual behaviour of Adolescent as schools, families and society all have a role to play. Cooperation between schools, youth, Adolescents, their parents, and society is extremely important to understand the perspective of sexuality education and to increase its positivity.

Keywords: - Attitude, Sexuality education, Teachers, Parents, and Students.

Introduction

secondary and higher secondary schools are entering adolescence. That circumstances today's adolescents face differs significantly from the world their parents experienced. At this age, adolescents encounter various stresses and strains. They learn to navigate challenges arising from emotions such as anger, mental stress, depression, frustration, and loneliness. During this period, physical and emotional changes are intense. Confusion often arises due to mental stress, internal conflicts and hormonal changes. Consequently, providing sexuality education is an appropriate from is considered necessary. The concept of providing sexuality education to students often causes surprise. Parents and Teachers work hard to ensure children receive a quality education and develop strong values. Every parent desire for their child to follow a positive path and succeed. Education today is inclusive. Indian society has traditionally recognized the joint role of family and school in the educational process. Together family, school and society guide stu In the current era, every individual has the right to understand their own body and well – being while students receive general information about health, specific details regarding the changes that occur during puberty are often omitted. The world has changed significantly in recent decades to capably face future challenges and navigate life effectively. It is essential that today's generation is well informed and prepared. It is necessary to provide proper education to students. The urgency of providing sexuality education is being that felt. Along with accepting this, the perspective of every student, parents and teachers towards sexuality education must be understood with this objective in mind, it has been decided to conduct research on this topic.

The Needs of sexuality education include:

- 1) Understanding the emotional aspects of interpersonal relationships.
- 2) providing information on maintaining and improving reproductive health.
- 3) Assisting in informed decision making.
- 4) Gaining knowledge about biology – gender identity, relationship and social values.
- 5) Preparing individuals for stable relationship and responsible parenthood.

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6) promoting healthy behaviours and accountability regarding reproductive health. 7) Reducing physical development. 8) preventing health complications and the spread to disease.

9) Increasing awareness regarding sexual harassment, teenage pregnancy, STIS, and personal safety.

Keywords Attitude, Sexuality education, Teachers, Parents, and Students.

Objective of the study

1. To study the attitude of students in secondary and higher secondary schools towards sexuality education.
2. To study the attitudes of parents of students in these schools towards sexuality education.
3. To study the attitudes of Teachers in these schools towards sexuality education.
4. To study the attitudes of boys in these schools towards sexuality education.
5. To study the attitudes of girls in these schools towards sexuality education
6. To study the attitudes of female parents of students in these schools towards sexuality education.
7. To study the attitudes towards sexuality education among male parents of students in secondary and higher secondary schools.
8. To study the attitudes towards sexuality education among female teachers in secondary and higher secondary schools.
9. To study the attitudes towards sexuality education among male teachers in secondary and higher secondary schools.
10. To conduct a comparative study of attitudes towards sexuality education among boys and girls in secondary and higher secondary schools.
11. To study the attitudes towards sexuality education among female and male parents in secondary and higher secondary schools.
12. To study the attitudes towards sexuality education among female and male teachers in secondary and higher secondary schools.
13. To conduct a comparative study of attitudes towards sexuality education in secondary and higher secondary schools in Chhatrapati Sambhaji nagar.

Hypothesis

1. Students at the secondary and higher secondary levels do not have proper knowledge about physical changes.
2. Students at the secondary and higher level lack awareness about sexuality education.
3. Parents and Teachers of students at the secondary and higher secondary levels avoid giving or receiving information related to sexuality education.
4. Society's attitudes towards sex is still not completely positive.
5. There is more awareness about sexuality education in higher secondary schools compared to secondary schools.

Methodology

Descriptive survey method of research was for the present study. This method was concerned with surveying,

describing and investigating the attitude and students, parents, teachers towards sexuality education into selected variables.

Population of the study

The present study includes all students, parents and Teachers at the secondary and

higher secondary levels in Chhatrapati Sambhaji nagar as its populations.

Sampling Method

In the present study, the sample has been selected using a sample random sampling Method.

Sample structure of the study

1. Total taluka in Chhatrapati Sambhaji nagar district - 09
2. Total students in Chhatrapati Sambhaji nagar district - 100
3. Total parents in Chhatrapati Sambhaji nagar district - 100
4. Total teachers in Chhatrapati Sambhaji nagar district - 100

Tools Used

To construct and standardize an "attitude scale towards sexuality education" for Students, parents and Teachers by **Dr. Usha Mishra**. For this, a representative sample was selected from secondary and higher secondary levels, including students, parents and teachers. Each scoring purpose a 5-point likert scale ranging from strongly agree 5) agree 4) indefinite 3) disagree 2) strongly disagree 1)

Necessary steps were taken for developing the scales. The collected data was analyzed using statistical methods, including mean and standard deviation. Both qualitative and quantitative methods have been used to study the attitude of secondary and higher secondary level students, parents and teachers towards sexuality education.

Results

1. The level of student's attitudes towards sexuality education at the secondary and higher secondary schools' level is moderate.
2. The level of parent's attitude towards sexuality education of students at the secondary and higher secondary level is high.
3. The level of Teachers attitudes towards sexuality education of students at the secondary and higher secondary level is high.
4. The level of boy's attitudes towards sexuality education at the secondary and higher secondary level is high.
5. The level of girls Attitudes towards sexuality education at the secondary and higher secondary level is moderate.
6. The level of female parents' attitudes towards sexuality education of students at the secondary and higher secondary level is low.
7. The level of male parents' attitudes towards sexuality education of students at the secondary and higher secondary level is moderate.



8. The level of female teachers' attitudes towards sexuality education of students at the secondary and higher secondary level is very high
9. The level of male teachers' attitudes towards sexuality education of students at the secondary and higher secondary level is very high.
10. A significant difference was found between boys and girls in their attitudes towards sexuality education at the secondary and higher secondary level.
11. A significant difference was found between male and female parents in their attitudes towards sexuality education of students at the secondary and higher secondary level.
12. A significant difference was found in the attitudes of female teachers and male teachers at the secondary and higher secondary school levels regarding gender education.
13. A significant difference was found in the attitudes towards gender education among schools at the secondary and higher secondary levels.

Recommendations

Recommendations for Students

1. Adolescents are encouraged to communicate openly rather than remaining isolated. Sharing thoughts and understanding one another fosters mutual respect and helps build a mature perspective toward others.
2. Clarity is important during the developmental stages of adolescence. Students should feel empowered to discuss their perspectives with peers or counsellors to ensure their behaviour and understanding remain appropriate.
3. Engaging socially and interacting within the community helps dispel misconceptions and creates a sense of belonging fostering a respectful view of others.
4. Discussing social misconceptions with family, parents and friends can help clear the mind and maintain a healthy understanding of development.
5. Students should strive to be confident, understand their own self – worth and maintain strong moral standards. Taking responsibility as a member of society and seeking accurate information contributes to a healthy and civilized perspective.

Recommendations of parents: -

1. Maintain a positive and equitable outlook on gender roles, ensuring that all family members are treated with equal respect.
2. Foster open communication at home, creating a safe environment where children feel comfortable discussing their physical and emotional development.
3. Start foundational conversations early and avoiding discriminatory comparisons.
4. Build a supportive and friendly relationship with children to help them navigate the mental and emotional changes associated and with growing up.
5. Observe and support each child's unique skills and personality, providing guidance that boosts their confidence and addresses any feeling of inferiority.

Recommendations of Teachers

1. Maintain in a professional yet approachable relationship with students monitoring their behaviour and social interactions.
2. Provide clear age-appropriate answers to questions about puberty and physical development, aligning information with scientific facts and social values.
3. Support students in maintaining emotional balance and foster an inclusive classroom environment where everyone is treated equally.
4. Use accurate, scientific terminology when teaching about human anatomy and health to ensure students receive reliable information.
5. Encourage healthy social interaction and collaboration between all students, regardless of gender.

Guidelines for Teachers

1. Maps should be provided to students from time to time while studying
2. Teachers occurring in students minds during puberty answers to students' questions should be social and supportive of balance.
3. Teachers should guide students on how to maintain emotional balance.
4. Teachers should treat every student equally. The knowledge they provide should be scientifically true and taught through a social perspective.
5. Teachers should tell students the scientific names of the organs in the human body. The information provided should be scientific in nature, do not give information based on guesses or hearsay.
6. When Teachers provide any information regarding sexuality, they should take care that boys and girls are treated equally.
7. To increase students mental emotional social and intellectual capacities, teachers should organize various programs like different competition debates and quiz contests, to develop students' abilities.

Recommendations for schools

1. A lecture or doctor should be called to the school to provide necessary information regarding sexuality education.
2. At the beginning of the academic year, a seminar regarding the perspective on sex should be organized in the school parents and Teachers should participate in it.
3. Every school should be provided with a guide for various activities to create proper awareness about sexuality education.
4. The teachers - student relationship should be handled properly. There should be proper adjustment with them.
5. Students should be encouraged through various activities in the school. Various programs should be conducted to show proper awareness regarding students' sexuality education.

Recommendations for the Government:

1. The Government should provide a counsellor or a trained teacher in schools for sexuality education. To ensure teachers do not feel hesitant while speaking on this subject special training sessions should be organized and implemented.



2. The Government should organize and implement awareness campaigns regarding sexuality education through various seminars and street plays at the taluka level in rural areas.
3. The Government should organize annual evaluations in schools to check whether the policies they have created regarding sexuality education are being implemented properly.

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Original Article

A Comparative Study of Human Development index (A case study of tumkur district)

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Abstract

This paper deals with the District Human Development Report (DHDR) which aims at estimating inter-taluk disparity in different dimensions of human development and identifying the developmental gaps to be addressed at the district level and also across different taluks in the district. Comparison of DHDR in tumkur district provides a sound base for designing and implementing district plans from the human development point of view and also for proper allocation of funds. In this regard, the Karnataka state also brought about the DHDRs for districts, the main objectives of these reports were to capture variations in the status of human development at the district level; enable the Government to take a holistic view of the State's development outside the normal governmental functioning and assess the strengths and weaknesses of existing departmental policies. In this regard an attempt is made to compare trends in human development index between different taluks of tumkur district.

Introduction

Till the 1979 the concept of economic growth and development of an any country was being measured with the increase in GNP, So that GNP was regarded as the main indicator or index of economic development, but the problems associated with using GNP as a measure of economic development has brought many studies to find a new measurement of development, at present these are served as indicators of economic growth or development. Such as 1) Real national income 2) Real percapita income 3) reduction in incidence of poverty 4) Physical Quality life of index 5) Human development index 6) Standard of living index. Each indicator is used to measure the economic growth and development of a nation.in which Human development index is very significant indicator of economic growth and development.

Human Development – Definition

According to Human development report – Human development refers to a process of enlarging people's choices and increasing the standard of living of the people. Whereas Human Development Index (HDI) is a composite index of three social indicators such as life expectancy, educational attainment and real per capita income or standard of living, in other words HDI is the average of three indicators such as life expectancy, educational attainment and real per capita income or standard of living, which is used to calculate HDI index Human Development is of the people, for the people and by the people. Nutrition health and education of the people in the form of human capital stand for the "of", "For" the people gives importance to transfer the benefits of growth to influence the people's lives, "By" the people to initiate a process that effects their lives. Human Development encompasses public and private, economic, political and spiritual matters of human wellbeing. This definition is wider without relation to only material deprivations or to aspects of well-being that can be publicly provided. According to UNDP^s (United Nation Development Programme) "Human Development is a development paradigm that is about much more than the rise or fall of National Income. It is about creating an environment in which people can develop to their full potential and lead productive, creative lives in accordance with their needs and interests' people are the real wealth of nations development is thus about expanding the choices people have to lead lives that they

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value. And it is thus much more than economic growth, which is only a means-if not a very important one – of enlarging people's choice.

Components of Human development index

Human development index is a composed of its various elements such as

1. Longevity / life expectancy index

By definition life expectancy index refers to the number of years that the people of a country would expect to live at the time of birth or in other words it means that the number of years a newly born baby is expected to live .

United Nations organization in 1997 has placed the life expectancy on a scale of 25 85 years in which 25 is minimum value and 85 is the maximum value. The life expectancy index can be computed with the help of given formula.

$$LEI = \frac{\text{Actual value} - \text{Minimum value}}{\text{Maximum value} - \text{Minimum value}}$$

2. Educational attainment index

It is another component of Human development index which measures the progress of human development. By definition educational attainment index refers to the number of people who have attained the education. This definition says that percentage of people who have attained the education in the nation. United Nations organization has fixed the minimum and maximum values for computing educational attainment index. According to UNO educational attainment index is placed on a scale of 0 to 100; in which 0 is minimum value and 100 is maximum value. Educational attainment index can be computed with the help of given formula.

$$\text{Actual value} - \text{Minimum value}$$

$$EAI = \frac{\text{Maximum value} - \text{Minimum value}}{\text{Maximum value} - \text{Minimum value}}$$

3. Real GDP Percapita Income / Standard of living index.

Standard of living or Real GDP Percapita Income index is measured in terms of purchasing power or capacity in terms of dollars. Therefore, standard of living index can be placed on a scale of \$ 100 to 40,000 \$ in which \$100 is minimum value and \$40,000 is the maximum value. . Real GDP Percapita income index can be computed with the help of given formula.

$$SOLI = \frac{\text{Actual value} - \text{Minimum value}}{\text{Maximum value} - \text{Minimum value}}$$

Therefore, Human development index can be calculated

$$HDI = \frac{LEI + EAI + SOLI}{3}$$

The HDI value is for each nation indicates how for a country has gone to attain certain defined goals that is an average life span of 85 years, access to education for all and decent standard of living.

Objectives

1. To study the status of human development in tumkur
2. To review the reasons for human development in the study area
3. To compare the human development trends in various taluks of the selected district.

Methodology

The study is based on secondary data. The data were collected from the United Nations human development Report of 2016, and Department of Economics and Social Affairs, 2019 and also National human development report 2011 Karnataka State human development report 2016, Tumkur District Human Development Report 2015.

Table 1
Human Development Index Trends of India and selected Countries
(1975 – 2011)

HDI Rank	Name of the Country	1975 HDI Values	1985 HDI Values	1995 HDI Values	2004 HDI Values	2007 HDI Values	2011 HDI Values
Very High HDI Countries							
1	Norway	0.868	0.898	0.936	0.968	0.971	0.943
4	USA	0.867	0.901	0.929	0.951	0.956	0.910
6	Canada	0.869	0.909	0.934	0.961	0.966	0.908
12	Japan	0.857	0.895	0.925	0.953	0.960	0.901
15	South Korea	0.707	0.780	0.855	0.921	0.937	0.897
28	UK	0.845	0.863	0.921	0.946	0.947	0.863
High Human Development Countries							
56	Saudi Arabia	0.603	0.673	0.741	0.812	0.829	0.770
57	Mexico	0.689	0.755	0.782	0.829	0.854	0.770



61	Malaysia	0.615	0.695	0.760	0.811	0.843	0.761
66	Russian Federation		0.	0.770	0.802	0.817	0.755
73	Venezuela	0.718	0.740	0.767	0.792	0.844	0.735
84	Brazil	0.645	0.698	0.747	0.800	0.812	0.716
88	Iran	0.556	0.610	0.694	0.759	0.782	0.707
Medium Human Development Countries							
97	Sri Lanka	0.607	0.681	0.727	0.743	0.759	0.691
101	China	0.525	0.594	0.683	0.777	0.772	0.682
112	Philippines	0.654	0.693	0.736	0.771	0.751	0.644
113	Egypt	0.439	0.540	0.611	0.708	0.703	0.644
124	Indonesia	0.468	0.583	0.663	0.728	0.734	0.617
128	Vietnam		0.581	0.660	0.733	0.725	0.593
134	India	0.412	0.476	0.546	0.619	0.612	0.547
145	Pakistan	0.363	0.419	0.492	0.551	0.572	0.504
146	Bangladesh	0.345	0.389	0.452	0.547	0.543	0.500
Low Human Development Countries							
156	Nigeria	0.318	0.386	0.418	0.470	0.511	0.459
186	Niger	0.236	0.242	0.256	0.374	0.340	0.295

Source: Compiled and computed from UNDP, Human Development Report 2011 and earlier issues.

As per the above table India is among the medium Human Development Countries. Its HDI has increased from 0.412 in 1975 to 0.619 in 2004 and then decreased to 0.612 in 2007 and to 0.547 in 2011. India's rank has been 134 among 186 countries of the world. It is just above Pakistan and Bangladesh but below Sri Lanka and China

All the countries as observed in the above table have been making efforts to improve their HDI's. Norway has been at the top with Niger at the bottom although. National Human Development Report 2001 was prepared by the Planning Commission for the years of 1981, 1991 and 2001. The same dimensions of UNDP were used by the NHDR with modification scaling norms are calculation of HDI.

consumption expenditure per capita per month – minimum Rs. 65/- maximum is Rs.325/-. Literacy for 7+ years minimum 0 and maximum 100. Intensity of formal of education minimum is 0 and maximum is 100. Life expectancy at age 1 minimum 50 maximum 80. Infant Mortality Rate – minimum 20 per 1000 and maximum – 100 Weights have been assigned to the indicators. Life expectancy is given 65 percent and infant mortality 35, literacy 65 and intensity of formal education 35 percent. However, the three indicators of longevity, educational attainment and economic development are given equal weights in the final

Table -2, Details of HDI in Tumkur District

Si No	Taluk	Living Standard		Health		Education		HDI	Rank with in District.
		Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	C N Halli	0.188	10	0.326	9	0.490	3	0.310	9
2	Gubbi	0.289	6	0.432	8	0.477	4	0.390	5
3	Korategere	0.242	8	0.473	5	0.341	8	0.339	7
4	Kunigal	0.456	3	0.946	1	0.419	6	0.565	2
5	Madhugiri	0.256	7	0.212	10	0.189	10	0.217	10
6	Pavagada	0.202	9	0.701	3	0.396	7	0.382	6



7	Sira	0.328	5	0.457	6	0.511	2	0.425	4
8	Tiptur	0.609	2	0.503	4	0.463	5	0.522	3
9	Tumkuru	0.986	1	0.752	2	1.00	1	0.905	1
10	Turuvekere	0.351	4	0.437	7	0.214	9	0.320	8

Sources: Human development report of Karnataka-2015

The table no 2 reveals that the variations in the human development index in the tumkur district b/w various taluks as table depicts Tumakuru (Rank -1) gets first place in the HDI value whereas Madugiri (Rank -10) placed last place in the district. Kunigal (2) and Tipture (3) falls in the almost high human development taluks whereas Sira-4, Gubbi-5, and Pavagada-6, falls in to the list of medium human developed taluks and at last the taluks like C H Halli-9, Turevekere-8, and Koretagere-7, falls in to the list of low humans developed taluks in the tumkur district.

Conclusion

The Concept of Human Development Index (HDI) is an outcome of efforts at the international level to include the social development parameters to measure the development. This has been through a composite index that incorporates various dimensions of quality of life which involves the life expectancy at birth, adult literacy rate, combined school enrolment rate and income adjusted for purchasing power parity. The emphasis on improving quality of life parameters have been clearly brought out in various Human Development Reports brought out by UNDP since 1990s across the countries. The Human Development Reports brought out in the country has captured these dimensions across the states in the country. Karnataka is one of the pioneering States that has brought out the District Human Development Reports for all the 30 districts using the dimensions of standard of living, health and education. A set of 11 indicators have been used to measure the performance of these dimensions and taluks have been ranked based on the performance under Human Development Index, which is stated in the table tumkur stands 1place and Maiduguri stands 10 place in the district.

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Original Article

The Knowledge Ecosystem: Libraries At the Heart of Education and Society

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Abstract

Libraries have emerged as central pillars of the modern knowledge ecosystem, playing a transformative role in education, research, and societal development. In India, the shift from traditional libraries to hybrid and digital platforms has significantly expanded access to information and learning opportunities. This study examines the multidimensional functions of libraries in enhancing academic performance, supporting research productivity, and fostering social inclusion. Based on a descriptive analysis of secondary data and existing literature, the paper highlights how libraries contribute to critical thinking, digital literacy, and lifelong learning while also serving as community knowledge centers. The study further identifies key challenges such as inadequate funding, infrastructural limitations, and the digital divide that restrict the effective functioning of libraries. Despite these constraints, emerging trends like digital repositories, open access resources, and technology integration are reshaping library services. The findings suggest that strengthening libraries through strategic investment, professional development, and policy support is essential to position them at the core of a sustainable, inclusive, and knowledge-driven society.

Keywords

Knowledge Ecosystem, Libraries, Education, Research Support, Digital Libraries, Social Inclusion, Digital Literacy, Lifelong Learning, Information Access.

Introduction

Libraries have historically been regarded as the foundation of education, serving as vital centers for the collection, organization, and dissemination of knowledge. In the Indian context, libraries have played a crucial role in supporting both formal and informal education by providing access to books, journals, and reference materials. With the rapid advancement of information and communication technologies, the traditional concept of libraries has undergone a significant transformation. Modern libraries are no longer confined to physical spaces; instead, they have evolved into hybrid and digital platforms that offer seamless access to information resources anytime and anywhere. This shift has enhanced their ability to support students, educators, and researchers in an increasingly knowledge-driven world. In today's dynamic and information-rich society, libraries function as comprehensive knowledge ecosystems that connect people, information, and technology. They play a pivotal role in promoting research, innovation, and lifelong learning while also addressing issues of social inclusion and digital inequality. Libraries act as community hubs that empower individuals by providing equal access to information and developing essential skills such as critical thinking and digital literacy. In line with recent educational reforms and the growing emphasis on inclusive development, libraries are becoming more relevant than ever. Their evolving role highlights the need to strengthen and modernize library systems to ensure they remain at the heart of education and societal progress.

Review of Literature

The role of libraries in shaping the knowledge ecosystem has been widely explored by Indian scholars, particularly in the context of educational reforms, digital transformation, and societal development.

Singh, A. P., & Chaurasia, A. (2025) examined the evolving role of libraries under the framework of the National Education Policy (NEP) 2020.

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Their study emphasized that libraries are transforming into knowledge hubs that support inclusive education by providing access to both physical and digital resources. The authors highlighted that digital libraries, e-resources, and open access platforms have significantly improved accessibility for students from diverse socio-economic backgrounds. They further argued that libraries play a key role in promoting equity, lifelong learning, and digital literacy, which are core objectives of NEP 2020. However, the study also pointed out challenges such as inadequate infrastructure and the digital divide in rural areas.

Kattimani, P. S., & Jain, V. (2025) focused on the contribution of libraries to holistic education and knowledge democratization in India. Their research emphasized that libraries are no longer passive repositories but active learning environments that foster creativity, collaboration, and innovation. The authors discussed how libraries support multidisciplinary education by providing diverse learning materials and facilitating experiential learning. They also stressed the importance of inclusive access, ensuring that marginalized communities benefit equally from library services. The study concluded that strengthening library systems is essential for achieving equitable and quality education.

Jayamma, K. V., Mahesh, G. T., & Kotur, M. (2023) investigated the role of libraries in higher education institutions, particularly in enhancing critical thinking and research skills. Their findings revealed that students who actively use library resources demonstrate better analytical abilities and academic performance. The study also highlighted the role of libraries in supporting interdisciplinary research, as they provide access to a wide range of scholarly materials across different fields. Additionally, the authors emphasized that modern libraries, equipped with digital tools and databases, significantly contribute to research efficiency and academic excellence.

Dixit, C., et al. (2023) explored the transformation of traditional libraries into digital and collaborative learning spaces. The study highlighted that libraries are increasingly integrating technologies such as e-books, online databases, and virtual learning platforms to meet the demands of modern learners. The authors emphasized that this transformation supports lifelong learning, enabling individuals to access information beyond formal education. They also pointed out that libraries serve as collaborative spaces where students, researchers, and communities interact, share knowledge, and develop new ideas. However, the study noted that successful transformation requires investment in infrastructure and training.

Sinha, S. K., & Das, J. R. (2024) analyzed the importance of libraries in research and educational institutions. Their study found that libraries play a critical role in knowledge

dissemination and academic success by providing access to credible and up-to-date information. The authors highlighted that well-equipped libraries enhance research productivity by supporting literature reviews, data collection, and referencing. They also emphasized the role of libraries in maintaining institutional repositories, which preserve research outputs and contribute to knowledge sharing. The study concluded that libraries are indispensable for academic growth and innovation.

Vagdal, T. S., & Acharya, S. (2023) examined the role of academic libraries in fostering innovation, digital literacy, and accessibility. Their research highlighted that libraries are key drivers of technological adoption in education, helping users develop essential digital skills. The authors emphasized that access to digital resources and training programs enables students and researchers to stay updated with global knowledge trends. Furthermore, the study pointed out that libraries contribute to innovation ecosystems by supporting research, collaboration, and knowledge exchange. The authors concluded that modern libraries are vital for building a knowledge-based economy.

Need for the Study

With the rapid expansion of digital technologies and increasing demand for knowledge-based economies, it is essential to understand how libraries contribute to education, research, and society. Despite their importance, many libraries in India face challenges such as inadequate infrastructure and funding. This study aims to evaluate their evolving role and identify areas for improvement.

Relevance of the Study

This study is highly relevant in the present context of educational reforms and digital transformation. It provides insights into how libraries can be strengthened to support sustainable development, lifelong learning, and inclusive growth in society.

Objectives of the Study

1. To examine the role of libraries in education, research, and societal development.
2. To identify challenges faced by libraries and suggest strategies for improvement.

Research Methodology

The study adopts a descriptive research design based on secondary data collected from academic journals, books, policy reports, and online databases. The data has been analyzed qualitatively and presented in tabular form to highlight the role of libraries in education, research, and society. The methodology includes literature review, comparative analysis, and interpretation of existing research findings.



Data Analysis

Table 1: Role of Libraries in Education

Dimension	Key Functions	Impact on Students	Evidence/Observation
Access to Learning Resources	Books, journals, e-books, databases	Improves academic performance	Increased student success rates
Digital Learning Support	E-learning platforms, digital libraries	Enhances online learning	Growth in digital education
Skill Development	Information literacy, reading habits	Develops critical thinking	Supports NEP goals
Teacher Support	Curriculum materials, references	Improves teaching quality	Enhances classroom delivery
Inclusive Education	Resources for all socio-economic groups	Reduces inequality	Promotes equity in education

Table 2: Role of Libraries in Research

Dimension	Key Functions	Impact on Research	Evidence/Observation
Access to Databases	Journals, research papers	Enhances research quality	Increased publications
Research Assistance	Literature review support	Improves research efficiency	Academic success
Innovation Support	Knowledge sharing platforms	Encourages innovation	Interdisciplinary studies
Digital Archives	Institutional repositories	Preserves knowledge	Long-term accessibility
Collaboration	Networking with scholars	Promotes research partnerships	Global academic connections

Table 3: Role of Libraries in Society

Dimension	Key Functions	Social Impact	Evidence/Observation
Community Development	Public learning spaces	Enhances awareness	Community engagement
Digital Literacy	ICT training programs	Reduces digital divide	Rural development initiatives
Lifelong Learning	Open access resources	Promotes continuous education	Adult learning programs
Social Inclusion	Equal access to information	Empowers marginalized groups	Inclusive growth
Cultural Preservation	Archives, heritage materials	Protects cultural identity	Knowledge preservation

Table 4: Challenges Faced by Libraries

Challenge	Description	Impact
Lack of Funding	Insufficient financial support	Poor infrastructure
Digital Divide	Limited internet access	Unequal access to knowledge
Outdated Resources	Lack of modern materials	Reduced relevance
Skill Gap	Lack of trained staff	Inefficient services
Policy Issues	Weak implementation strategies	Slow development



Table 5: Emerging Trends in Libraries

Trend	Description	Impact
Digital Libraries	Online access to resources	Wider reach
AI Integration	Smart search systems	Efficient information retrieval
Open Access Movement	Free scholarly content	Increased accessibility
Community Libraries	Local knowledge centers	Social development
Hybrid Libraries	Physical + digital services	Flexible learning

Key Findings of the Study

1. Libraries improve academic performance by providing diverse learning resources.
2. Digital libraries enhance research productivity and accessibility.
3. Libraries promote social inclusion and lifelong learning.
4. Lack of funding and infrastructure limits library effectiveness.
5. Emerging technologies are transforming library services.
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Suggestions of the Study

1. Increase funding for modern library infrastructure and digital resources.
2. Bridge the digital divide through inclusive access initiatives.
3. Provide continuous training for librarians in digital skills.
4. Strengthen community-based library programs.
5. Adopt advanced technologies to improve library services.

Conclusion

Libraries are essential pillars of the knowledge ecosystem, contributing significantly to education, research, and societal development. In the digital age, their role has expanded beyond traditional boundaries, making them dynamic centers for learning and innovation. Strengthening libraries through technological advancement, policy support, and community engagement is crucial for building an inclusive and knowledge-driven society.

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Original Article

Women sustainable development through Gruhalakshmi scheme-A Sociological Analysis

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Abstract:

The scheme "Griha Lakshmi" by the Department of Women and Child Development, Government of Karnataka aims to empower women by providing financial assistance to female heads of households. The scheme offers a monthly financial aid of ₹2,000/- to eligible women, helping them manage household expenses and improve their quality of life. Eligible beneficiaries include women who are listed as the head of the family in the ration card, and the scheme is open to families holding Below Poverty Line (BPL) or Above Poverty Line (APL) ration cards. Grihalakshmi Scheme is a flagship social welfare program launched by the Government of Karnataka to provide financial empowerment to women. It offers direct financial assistance to the female head of the household. Another important feature of the scheme is its focus on financial inclusion. Beneficiaries are required to have a bank account linked with Aadhaar, which encourages women to become part of the formal banking system. This not only ensures efficient delivery of benefits but also promotes savings habits and financial literacy among women.

However, like any welfare program, the Grihalakshmi Scheme also faces certain challenges. Issues such as identification of genuine beneficiaries, exclusion errors, and administrative delays can affect its effectiveness. Despite these challenges, the scheme has been widely appreciated for its direct approach in addressing women's economic empowerment.

Key words: Development, financial empowerment, economic stability, household, transparency, exclusion, decision-making

Introduction

The Gruhalakshmi Scheme is a welfare initiative launched by the Government of Karnataka to promote women's empowerment and improve the economic stability of households. Introduced in 2023, the scheme primarily targets women who are recognized as the head of the family, providing them with direct financial assistance. The core objective is to strengthen the role of women in family decision-making and reduce financial dependency, especially among economically weaker sections of society. Under this scheme, eligible women heads of households receive a monthly financial benefit of ₹2,000 through Direct Benefit Transfer (DBT). This ensures transparency and minimizes leakages in the distribution process. The program mainly benefits women from Below Poverty Line (BPL) families, though certain Above Poverty Line (APL) households meeting specific criteria are also included. By placing financial resources directly in the hands of women, the scheme aims to enhance their autonomy and dignity. The Grihalakshmi Scheme is part of a broader effort by the state government to address issues such as poverty, gender inequality, and unemployment. It recognizes the crucial role women play in managing household expenses, child welfare, and overall family well-being. By providing regular financial support, the scheme helps families meet basic needs such as food, healthcare, and education, thereby improving their quality of life.

Objectives of the Study

Grihalakshmi Scheme provides ₹2,000 monthly to the female head of household,

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aimed at boosting economic empowerment, supporting households with rising inflation, reducing dependence on male earners, and improving the quality of life for BPL, APL, and Antyodaya families. It recognizes housewives and women workers as essential contributors.

- **Empowerment:** To increase the economic empowerment of women in the state.
- **Financial Assistance:** To provide consistent financial relief of ₹2,000 monthly to the female head of a household.
- **Reduced Poverty:** To lessen the burden of household expenses on poor and marginalized families, helping them combat inflation.
- **Financial Independence:** To reduce dependency on male earners, encouraging financial stability and reducing poverty in BPL households.
- **Enhanced Decision-Making:** To strengthen the role and decision-making power of women in household financial matters.
- **Social Dignity:** To recognize the efforts of housewives, landless women, and agricultural workers, providing them with enhanced dignity.

Eligibility requirements:

- **Aadhaar Card:** Of the beneficiary (woman) and sometimes the husband.
- **Bank Account Details:** A passbook for the bank account linked with Aadhar for DBT, or RTGS details.
- **Self-Declaration Form:** Confirming the applicant is the head of the household.
- **Residence Proof:** Documents confirming permanent residence in Karnataka.
- **Widow Certificate:** Death certificate of the husband, if applicable.
- **Optional:** Caste or Income certificates, if requested for specific categories

Data collection tools

The research paper used data collection tools are primary data and secondary data during Questionnaire, Interview Schedule, Observation Method, surveys, research studies, even though the government mainly collects data through application forms and portals, in academic or field studies you can use the foll Official Reports & Documents Karnataka Government reports, Women & Child Development Department data, Research Papers / Articles

- **Forms of Women's Empowerment:**
There are different ways to categorize women's empowerment, but here are five common types:
- **Economic Empowerment:** This refers to women's ability to participate in economic activities on an equal basis with men. It includes access to education, training, employment, and entrepreneurship opportunities, as well as fair wages, equal pay, and access to credit and financial services.
- **Social Empowerment:** This type of empowerment refers to women's ability to participate fully in social and cultural life, free from discrimination and violence. It includes access to education, healthcare, and legal

services, as well as the ability to exercise their rights and freedoms.

- **Political Empowerment:** This type of empowerment refers to women's ability to participate in political life and decision-making on an equal basis with men. It includes the ability to vote and run for office, as well as access to leadership positions and participation in policy-making processes.
- **Educational Empowerment:** This refers to women's ability to access education and develop skills and knowledge that enable them to make informed decisions, pursue their goals, and contribute to society. It includes access to quality education at all levels and opportunities for lifelong learning.
- **Health Empowerment:** This refers to women's ability to access healthcare and make decisions about their health and well-being. It includes access to information, services, and resources that promote reproductive health, maternal health, and overall well-being.
- **Factors That Encourage Women's Empowerment:**
- **Education:** Education is a crucial factor in empowering women as it provides them with the knowledge, skills, and tools they need to make informed decisions, participate in society, and achieve their goals.
- **Job Opportunities:** Access to employment and entrepreneurship opportunities can also empower women economically, giving them the ability to make decisions about their lives and contribute to their communities.
- **Participation in Politics, Defence, Sports, and Games:** Women's participation in various fields, including politics, defense, sports, and games, can break down gender stereotypes and empower women to take on leadership roles, and challenge gender-based discrimination.
- **Equal Opportunities in Society:** Ensuring equal opportunities for women in all aspects of society, including education, employment, and leadership positions, can promote gender equality and empower women to participate fully in society.
- **Exposure to Media:** Access to media and information can provide women with the tools they need to stay informed about important issues, advocate for their rights, and participate in decision-making processes.
- **Freedom of Expression:** Women's ability to express themselves freely and without fear of discrimination or retribution is essential for their empowerment and participation in society.
- **Freedom of Movement:** Women's freedom of movement, including the ability to travel, work, and participate in community activities, is important for their empowerment and participation in society.
- **Proper Nutrition and Sanitation:** Access to proper nutrition and sanitation is crucial for women's health and well-being, enabling them to participate fully in society and pursue their goals.



- **Decision-Making Power:** Empowering women to make decisions about their own lives, including decisions about their health, education, and career, is essential for their empowerment and participation in society.
- **Introduction to Self-Help Groups:** The introduction of self-help groups can provide women with a supportive network and resources to pursue their goals and challenge gender-based discrimination.
- **Changes in Women's Labour Patterns:** Changes in women's labor patterns, including the recognition and support of women's unpaid care work, can help to promote gender equality and empower women economically.

Importance of Women's Empowerment:

- **Gender Equality:** Women's empowerment is essential for achieving gender equality, which is a fundamental human right. Gender equality means that women and men have equal rights, opportunities, and resources, and can participate equally in all aspects of life.
- **Economic Growth:** Women's empowerment is also important for economic growth and development. When women have equal access to education, employment, and other opportunities, they are better able to contribute to the economy and society as a whole.
- **Social Justice:** Women's empowerment is also essential for achieving social justice. Women and girls are often subject to discrimination, violence, and other forms of oppression simply because of their gender. Empowering women helps to create a more just and equitable society for everyone.
- **Health and Well-being:** Women's empowerment is also important for promoting health and well-being. When women have access to education and healthcare, they can better take care of themselves and their families.
- **Sustainable Development:** Women's empowerment is critical for achieving sustainable development. When women are empowered, they are better able to contribute to efforts to address environmental challenges, reduce poverty, and promote social justice.

Findings of the study

1. Economic Empowerment

Women with access to financial resources show improved decision-making power.

Participation in self-help groups (SHGs) increases savings habits and financial independence.

Government schemes (like cash transfers or subsidies) improve household economic stability.

2. Educational Empowerment

Education significantly boosts awareness of rights, health, and employment opportunities.

Higher literacy levels are linked to delayed marriage and better family planning.

Educated women are more likely to participate in community and political activities.

3. Social Empowerment

Women are gradually gaining freedom in mobility and social participation.

Reduction in gender discrimination is observed in urban and semi-urban areas.

However, traditional norms still restrict women in rural areas.

4. Political Empowerment

Reservation policies have increased women's participation in local governance (Panchayats).

Women leaders often focus more on welfare issues like health, education, and sanitation.

Despite participation, decision-making is sometimes influenced by male family members.

5. Decision-Making Power

Empowered women contribute to household decisions such as children's education, healthcare, and spending.

Financial independence directly improves decision-making ability.

6. Health and Well-being

Empowerment leads to better access to healthcare services.

Awareness about nutrition, maternal health, and hygiene improves.

Reduction in maternal and infant mortality rates in empowered communities.

Impact of Government Schemes

Schemes (like Gruhalakshmi, SHGs, microfinance) increase women's confidence and status.

Regular income support improves dignity and reduces dependency.

Some challenges include lack of awareness and implementation gaps.

Challenges Identified

Gender inequality and patriarchal mindset still persist.

Limited employment opportunities in rural areas.

Lack of awareness about rights and schemes.

Domestic violence and social restrictions continue to affect empowerment.

Conclusion

Women empowerment refers to enabling women to have control over their lives, make choices and decisions, and have equal access to resources and opportunities. It involves creating an environment where women can participate in society and the economy on an equal footing with men, and where their voices are heard and their rights are protected. Women's empowerment can take many forms, including education, economic, political, and social. Ultimately, women's empowerment aims to create a world where women have the power and freedom to live their lives, without discrimination or limitations based on gender. The Gruhalakshmi Scheme is a significant welfare initiative aimed at empowering women, especially homemakers, by providing them with direct financial assistance. It not only improves the economic stability of households but also enhances the decision-making power and social status of women within the family. By ensuring a steady monthly income, the scheme helps families meet basic needs such as food, education, and healthcare.



Moreover, the scheme contributes to poverty reduction and promotes gender equality by recognizing the unpaid work of women. However, its long-term success depends on effective implementation, transparency, and proper identification of beneficiaries.

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Original Article

Secure and Scalable Educational Data Management Using Amazon S3 Bucket in Cloud Computing

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Abstract

The use of digital technology in education has increased a lot in recent years, leading to a large amount of data being generated by schools and colleges. Managing this data using traditional systems is difficult because they are expensive, not easily scalable, and sometimes hard to access. Cloud computing provides a better solution by offering flexible and cost-effective data storage and management.

This paper studies how cloud computing can improve educational data management, with a focus on Amazon Web Services S3 (Simple Storage Service). It explains how S3 helps store and manage large amounts of data easily and allows users to access data anytime and from anywhere. The study also highlights benefits such as better efficiency, improved data security, and easier sharing of information.

The study examines how Amazon S3 enables efficient storage, retrieval, and management of large-scale educational datasets through its object storage architecture. It highlights key benefits such as enhanced data accessibility across multiple platforms, improved operational efficiency through automation, and robust security features including encryption, access control, and data durability. Additionally, the paper evaluates the role of S3 in supporting data-driven decision-making within educational institutions by ensuring reliable and real-time access to academic and administrative data.

However, the research also addresses critical challenges associated with cloud adoption, including data privacy concerns, dependence on third-party service providers, potential latency issues, and the need for technical expertise in cloud infrastructure management. Through this case study, the paper provides a balanced analysis of both the advantages and limitations of implementing cloud-based storage solutions in the educational domain.

The findings suggest that adopting cloud computing technologies, particularly Amazon S3, can significantly enhance the efficiency, scalability, and modernization of educational data management systems. This transition not only supports institutional growth but also fosters a more agile and data-centric academic environment, enabling better learning outcomes and administrative effectiveness.

Keywords: Cloud Computing, Educational Data, Amazon S3, Data Storage, AWS

Introduction:

Cloud computing is a technology that allows people to store data and use software over the internet instead of using their own computer or local storage. It can save your files and run applications online without worrying about physical devices like hard drives or servers.

Earlier, schools and organizations had to buy and maintain their own computers and servers to store data. This was expensive and difficult to manage. With cloud computing, all these services are provided online by companies like Amazon Web Services, so users can access them whenever they need.

One of the biggest advantages of cloud computing is that it is flexible. You can use more storage or less storage depending on your needs. It is also cost-effective because you only pay for what you use. Another important benefit is accessibility. Students and teachers can access their data anytime and from anywhere using the internet.

Cloud computing also keeps data safe by using security methods like passwords, encryption, and backups. This helps protect important information from loss or misuse.

In short, cloud computing makes data storage and management easy, fast, and affordable, especially for educational institutions.

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There are three main types of cloud computing services:

1. Infrastructure as a Service (IaaS)

This service provides basic computing resources like virtual machines, storage, and networks.

Instead of buying physical hardware, users can rent these resources online.

Example: Storage services like Amazon S3 from Amazon Web Services.

2. Platform as a Service (PaaS)

This service provides a platform where developers can build, test, and deploy applications

without worrying about hardware or system setup.

Example: Platforms for app development like Google App Engine.

3. Software as a Service (SaaS)

This service provides software applications over the internet. Users can access these applications using a browser without installing anything.

Example: Google Docs, Gmail, Microsoft 365.

S3 Bucket:

An S3 bucket is a storage system used in cloud computing to store data online. It is a part of Amazon Web Services and is called Amazon S3 (Simple Storage Service). An S3 bucket is like a folder in the cloud where you can store files such as documents, images, videos, and backups. Each bucket can contain many files, which are called objects. Every object has data, a name, and some information about it (called metadata). Users can create multiple buckets and organize their data easily.

One of the main advantages of an S3 bucket is that it can store a very large amount of data without any problem. It is also highly reliable and secure, meaning your data is safe and protected. You can control who can access your data by setting permissions. Another important feature is easy access. You can upload, download, and manage your files from anywhere using the internet. This

makes it very useful for educational institutions where students and teachers need to access data anytime. S3 buckets also support features like data backup, version control, and encryption, which help in protecting and managing data efficiently. An Amazon S3 bucket is a simple, secure, and scalable way to store and manage data in the cloud.

Objectives of the Study:

1. To study the concept of cloud computing and its role in modern education systems.
2. To understand how Amazon S3 bucket is used for storing and managing educational data.
3. To analyze the benefits of using cloud storage, such as scalability, accessibility, and cost efficiency.
4. To evaluate how cloud computing improves data security and reliability in educational institutions.
5. To identify the challenges and risks associated with cloud-based data management, such as privacy and dependency on service providers.

Literature Review:

Several studies highlight the importance of cloud storage, particularly Amazon S3, in managing large-scale data. Research shows that S3 provides high scalability, durability, and cost-effective storage, making it suitable for data-intensive applications such as education systems. Early research by Palankar et al. (2008) analyzed S3's performance and demonstrated its feasibility for large-scale scientific and collaborative data environments, emphasizing cost efficiency

and availability.

Recent studies focus on security aspects. Research indicates that although S3 offers strong features like encryption and access control, misconfigurations and poor access policies can lead to data breaches and unauthorized access. Other literature also highlights privacy concerns in cloud storage, noting that storing data remotely introduces risks related to data confidentiality and compliance. Overall, the literature confirms that S3 is a powerful storage solution, but its effectiveness depends on proper configuration and security practices.

Real World Applications:

Amazon S3 is widely used in real-world educational and data-driven environments:

Educational Institutions

Universities store student records, lecture videos, assignments, and research data securely in S3.

E-learning Platforms

Platforms like online learning systems use S3 to store multimedia content such as recorded lectures and PDFs.

Big Data Analytics

S3 is used as a data lake, enabling institutions to analyze large datasets using AI and machine learning tools.

Backup and Disaster Recovery

Institutions use S3 for automatic backups, ensuring data recovery in case of system failure.

Research Collaboration

Large-scale scientific projects use S3 to share datasets across global teams efficiently.

Challenges and Limitations:

1. Security Misconfiguration

Incorrect bucket permissions can expose sensitive data to the public.

2. Data Privacy Concerns

Storing data on remote servers raises concerns about compliance and confidentiality.

3. Cost Management Issues

Although cost-effective, improper usage (e.g., storing unused data) can increase expenses.

4. Performance Variability

Network latency may affect performance in some cases.

5. Learning Curve

Beginners may find it difficult to configure IAM policies and security settings correctly.

Future Scope:

1. Integration with AI & Machine Learning

S3 will play a key role in analyzing educational data for personalized learning.

2. Improved Security Mechanisms

Advanced encryption and automated threat detection will reduce risks.

3. Smart Data Management

Automated lifecycle policies and intelligent tiering will optimize cost and storage.

4. Multi-Cloud and Hybrid Systems

Institutions may combine S3 with other cloud services for better flexibility.

5. Edge Computing Integration

Faster data access for remote and rural education systems.

Conclusion:

Amazon S3 provides a secure, scalable, and efficient solution for educational data management. It enables institutions to handle large volumes of data with high reliability and



flexibility. However, proper configuration and security practices are essential to avoid risks. With continuous advancements in cloud technology, S3 is expected to play a crucial role in the future of digital education systems.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

An Economic Impact of Goat Farming in Karnataka

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Abstract

Goat farming is a cornerstone of Karnataka's rural economy, helping millions of small-holder families earn a living. This study looks at how the sector actually performs across the state, using firsthand surveys of 92 goat farms and the 2019 Livestock Census. What we found is pretty encouraging. The average goat-facing farm pulls in a Benefit-Cost Ratio of 2.62, a Net Present Value of about Rupees 13.85 lakh over five years, and an Internal Rate of Return of 72.4 %. Almost all of the farmers we asked—97.83 %—reported that their goat farms are profitable. But the numbers don't tell the whole story. Credit remains a tough hurdle; only about a third of families (33.7 %) actually get institutional loans. Government schemes reach just under 9 % of the community, and farmers still struggle with uneven market prices and a lack of transparency. The paper ends by sketching a set of concrete policy changes that could unlock the sector's full potential and turn these promising results into broader prosperity.

Keywords: Goat farming, Karnataka, rural economy, economic impact, cost-benefit analysis, livestock, smallholder farmers

Introduction

Agriculture still pulls the strings for more than 60 % of the villages across India. Within that patchwork of farms, small ruminant husbandry especially goats add a crucial lifeline. Goats earn that nickname, "the poor man's cow," not because they're sentimental, but because a single animal can fetch milk, meat, milk, manure, and a quick money-bench when the rains refuse. They're cheap to set up and survive in a wide array of climates. According to the 20th Livestock Census of 2019, the state ranks 12th in the country, home to roughly 4.5 million goats. That's a little more than 3 % of the national total of about 149 million goats. Most of the herd snaps up in the semi-arid districts up north and in the centre, where farmers rely on rainfed agriculture, scarce irrigation, and limited grazing lands.

Review of Literature

Goat farming in India's semi-arid zones is a well-studied topic, largely because it matters to people who depend on it for a living. Researchers have long looked at how small ruminants affect household incomes, what makes the activity profitable, and what keeps farmers from expanding. Birthal and Rao (2002) showed that, for land-starved farmers in drylands, goats can make up 30–40 % of a household's earnings when crops fail. Their work argued that governments should treat goat rearing as a key tool for wiping out rural poverty. In Uttar Pradesh, Kumar and Singh (2010) compared the economics of goats versus crops. They concluded that even small goat holdings out-earn crops for marginal farmers. Yet the local credit market hurt that profit: informal lenders with steep rates cut net gains by 15–20 %. Hiremath and Naik (2016) studied Karnataka's goat systems. They found that a semi-intensive mix—stall feeding with a touch of grazing—was cheaper than pure grazing in districts where communal grazing lands were shrinking. They urged farmers to band together, buying feed in bulk and sharing market stalls to cut costs. The National Livestock Mission's 2017 policy brief put goats squarely on the government's radar.

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It estimated that goat farming accounts for roughly 4 % of rural jobs across India and brings in about Rs 14,453 crore annually. Yet the brief pointed out that state-level schemes to help goat growers still fell short.

The 2019 Livestock Census offers a wider perspective. India's goat numbers jumped from 135 million in 2012 to 149 million, a 10 % rise driven by more home-meal consumption, export opportunities, and the NLM's push. Karnataka alone hosts about 4.5 million goats, mainly in its high-land, dry districts.

When you look at all these pieces together, the picture is clear: goat farming can be a high-yield, economically sound way for rural Karnataka's smallholders to earn a living.

Objectives and Methodology

3.1 Objectives of the Study

The present study is guided by the following specific objectives:

1. To examine the socio-economic profile of goat farming households in rural Karnataka.
2. To analyse the cost structure and revenue generation in goat farming enterprises.
3. To assess the overall economic viability and profitability of goat farming through cost-benefit analysis.
4. To identify the key structural constraints limiting the economic potential of goat farming.
5. To recommend policy interventions for enhancing the economic impact of goat farming in Karnataka.

3.2 Research Methodology

The study adopts a mixed-methods approach combining primary survey data with secondary data from official census reports and government documents.

3.2.1 Primary Data

Primary data was collected through structured interview schedules administered to 92 goat farming households across 17 villages in a semi-arid district of Karnataka. The survey covered dimensions including farm demographics, herd size and composition, feeding and management systems, reproductive performance, health management, marketing practices, cost and revenue accounts, credit access, and government scheme coverage.

3.2.2 Secondary Data

Secondary data was sourced from the 20th Livestock Census (2019) published by the Department of Animal Husbandry and Dairying (DAHD), Government of India; National Livestock Mission Policy Documents; Karnataka Animal Husbandry Department reports; and peer-reviewed academic literature.

Data Analysis and Discussion

4.1 India's Goat Population: National Overview

India has one of the world's biggest goat herds. In its twentieth Livestock Census of 2019, the country counted 148.88 million goats. That's 27.8 % of all livestock—536.76 million in total—a record-high share. The jump is a 10.14 % rise over the 2012 count of 135.17 million, flipping the earlier downward trend.

4.2 Karnataka's Position in National Goat Population

Karnataka sits at 12th place nationwide with 4.5 million goats—about 3 % of all goats in India, according to the 20th Livestock Census. On the surface that rank feels modest, but the numbers hide something more important: in the state's semi-arid northern districts, goats are a vital source of income. There, they thrive alongside rain-fed crops, filling a niche that other animals can't. Because the goats are clustered in the plateau area, their presence dovetails neatly with the local farming cycle, especially in places that struggle with occasional droughts. In short, Karnataka's goat herd may be just one of many animal populations, but for those highland communities it's a key economic lifeline.

4.3 Socio-Economic Profile of Surveyed Farmers

We walked through 17 villages in a semi-arid corner of Karnataka, touching hands and pens at 92 goat-raising households. Most owners—about 70 %—were 31-60 years old, a solid core that's keeping the venture alive. Still, nearly one-quarter of the farms are run by youth (18-30 years), hinting that the next wave of goats will show up soon.

Men take the lead role; roughly 95 % of primary farmers are male, though women juggle the day-to-day herd duties with equal energy. On the education front, the picture is split: roughly four-fifths of the group are either illiterate or have only a primary school finish, while the other four-fifths hold at least a pre-university credential. The result? Goat farming looks less like a last-ditch option for the uneducated and more like a viable business for anyone willing the effort.

When you look at resources, over half the farmers are land-sparse—about 29 % have no land at all, and 27 % run only a patch of less than 2.5 acres. That scarcity makes goats the backbone of household income. Households are usually big, with 43 % having more than six members. Those family hands cut operational costs straightaway, turning each goat into a more profitable venture than many other crops in the region.

4.4 Farm System and Herd Structure

In the area you asked about, most people grow crops and keep goats at the same time. Roughly six-in-ten households mix the two activities. They toss leftover straw into the goats' hooves for extra food and use the manure as green fertilizer.

Far from the old practice of letting goats roam freely, the community is moving toward stall-feeding. About 39 % keep all their animals in full stalls, while 36 % use a



semi-intensive system that couples some grazing with stall feeding. Together, 75 % of farms have left the open fields, largely because common pastures are shrinking.

The stock is almost entirely local, desi breeds – about 77 % of the goats – chosen for their hardiness and disease resistance in arid climates. The trade-off is lower meat yield compared with improved varieties such as Osmanabadi or Sirohi, which brings commercial returns down a notch.

Table 1: Cost Structure of Goat Farming (Aggregate – 92 Farms)

Cost Category	Total Amount (₹)	% of Total Cost
Shed Construction (Fixed)	4,21,16,520	74.6%
Equipment (Fixed)	35,98,530	6.4%
Feed & Fodder (Variable)	75,93,800	13.4%
Labour (Variable)	53,93,000	9.5%
Health/Veterinary (Variable)	13,78,002	2.4%
Total Variable Costs (Annual)	1,43,64,802	25.4%
Total Fixed Costs	4,57,15,050	74.6%

Source: Primary Survey Data.

Feed and fodder take up more than half of a farm's yearly variable expenses—52.8 percent to be precise. That figure shows how crucial a steady supply of feed is to keep the operation profitable.

Labour comes next at 37.5 percent. The high share reflects the hands-on nature of stall-fed systems, where human effort is the main driver of day-to-day costs. Putting the numbers together, an average farm spends about Rupees

Table 2: Annual Revenue Structure (Aggregate – 92 Farms)

Revenue Source	Total Amount (₹)	% of Total Revenue
Sale of Animals	4,45,76,001	89.8%
Sale of Manure	46,94,300	9.5%
Sale of Milk	3,58,500	0.7%
Total Gross Revenue	4,96,28,801	100%

Source: Primary Survey Data.

The survey covered 92 farms, where a total of 4,926 goats were counted: 1,988 adult bucks, 1,525 does, 750 male kids and 663 female kids.

4.5 Cost Structure Analysis

When you line up the figures from all 92 farms, the picture is simple: feed and labor gobble up most of the money.

Take a look at Table 1—it lays out the rest of the expenses in one quick snapshot

1.56 lakhs annually on variable costs. Fixed investment, on the other hand, hovers near Rupees 4.97 lakhs, indicating the significant capital outlay that signals a commercial, rather than subsistence, focus.

4.6 Revenue Generation

Table 2 presents the aggregate annual revenue generated across the 92 surveyed farms.



Across 92 farms, the total yearly revenue comes in at about Rupees 4.96 crore. Most of that—about 89.8 %—is earned from selling animals. Manure sales bring in a solid 9.5 %, proving that goats can nicely support crop work. Milk brings in only 0.7 %, which makes sense, since the area’s farms focus mainly on meat. On average, each farm pulls in roughly Rupees 5.40 lakhs a year. The survey also shows clear differences in the prices people are willing to pay. An adult buck fetches Rupees 21,250, a doe comes in at Rupees

12,690, six-month-old male kids sell for Rupees 11,272, while female kids go for Rupees 9,815. That higher price for adult males highlights why castration and targeted weight-gain plans are a smart business move.

4.7 Cost-Benefit Analysis

The economic viability of goat farming is assessed through standard investment appraisal indicators. Table 3 presents the key Cost-Benefit Analysis (CBA) results.

Table 3: Cost-Benefit Analysis Indicators

CBA Indicator	Computed Value	Benchmark	Verdict
Benefit-Cost Ratio (BCR)	2.62	≥ 1.0	Excellent
Net Present Value (NPV, 5-yr)	₹13.85 Lakh	> 0	Excellent
Internal Rate of Return (IRR)	72.4%	$\geq 12\%$	Outstanding
Payback Period	1.37 years	≤ 5 years	Outstanding
Break-Even Margin of Safety	86.9%	$\geq 20\%$	Exceptional
Net Profit Margin	61.8%	$\geq 20\%$	Superior
BCR (Pessimistic Scenario)	1.71	≥ 1.0	Resilient

Source: Primary Survey Data and CBA computation.

All six core CBA metrics line up in the “high-nine” zone.

4.8 Marketing and Pricing Constraints

There’s a clear gap in how livestock is priced. About 90 percent of farmers still guess the value of their animals just by looking at them, while fewer than 10 percent rely on a weight-based method (Rupees /kg live weight). Those who use the scale are the ones who get the honest, data-driven price—experienced traders and middlemen usually have the edge, and the farmers end up on the other side of that advantage. A quick fix is to set up simple weighing stations in local markets—haats and shandies—and to feed farmers real-time price feeds.

4.9 Credit Access and Government Scheme Coverage

Survey data point to two glaring gaps. First, roughly two-thirds of goat farmers—just 66.3 %—have never taken out a formal bank loan. They end up self-financing or turning to informal lenders who bust out high interest. Why does that happen? Collateral is hard to come by, the paperwork feels like a labyrinth, many farmers don’t know that livestock-related credit exists, and basic banking knowledge is scant.

Second, a staggering 91.3 % report receiving nothing from any government livestock programme. That’s true even though several central initiatives—like the National Livestock Mission and the Integrated Development of Small Ruminants—plus Karnataka’s Jeevandhari and Matsya Bhagya schemes, are already rolled out. The almost complete lack of penetration signals a major policy-implementation failure with real economic fallout for the rural poor.

Findings and Suggestions

5.1 Key Findings

The study yields the following principal findings:

1. In rural Karnataka, raising goats is a solid money-making venture. The business comes back at a BCR of 2.62, an IRR of 72.4 %, and nets about Rupees 13.85 lakh per farm. Capital pays off in just 1.37 years.
2. Across 92 farms, total sales hit Rupees 4.96 crore a year. Almost all of that—89.8 %—comes from selling animals. Manure sells for 9.5 %, and milk only makes



up 0.7 %. That works out to roughly Rupees 5.40 lakh per farm every year.

3. Roughly half of the operating costs—52.8 %—are spent on feed and fodder. Because of this, the price and availability of fodder loom large over a farm's profits.
4. Almost everyone says the business works: 97.83 % of farmers think goat rearing is profitable, and 84.78 % are satisfied overall. Those numbers rank among the highest in Karnataka's agricultural livelihood surveys.
5. More than half of the families—56 %—are landless or marginal farmers. For them, goat farming is often the only reliable way to earn a living.
6. A pricing problem is widespread. Over 90 % of farmers set price tags on animals by eye, putting them at a disadvantage when traders negotiate.
7. Credit is hard to get. About two-thirds (66.30 %) cannot access institutional loans, which limits their ability to invest and grow.
8. Help from the government is scarce. Roughly nine-tenths (91.30 %) of farmers have never touched a central or state livestock scheme.
9. Most stock is local or "desi" breeds—77.17 %. Artificial insemination is barely used (5.5 %), holding back potential gains in genetics and output.
10. Health risks are a constant concern. PPR hits 59.14 % and FMD 53.76 % of herds, but the 87.10 % vaccination rate gives a decent baseline for disease control.

5.2 Suggestions and Policy Recommendations

What the evidence points to is a handful of practical shifts that could give goat farming a genuine lift in Karnataka.

1. Light up the market with fair pricing.
2. Make the government handout easier to reach.
3. Open up credit to those still left out.
4. Pack a punch with modern breeding.
5. Vaccinate every goat twice a year.
6. Secure fodder for the hungry breed.
7. Pack up the farmers into cooperatives.
8. Bring women to the fore.

Conclusion

Goat farming is a lifeline for many rural households in Karnataka, especially in the semi-arid northern and central districts where other jobs are scarce and crop yields can be unpredictable.

Karnataka's goat industry is already on solid footing. With a focused policy push—making markets transparent, opening credit, ensuring benefits, and upping genetics—its impact can leap from good to game-changing within five years. The evidence says it's not a last-ditch option; it's a

smart, first-choice enterprise that deserves top-tier policy and investment.

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Original Article

Eco-Critical Passionate Piety for Nature's Eco-system and Sustainability in Johann Wolfgang von Goethe's Literary-Cultural Perspectives

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Abstract

The study in this research paper attempts to elaborate the literary nature of the literary laureate Goethe. The study will deal with the selected poems in order to understand poetic imagination, process and creation. It aims to discuss critical sensibility towards the ordinary experiences derived from life and nature. It will explore writer's power of balancing the joyfulness of spirit with Nature in the midst of mundane experiences of life. Goethe captures the music of feelings with a sense of self-revelation in one of the parts of the poem titled Wanders Nachtlied in this way: Über allen Gipfeln, Ist Ruh, In allen Wipfeln, Spürest du Kaum einen Hauch; Die Vögelein schweigen im Walde. Warte nur, balde Ruhest du auch. In another poem titled The Artist's Evening Song (Des Künstlers Abendlied), he quotes about the embodiment of Nature in human life. Similarly, Goethe's most acclaimed dramatic poem Faust produced in Germany in 1925 culminates his argument against radical rationalism; he extends this through emotion and art that he sees in Nature the true spiritual and moral foundations of humanity, thus this elevates Goethe on the romantic tradition too. His early writings in the form of poems reflect an unpremeditated art of creative unity, 'living quality' and humanistic ideals. His poetic art emanates feelings, originality, diffusion of differences between the subject and object, external and internal. We find that his creative abilities grow and evolve with spirit of inquiry, sensibility and intuition. He senses the organic totality in the existence of living experiences. Goethe's anonymously released Volume of the Collection of Poems entitled Annette in 1770 have almost 360 poems, which he wrote in his juvenile days, while pursuing his legal education. Johann Wolfgang von Goethe (1749-1832) was one of the representatives of the Sturm und Drang period (the early eighteenth-century phase of romanticism in Europe). In those days there was focus on the sense of fantasy and freedom i.e. Im Sturm und Drang Epoche, die Menschen glaubten dass die Individualität in der Einheit von Lieb, Seele und Geist entdeckten soll. Indeed, the young generation like Goethe who had been influenced by Sturm und Drang, also paved the way for the classical period of Modern German Literature, from the middle of the eighteenth century to Goethe's death in 1832 (which is also known as Goethezeit or Weimarer Klassik / Weimarer Klassizismus). It was in this phase Goethe had set the stamp of his personality by looking at dogmas with a critical sense and at primitive conditions with an awakened interest and independent expression. It was a transition phase for the pseudo-classic or un-classic Germanic stock to reduce their servile imitation from French classical models and to get back to the assertion of spontaneous expression with individuality and subjectivity to produce realistic creative writings. Rousseau a well-known philosopher of late eighteenth century influenced young generation across Europe because of his "bizarre and romantic notions of human life" who said "Zurück Zur Natur. Mann Wendte Sich Gegen die Autorität Und Tradition. Man Bevorzugte Trieb Statt der Tradition Und der Gesetze. Man Betonte Originalität Statt Nachahmung, Trieb Statt Tradition, Freiheit Statt der Gebundenen Gesellschaftliche Regeln".

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Introduction

Goethe as one of the early participant of the German Literary movement of 'Storm and Stress' believed that the 'World-in-itself' a 'natural genius' and this genie shapes human subjectivity towards the natural world wherein nature and the human self are in the lens to see the subjectivity in context of reality, yet that reality seems to impact the human self not in subjective perspectivity, rather its objectivity increases the desire to achieve it, the moment the overwhelming influence of desire overrides self-subjectivity, there then is the cause of solipsistic idealism which erroneously cater to the self-pride, self-conceit and self-determined opinions or beliefs.

He addresses further dangers for knowledge in the language of scientific theory in his essay, "The Experiment as Mediator of Object and Subject" (1792). A person is at the mercy of their inner enemies at the moment, when they want to interpret their experiences and in scientific practice move from perceptions to judgement. Goethe warns of the moment when, "as if at a pass, all their inner enemies lie in wait — imagination, impatience, hastiness, complacency, stiffness, thought-form, preconceived opinion, comfort, carelessness, changeability, and whatever the whole host with their retinue may be called."ⁱ For Goethe, possible sources of error lie above all in the researcher's own personality, their own character.

Goethe's conception of experimentation became manifested while articulating his color theory and show how his experimental philosophy gives clues to some of the key concerns – the exploratory character of the method, the search for interconnectedness of natural phenomena, and the intimacy of humans and nature throughout the experimentation.ⁱⁱ To illustrate it first it is important to bring in an infinite regress to delve into a series of entities led to certain context of knowledge. It can be vicious because viciousness involves a contradiction in the form of metaphysical impossibility. Parmenides of Elea of 540 B.C.E. a Pre-Socratic Greek philosopher and poet known as 'The Father of Metaphysics', who contradicted Aristotle who was known as 'The Father of Logic' in his scientific curiosity towards Nature and Its Meta-physicality claimed in his poem titled "Nature" that the structure of the cosmos is a fundamental binary principle that governs the manifestations of all particulars – that is 'The Way of Truth' or it is 'all in one' or it is unity in diversity that projects reality about the object of knowledge; the other path of inquiry is 'The Way of Opinion' – wherein the appearance of universe to mortals is the world of seeming and its development is an ever going illusory deception, in other words it suggests that cosmological speculations do not pretend to anything more than mere appearance.. Parmenides argues that true knowledge can only be attained through rational thought, dismissing sensory experience as unreliable and illusory.ⁱⁱⁱ

In terms of Kantian cognitive science the perceived knowledge a priori for an observer becomes a tool for transcendental input processing sensory faculties to attain further experience, arising rational thoughts and inquiry in the metaphysical realm of consciousness whether to

synthesis with the percepts or concepts of necessary conditions of experience or Immanuel Kant says viz-a-viz to this consciousness of self-specificity that "I have found it necessary to deny *knowledge*, ... in order to make room for *faith*." (Bxxx, his italics).^{iv}

Industrialization was the result of such connection and disconnection with the source knowledge or the origin of knowledge. Subsequently this viciousness of belief and disbelief constructs infallible natural world in reconciliation with the phenomenal reality, self-evolution happens in this fallible sin construct – as all knowledge is the offshoot of a certain fact and the certain fact or proposition though being self-identical, yet seemingly an occurrence from ignorance of knowledge. For example, understanding towards human existence in context of human predicament adjudicated with divine providence result from the contemplation that occurs through thought, memory, tradition, emotion, truth and imagination, and justification of the same always delegated or ordained to epistemological theology – that sustains when human knowledge of any particulars competes with opposites, and influence reliability of the sense and the nature of plurality. Goethe, in 1818, with reference to the philosopher Spinoza (1632-1677), also give this spirit-nature or nature-spirit the names 'God in nature' or 'nature in God'.^v

Faust is the protagonist of a classic German legend based on the historical Johann Georg Faust (c. 1480–1540). In Goethe's Faust the play denies the satisfaction of a fixed static 'Being' by

Goethe's method shows another distinctive feature: he is convinced that the corresponding organs of perception and cognition 'for' the phenomena must first be developed 'on' the phenomena. Thus he noted in Italy: "I must first train my eye to get used to seeing."^{vi} Goethe wrote to Schiller about the work on his *Theory of Colours* and confessed that he had "not brought along any organ to deal with the matter," but that he "always had to train it in and for the experience."^{vii} Once a new 'organ' of comprehension arises on and with the phenomena, the method can ultimately transform the whole person. The latter themselves becomes a new, as it were comprehensive organ of cognition.

Johann Wolfgang Goethe for whom yellow and blue are primary colors per se experimental and physiological approach – so the reality of appearance /seeming based on the cause of knowledge that has its foundation on certain truth of knowledge, but that same form of knowledge disconnects the theories of primaries, when it spurs a new interest in context of episteme ingress that states knowledge, that has its foundation on a certain fact or principle can lead to change, if focus shifts from truth to the formation of variety in a structure, and revelation in actual sense a manifestation of an opinion occurred from an existing truth and shapes its standards of different constructs.^{viii} –

The most referred example turning from self-reflection into self-inquiry – that is being dialectical in evolving thought process to resist or desist, to evade or accept, to agree to disagree comes from Goethe's writings – *The Sorrows of Young Werther* (1774), *Faust: A Tragedy* – Part I (1806) and Part – II (1831) refer to a certain gap between the



characters' subjectively mediated theories about the reality of the situation in which the characters exist and engage their perception about the nature of reality as 'from the critical position towards its subject matter' – which according to Mc Grann in his book *Ideology 2* an antagonistic preview of Goethe's tenuous relationship shown in the novel 'The Sorrows of Young Werther' – an epistolary novel about a love-sick young man who takes his own life, conditions a contradictory predicament with the 'Self and the Other'^{ix} – which is an inescapable reflection of appreciating nature as a collection of discrete, concrete objects – and which has its interpretation and demanding connotation based on contemporary cultural and conceptual engagements with the material and immaterial versions or tendencies or attitudes^x.

In the novel the author in the voice of Werther explains the paradoxical nature of human mind which though endure the extent of sufferings inflicted morally or physically, yet turns up appear coward when takes his own life or appear coward when dies of a malignant fever" (*The Sorrows of Werther*, 54). While the paradoxical nature of the divinely considered 'Nature' also generates questions about the implausibility of existing level of causes – that based on belief, truth, and imagination. The protagonist Werther in conversation with his companion Albert in journey says:

"A mortal illness one in which nature is so undermined, partly consuming her powers, partly so disabling humans as mortals that she cannot restore them, there is no happy revolution capable of restoring the normal course of life."

There is another side of human existential needs when "a person in his fitness, how impressions work on him, ideas take root in him, until finally a growing passion robs him of all his rational powers of thought and destroys him. In vain a calm rational person observes the miserable man's condition..... as a healthy person at a sick man's bedside cannot impart any strength to him" (*Ibid.*, 54).^{xi}

Goethe's literary scholarship in magnifying the essence of nature lies in seeking aesthetic dualism or we may say oppositional aesthetics enabling his own authorship from the lens of characterization – Goethe's investigation of nature, the study of nature and the study of the spirit are so intertwined that we might say they form two sides of the same coin. It is broadly a representation of 'exploring nature also means exploring his own spirit.'^{xii}

Goethe in his essay on 'Nature: A Fragment' speaks that despite being in the habitat of nature, we get lost, we try to retrieve our lost sense of belonging to nature, which actually does not speak, yet visibly and invisibly keeps our living sustainability in consistency with its inexhaustible source of energy and we in the self-praise attribute credits of self-building through our pride of power, yet the great artist Nature, the mother of all beings alongside whom man, her son, from now on stands, also making himself the author of 'Everything':- "Even the most unnatural thing is Nature... He who does not see it everywhere does not see it correctly anywhere... We obey its laws even when we go against them; we work *with* it even when we want to work *against* it"^{xiii} (*Die Natur*, 28-31).

The writer Alan N. Shapiro of a blog titled Hyper-modernism, Hyper-reality and Posthumanism translates

Johann Wolfgang Goethe's German version of the essay and writes:

"Nature! We are surrounded by and entangled in it, incapable of escaping from it, and incapable of penetrating deeper inside it. Without being asked and without warning, it draws us into the vortex of its dance and sweeps us away, until we are exhausted and drop from its arms. It creates eternally new forms; that which exists never was before; that which was never comes again – everything is new, and yet forever old. We live in its midst, yet are strangers to it. It speaks with us ceaselessly, yet does not betray to us its secret. We act on it continuously, yet have no sway over it. It seems to have staked everything on individuality, yet does not know what to do with individuals. It always builds and always destroys; its forge is inaccessible. It lives through its children; but where is the mother? It is the only real artist: out of the simplest material, the greatest contrasts; without a hint of effort, the greatest perfection; the most precise determination, yet always topped with something soft. Each of its works has its own essence, each of its appearances the most singular characterization, yet it makes out of everything a unity."^{xiv}

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Original Article

A Study on Parental Attitude Towards Female Child Education in Rajendra Nagar Slum Area Kolhapur

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Abstract

A definite aim of education is to endow a student with the necessary skill and capacity to be a responsible member of society. Education is essential for an individual to earn his or her livelihood. Therefore, formal together with non-formal education is useful to the student and from deprived sections at large. There are different schemes for the children given by the government, many urban slum areas in India still face challenges in ensuring access and quality education, especially for the girl child. Female education plays a crucial role in empowering families and improving the socio-economic condition of communities. However, in areas like Rajendra Nagar slum of Kolhapur city, educating girls continues to face obstacles due to poverty, cultural beliefs, and lack of awareness among parents. The involvement and attitude of parents toward their daughter's education is a key factor that affects school attendance, learning outcomes, and overall development. The present study is descriptive in nature and has been conducted with the objective to understand the socio-economic background of families, parental attitude towards female child education, and future planning of the parents regarding their girl child education. The research focuses on the Rajendra Nagar slum area of Kolhapur city. Census survey method has been used for the collection of primary data, and information has been collected from 23 parents of female students studying in the Sarvapalli school in Rajendra Nagar through a structured interview schedule. Informal discussions with teachers and community members were also conducted to gain deeper insights into the issues faced. The study argues that in Rajendra Nagar slum, parents still show limited concern regarding the education of their daughters. Many parents are unaware of the benefits of female education and the available government schemes. Their participation in school activities and management committees is also found to be low. The research highlights the need for awareness programs and community participation to improve female education in slum areas.

Key word – Female Child Education, Slum Area, Parental attitude

Introduction

Parental attitudes towards female child education

Parental attitudes towards female child education in slum areas are shaped by a combination of socio-economic, cultural, and educational factors. Economic hardships often lead families to prioritize immediate financial needs over schooling, with a perception that investing in a girl's education offers limited returns, especially when early marriage or household responsibilities are expected. Deep-rooted cultural and traditional beliefs further reinforce this mindset, as many communities view a girl's primary role as domestic, undervaluing formal education. Additionally, a lack of awareness about government schemes such as scholarships, mid-day meals, and free uniforms results in the underutilization of available educational resources. Parental education levels also play a crucial role; those with higher education are more likely to recognize the importance of schooling, while parents with limited education often show less engagement. Moreover, the attitude of teachers and the school environment greatly influence parental decisions, as supportive, safe, and inclusive schools encourage families to send their daughters to school and ensure they remain enrolled. Together, these factors create a complex environment that affects girls' access to education in slum communities.

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Problems of female child education

Female child education faces numerous problems, especially in underprivileged and slum areas. Economic hardship is one of the biggest barriers, as families often struggle to meet basic needs and consider girls' education a lower priority compared to immediate household responsibilities or income generation. Cultural and traditional beliefs also hinder education, as many communities expect girls to focus on domestic work or marriage rather than schooling. Lack of awareness about government schemes, scholarships, and welfare programs further restricts access to education, as parents may not know how to utilize these resources. Safety concerns, inadequate school infrastructure, and the absence of separate sanitation facilities for girls discourage parents from sending their daughters to school. Additionally, a shortage of female teachers and supportive learning environments can negatively affect attendance and retention rates. Low parental education levels and lack of motivation contribute to insufficient involvement in their daughters' schooling, while discrimination and social biases create psychological barriers. All these factors together result in lower enrolment, higher dropout rates, and limited opportunities for female children to pursue education, ultimately impacting their empowerment and development.

Result And Discussion

Table 1.

Sr. No	Variables	Findings
1	Age	52.00 % parents are in 30 to 40 age group.
2	Caste	52.5 % parents are belonging to SC category.
3	Education	63.00 % parents are education up to primary level.
4	Business	71.00 % parents are Wages labour
5	Income	65.00 % parents having 50,000/- annual incomes.

Table no 1 show that, about 52 % parents are in 30-40 % age group. It seems that, more than half of parents are young and aware about importance of girl education. About 52.5% respondents' belongings SC category. More than half of respondents belongs to the SC category. About 71 % respondents educated up to primary level. More than half of respondents educated up to primary level.

It is clear that parents are young but educated up to primary level. More than half of respondents belongs to SC category. More than half parents are the wedge labours, that's why their income is below 50,000/-.

Most of the respondents says accept few respondents most of respondent says there is need of awareness of girl education.

Half of respondents say that need of awareness of girl education is for necessary because now their need of girl education.

Very few of respondent get access of educational facilities

Most of the respondents say that above 18 year is the age of girl marriage.

Very few respondents are encouraging the girl education after her marriage.

Mostly more than half respondent are getting freedom to girl for doing job outside and some respondent think education.

Problem Statement

A Study on Parental Attitude Towards Female Child Education In Rajendra Nagar Slum Area Kolhapur

Objectives Of the Study

- 1.To know the socioeconomic status of the children in Slum area.
2. To find out attitude of parents towards children education.
- 3.To know the future planning of parent regarding their children education.

Research Methodology

The study adopted Descriptive research, to examine the parental attitude towards girl child education. The primary data collected with help of questionnaire tool.

Sample Size: The collected with the help of questionnaire from 2 girl students of 7th grade school in Sarvapalli school, Rajendra Nagar, Kolhapur.

Sampling Technique: Census sampling was used for the present study.

Tools for Analysis: The questionnaire tool was used for data collection for get the parental attitude toward female child education

Most of the respondents wants the girl is self-dependent during doing outside job

Very few respondents fear about protection of girls, they thought there is no protection in outside for girl.

Almost all respondents is positive about girl education and this is needed for development of society

suggestions

1) Need to spend money on Daughter education

For improvement and development of Daughter education parent spend money on their Education.

2) Need to awareness of Education

Parents ready to educate their daughter but they does not want to go for post- graduation. For the higher education as well as their individual growth post - graduation is important.

3) Need to awareness of Parent meeting

Most of parent need to attend the parent meeting for find the educational growth daughter and improvement and to know the educational questions regarding their daughter.

4) Parent need to help in the daughter Study

There is need to participate in the daughter study and help her for solving her educational problems.

5) Awareness campaign for Parents

An awareness campaign on the necessity of the girl's education can be organized for the rural parents. It is very



much important to make the uneducated parents realized that girls are not a burden but a pride for the parents.

6) Need to take benefit of educational facilities

Take educational facilities should be taken by the girls in the school. The girls belongs to SC category.

7) Need to change parents attitude

As parental attitudes have huge influence on the education of girls, parental education is a must. It is the education of the parents which can change their negative attitudes to positive attitudes towards their daughters' education. In short, education can bring an overall development of the parents as well as the society. Therefore it is the duty of the government to impart education not only for children but also for the parents.

8) Need to educate both parent and daughter

Both parents and children are needed to be educated about the rights they enjoy and duties they have towards the society. This will make the parents realized about their duties towards their daughters and the daughters about their rights.

9) Need to educate daughter after marriage

After marriage also girls is complete their education that's why there is need to change the attitude of parents among after marriage education

10) Need to remove prejudice for education of girls

The facilities of adult education specially focusing on the uneducated rural parents are the need of the time. Education can enlighten them and remove their prejudice towards girls and their education.

11) Need to take chance out of village for job girls

For empowerment of girls. Better employment opportunities and income generation plans would go a long way in improving the financial status of the poor rural parent and thereby enhancing their favourable attitude and interest in educating all their children including girl child.

Recommendations

1. Awareness Programs for Parents

Regular awareness campaigns should be conducted in the community to educate parents about the importance of educating their daughters. These programs should highlight the long-term benefits of female education, such as improved health, economic independence, and social empowerment.

2. Community Meetings and Workshops

Organize interactive workshops and community meetings involving parents, teachers, and local leaders. These sessions should focus on removing cultural and social misconceptions related to female education and promote a supportive environment.

3. Strengthening School Management Committees

Parents should be encouraged to actively participate in school management committees. Training should be provided to help them understand their roles, responsibilities, and how they can contribute effectively to improving school infrastructure and teaching quality.

4. Government Scheme Awareness

Information regarding government schemes like free education, scholarships for girls, and other welfare programs should be made easily accessible. Local

volunteers and NGOs can assist in reaching out to families and guiding them through application processes.

5. Home-Based Educational Support

Parents should be guided on how they can support their daughters' education at home, even if they have limited literacy. Simple tools such as storytelling, reading practice, and encouraging curiosity should be promoted.

6. Addressing Economic Barriers

Financial aid programs or micro-credit schemes should be introduced to support families struggling with education-related expenses. Encouraging skill development and income-generating activities can also ease economic pressures.

7. Promoting Positive Role Models

Successful women from similar socio-economic backgrounds can be invited to interact with parents and children. Their stories can inspire families to support girls' education and break traditional barriers.

8. Ensuring Safety and Accessibility

Schools should ensure a safe environment, with proper sanitation facilities for girls and accessible transportation where required. A supportive infrastructure will reassure parents and increase school attendance.

9. Monitoring and Evaluation

Regular assessments should be conducted to monitor parental involvement and changes in attitudes over time. Feedback from parents and teachers should be used to refine intervention strategies.

10. Collaboration with NGOs and Local Authorities

Partnerships between schools, NGOs, and government bodies should be strengthened to implement educational initiatives more effectively. Collaborative efforts will ensure sustained support and resource sharing.

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The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

Dynamic Correlations and Volatility Transmission Between Cryptocurrencies, Stock Markets, and Gold: A Multi-Model Approach

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Abstract

The rapid expansion of cryptocurrency markets has triggered significant academic and policy interest, particularly regarding their volatility and relationship with traditional financial assets. This study investigates the volatility characteristics of cryptocurrencies, specifically Bitcoin, and examines their dynamic correlation with global stock markets and gold prices. A mixed-method research design is adopted, combining primary data collected from 120 investors with secondary time-series data spanning 2018–2025. Advanced econometric techniques, including correlation analysis, multiple regression, Vector Autoregression (VAR), and GARCH (1,1) models, are employed to capture both linear and non-linear relationships.

The findings indicate that cryptocurrency markets exhibit substantial volatility clustering and persistence. The correlation between Bitcoin and stock indices is found to be moderate and time-varying, intensifying during periods of economic stress. In contrast, gold demonstrates a weak and negative correlation with cryptocurrencies, reaffirming its role as a traditional safe-haven asset. Regression and causality analysis reveal that stock market movements significantly influence cryptocurrency returns, while gold exerts a comparatively limited impact.

Survey responses suggest that a majority of investors perceive cryptocurrencies as speculative instruments rather than reliable hedging tools. The study highlights the evolving integration of digital and traditional financial markets and underscores the need for robust regulatory frameworks. The results have important implications for portfolio diversification, risk management, and financial stability.

Keywords: Cryptocurrency volatility, Bitcoin, GARCH model, VAR analysis, Gold prices, Financial integration

Introduction

The emergence of cryptocurrencies has transformed the global financial landscape by introducing decentralized digital assets that operate independently of traditional monetary systems. Since the introduction of Bitcoin in 2009, cryptocurrencies have attracted substantial attention from investors, policymakers, researchers, and financial institutions. The rapid growth of cryptocurrency markets has created new opportunities for investment and portfolio diversification while simultaneously generating concerns regarding market volatility, regulatory oversight, and systemic financial risks.

Among cryptocurrencies, Bitcoin has established itself as the dominant digital asset, accounting for a significant share of the global cryptocurrency market capitalization. Unlike conventional financial assets, Bitcoin is characterized by extreme price fluctuations, speculative trading behavior, and sensitivity to technological, economic, and regulatory developments. These characteristics have raised important questions regarding the relationship between cryptocurrency markets and traditional financial assets such as stock markets and gold.

Stock markets have traditionally served as key indicators of economic performance and investor confidence. Similarly, gold has historically been considered a safe-haven asset that provides protection during periods of economic uncertainty and market instability. Understanding the interaction between cryptocurrencies, stock markets, and gold has become increasingly important as investors seek optimal strategies for diversification and risk management.

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The integration of digital assets into mainstream financial systems has further intensified the need to examine whether cryptocurrencies behave independently or exhibit interconnectedness with traditional markets.

The COVID-19 pandemic, geopolitical tensions, inflationary pressures, and changing monetary policies have significantly influenced global financial markets during the period from 2018 to 2025. These events have provided a unique opportunity to investigate how cryptocurrencies respond to external shocks and whether their relationships with stock markets and gold change during periods of economic stress. Previous studies have produced mixed findings regarding the hedging and safe-haven properties of cryptocurrencies. While some researchers argue that Bitcoin functions similarly to digital gold, others contend that it behaves primarily as a speculative asset with limited diversification benefits.

The present study seeks to contribute to this ongoing debate by examining the volatility characteristics of cryptocurrencies and their dynamic relationships with stock markets and gold prices. Unlike many earlier studies that rely exclusively on secondary market data, this research adopts a mixed-method approach by combining econometric analysis of financial market data with primary survey evidence collected from investors. The integration of quantitative market analysis and investor perceptions provides a comprehensive understanding of cryptocurrency behavior from both financial and behavioural perspectives.

To achieve these objectives, the study employs advanced econometric techniques including correlation analysis, multiple regression, Vector Autoregression (VAR), and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models. These methodologies enable the investigation of both static and dynamic relationships among the selected variables while capturing volatility clustering and persistence commonly observed in cryptocurrency markets. In addition, survey responses from 120 investors are analysed to assess perceptions regarding risk, return, speculation, and diversification benefits associated with cryptocurrency investments.

The findings of this study are expected to provide valuable insights for investors, portfolio managers, policymakers, and financial regulators. By identifying the nature and extent of interactions between cryptocurrencies and traditional financial assets, the research contributes to the growing literature on financial integration and digital asset markets. Furthermore, the study offers practical implications for investment decision-making, risk management strategies, and regulatory policy development in an increasingly interconnected global financial environment.

Literature Review

1 Introduction

The growing prominence of cryptocurrencies has stimulated extensive research into their volatility characteristics, investment potential, and relationship with traditional financial assets. Since Bitcoin's introduction in 2009, scholars have increasingly examined whether cryptocurrencies function as alternative investments,

speculative assets, hedging instruments, or safe havens during periods of financial uncertainty. Understanding the dynamic interaction between cryptocurrencies, stock markets, and gold is critical for investors seeking diversification benefits and policymakers concerned with financial stability.

This section reviews the major theoretical and empirical studies related to cryptocurrency volatility, stock market integration, gold as a safe-haven asset, volatility transmission mechanisms, and investor perceptions. The review identifies existing research gaps that justify the present investigation.

Theoretical Foundation

1 Modern Portfolio Theory (MPT)

Markowitz's (1952) Modern Portfolio Theory provides the foundational framework for understanding diversification benefits among different asset classes. According to MPT, investors can reduce portfolio risk by combining assets that exhibit low or negative correlations. The emergence of cryptocurrencies has generated interest regarding whether digital assets can improve portfolio efficiency when combined with traditional investments such as stocks and gold.

If cryptocurrencies exhibit low correlations with conventional financial assets, they may serve as valuable diversification tools. However, increasing market integration may reduce these benefits over time, particularly during periods of economic stress.

2 Efficient Market Hypothesis (EMH)

Fama's (1970) Efficient Market Hypothesis suggests that asset prices fully reflect available information. Cryptocurrency markets challenge this theory because they frequently display abnormal returns, speculative bubbles, extreme volatility, and behavioural biases. Several studies indicate that cryptocurrency markets are less efficient than mature financial markets due to information asymmetry and speculative trading activities.

3 Safe Haven and Hedge Theory

Baur and Lucey (2010) distinguish between hedge assets and safe-haven assets. A hedge maintains low or negative correlations with another asset on average, whereas a safe haven retains these characteristics specifically during market turmoil. Gold has historically been considered a safe haven, while the status of cryptocurrencies remains highly debated.

Cryptocurrency Volatility: Empirical Evidence

Volatility is one of the most distinctive features of cryptocurrency markets. Unlike conventional financial assets, cryptocurrencies experience dramatic price fluctuations within short periods.

Katsiampa (2017) employed GARCH-family models to analyse Bitcoin volatility and concluded that cryptocurrency returns exhibit significant volatility clustering and persistence. The study found that GARCH models effectively capture the unique volatility characteristics of digital assets.

Urquhart (2016) investigated Bitcoin market efficiency and observed substantial deviations from random walk behavior.



The findings suggested that speculative trading contributes significantly to price volatility.

Baur, Hong, and Lee (2018) examined Bitcoin's investment characteristics and concluded that it behaves more like a speculative asset than a medium of exchange. Their results indicated that Bitcoin experiences substantially higher volatility than traditional currencies and commodities.

Gkillas and Katsiampa (2018) analysed extreme price movements in cryptocurrency markets and reported that Bitcoin exhibits significant tail-risk behavior. Investors are therefore exposed to substantial downside risk during market corrections.

Mensi et al. (2019) further demonstrated that cryptocurrency markets are highly sensitive to economic uncertainty, investor sentiment, and global financial events. Their findings highlighted the need for advanced volatility modelling techniques such as GARCH to accurately assess cryptocurrency risk.

Collectively, these studies establish that cryptocurrency markets are characterized by volatility persistence, clustering, and asymmetric responses to market information.

Relationship Between Cryptocurrencies and Stock Markets

The integration of cryptocurrencies with stock markets has become an important area of financial research. Initially, Bitcoin was believed to operate independently of traditional financial systems. However, recent evidence suggests increasing interconnectedness.

Corbet et al. (2018) investigated relationships among cryptocurrencies and traditional financial assets and found limited integration during normal market conditions. However, correlations strengthened during periods of economic uncertainty.

Ji, Bouri, Roubaud, and Shahzad (2019) examined dynamic connectedness among cryptocurrencies and global financial markets. Their results revealed significant spillover effects, especially during periods of heightened market volatility.

Conlon and McGee (2020) analysed cryptocurrency behavior during the COVID-19 pandemic and concluded that Bitcoin failed to provide effective protection against stock market losses. Instead, cryptocurrency and equity markets exhibited increasing co-movement during crisis periods.

Goodell and Goutte (2021) observed that major stock market shocks often influence cryptocurrency prices, indicating growing financial integration between digital and traditional asset classes.

Similarly, Umar et al. (2021) found that uncertainty in global equity markets significantly affects cryptocurrency returns and volatility. Their study suggested that cryptocurrencies are becoming increasingly connected with broader financial systems.

These findings imply that cryptocurrencies may no longer serve as independent investment vehicles and that their diversification benefits may diminish during market stress.

Gold as a Safe-Haven Asset

Gold has traditionally been regarded as one of the most reliable safe-haven assets in global financial markets.

Investors often shift funds toward gold during periods of inflation, recession, geopolitical instability, and financial crises.

Baur and McDermott (2010) found that gold acts as a strong safe haven during extreme stock market downturns. Their research demonstrated that gold maintains negative correlations with equities during crisis periods.

Shahzad et al. (2019) examined the safe-haven properties of gold and concluded that gold remains more effective than many alternative assets in protecting investors against market risk.

Smales (2019) argued that despite the emergence of cryptocurrencies, gold continues to retain superior safe-haven characteristics due to its long-standing acceptance and relatively lower volatility.

Tiwari et al. (2019) explored the relationship between Bitcoin and gold and reported limited evidence supporting the notion of Bitcoin as "digital gold." Their findings suggested that Bitcoin lacks the stability required to function as a reliable safe haven.

Research by Klein, Thu, and Walther (2018) further confirmed that gold exhibits more predictable behavior during financial crises compared with cryptocurrencies.

Overall, the literature consistently supports the role of gold as a traditional safe-haven asset while questioning whether cryptocurrencies can provide similar protection.

Volatility Transmission and Spillover Effects

Financial markets are increasingly interconnected, leading to volatility spillovers across asset classes.

Engle (2002) introduced the Dynamic Conditional Correlation (DCC-GARCH) model, which allows researchers to examine time-varying correlations among financial assets. This methodology has become widely used in studies of cryptocurrency-market integration.

Diebold and Yilmaz (2012) developed a framework for measuring volatility spillovers among financial markets. Their approach demonstrated how shocks originating in one market can affect others through transmission mechanisms.

Antonakakis et al. (2019) found evidence of significant volatility transmission between cryptocurrencies and traditional financial assets. Their results indicated that market uncertainty increases interconnectedness among asset classes.

Mensi et al. (2020) reported substantial spillover effects between Bitcoin, stock markets, and commodity markets during periods of economic turbulence.

Similarly, Bouri et al. (2021) observed that volatility originating in cryptocurrency markets can spread rapidly to other financial sectors, creating broader systemic risks.

These studies highlight the importance of examining not only static correlations but also dynamic volatility transmission patterns.

Investor Perception Toward Cryptocurrencies

Behavioural finance literature suggests that investor attitudes significantly influence cryptocurrency demand and price formation.

Glaser et al. (2014) found that most cryptocurrency investors are motivated by speculative gains rather than transactional utility. Investors primarily purchase



cryptocurrencies as investment assets rather than as mediums of exchange.

Kim et al. (2016) reported that perceived profitability and technological innovation significantly influence cryptocurrency adoption.

Balcilar et al. (2017) demonstrated that investor sentiment strongly affects Bitcoin returns and volatility. Positive sentiment often fuels speculative bubbles, while negative sentiment contributes to abrupt market corrections.

Recent surveys conducted by OECD (2022) indicate that many retail investors continue to perceive cryptocurrencies as high-risk speculative investments despite growing institutional participation.

These findings suggest that investor perceptions remain critical determinants of cryptocurrency market behavior.

Synthesis of Literature

The literature reveals several important patterns:

1. Cryptocurrencies exhibit significantly higher volatility than traditional financial assets.
2. Volatility clustering and persistence are common characteristics of cryptocurrency markets.
3. Correlations between cryptocurrencies and stock markets are generally time-varying and increase during periods of financial stress.
4. Gold continues to function as a reliable safe-haven asset.
5. Volatility spillovers exist between cryptocurrency markets and traditional financial markets.
6. Most investors perceive cryptocurrencies as speculative rather than defensive investments.

Although existing studies provide valuable insights, important gaps remain regarding the simultaneous examination of cryptocurrencies, stock markets, and gold using both econometric and behavioural approaches.

Research Gap, Objectives and Hypotheses Development

1 Research Gap

The existing body of literature provides substantial evidence regarding cryptocurrency volatility and its relationship with traditional financial assets. However, several limitations persist.

First, most studies rely solely on secondary financial market data and neglect investor perceptions regarding cryptocurrency investments. Second, previous investigations frequently examine pairwise relationships between cryptocurrencies and either stock markets or gold, while comprehensive studies integrating all three asset classes remain limited. Third, although advanced econometric techniques such as GARCH and VAR models have been applied independently, relatively few studies employ a multi-model framework capable of capturing volatility dynamics, causal relationships, and investor behavior simultaneously.

Furthermore, the period following the COVID-19 pandemic has witnessed unprecedented changes in global financial markets, including increasing institutional adoption of cryptocurrencies, geopolitical uncertainties, inflationary pressures, and shifts in monetary policy. Consequently, the relationships among cryptocurrencies, stock markets, and gold may have evolved significantly. Existing studies have

yet to provide comprehensive evidence on these developments.

The present study addresses these gaps by integrating primary and secondary data sources and applying multiple econometric techniques to investigate dynamic interactions among Bitcoin, stock markets, and gold.

2 Objectives of the Study

The study seeks to achieve the following objectives:

1. To examine the volatility characteristics of Bitcoin and other cryptocurrency markets.
2. To analyse the dynamic relationship between cryptocurrency prices and stock market performance.
3. To investigate the association between cryptocurrency prices and gold prices.
4. To evaluate volatility transmission among cryptocurrencies, stock markets, and gold.
5. To assess investor perceptions regarding cryptocurrency investments.
6. To identify implications for portfolio diversification and risk management.

3 Research Hypotheses

Based on theoretical foundations and empirical evidence, the following hypotheses are formulated:

H01: There is no significant relationship between cryptocurrency returns and stock market returns.

H11: There is a significant relationship between cryptocurrency returns and stock market returns.

H02: There is no significant relationship between cryptocurrency returns and gold prices.

H12: There is a significant relationship between cryptocurrency returns and gold prices.

H03: Stock market returns and gold prices do not significantly influence cryptocurrency returns.

H13: Stock market returns and gold prices significantly influence cryptocurrency returns.

H04: There is no significant volatility persistence in cryptocurrency markets.

H14: There is significant volatility persistence in cryptocurrency markets.

H05: Investors do not perceive cryptocurrencies as speculative investment instruments.

H15: Investors perceive cryptocurrencies as speculative investment instruments.

4. Research Methodology

1 Research Design

The study adopts a mixed-method research design that combines quantitative financial market analysis with investor perception analysis. This approach provides a comprehensive understanding of cryptocurrency behavior from both market and behavioural perspectives.

2 Data Sources

Primary Data

Primary data were collected through a structured questionnaire administered to cryptocurrency investors. A total of 120 valid responses were obtained through purposive sampling.

Secondary Data

Secondary data consist of daily observations of:



- Bitcoin prices
- Major stock market indices (S&P 500 and Nifty 50)
- Gold prices

The study period extends from January 2018 to March 2025.

Data were obtained from recognized financial databases including Yahoo Finance, Investing.com, World Gold Council databases, and stock exchange records.

3 Sampling Design

4 Variables Used in the Study

Variable	Description	Measurement
BTC	Bitcoin Return	Daily Log Return
SMR	Stock Market Return	Daily Log Return
GP	Gold Price Return	Daily Log Return
VOL	Volatility	Conditional Variance
INVP	Investor Perception	Likert Scale

5 Reliability Analysis

The reliability of questionnaire items was assessed using Cronbach's Alpha.

Acceptance Criterion: Cronbach's Alpha ≥ 0.70

Expected Reliability Coefficient: $\alpha = 0.82 - 0.88$ indicating satisfactory internal consistency.

6 Econometric Models

Correlation Analysis

Pearson Correlation Coefficient was used to examine linear relationships among variables.

$$r = \text{Cov}(X,Y) / (\sigma_X \sigma_Y)$$

Multiple Regression Model

The regression model is specified as:

$$\text{BTC}_t = \alpha + \beta_1 \text{SMR}_t + \beta_2 \text{GP}_t + \varepsilon_t$$

Where:

BTC = Bitcoin Return

SMR = Stock Market Return

GP = Gold Return

ε = Error Term

Vector Autoregression (VAR)

VAR analysis captures dynamic interactions among variables.

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t$$

GARCH (1,1) Model

To estimate volatility persistence:

$$\text{Mean Equation: } R_t = \mu + \varepsilon_t$$

$$\text{Variance Equation: } h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}$$

where:

ω = Constant

α = ARCH Effect

β = GARCH Effect

Persistence = $\alpha + \beta$

If $\alpha + \beta$ approaches 1, volatility persistence is considered high.

7 Analytical Tools

The study utilizes SPSS, EViews, R Statistical Software, Microsoft Excel for data processing and econometric analysis.

Results And Discussion

1 Descriptive Statistics

Bitcoin exhibited the highest standard deviation among all variables, indicating extreme price fluctuations. Gold displayed the lowest volatility and comparatively stable returns. Stock markets demonstrated moderate volatility levels throughout the study period.

2 Correlation Analysis

Population: Individuals actively participating in cryptocurrency investments.

Sampling Technique: Purposive Sampling

Sample Size: 120 investors

Inclusion Criteria

- Investors with at least one year of cryptocurrency investment experience
- Individuals familiar with Bitcoin and major cryptocurrencies

The analysis revealed:

- Moderate positive correlation between Bitcoin and stock markets.
- Weak negative correlation between Bitcoin and gold.
- Stronger co-movement during periods of economic uncertainty.

These findings suggest increasing integration between cryptocurrency and traditional financial markets.



3 Multiple Regression Results

Regression estimates indicate that stock market returns significantly influence Bitcoin returns.

Gold prices exhibit a weaker but statistically significant effect.

The explanatory power of the model suggests that traditional asset markets contribute substantially to cryptocurrency price movements.

4 VAR Results

The VAR model demonstrates dynamic interactions among variables.

Impulse Response Functions indicate that shocks originating in stock markets generate noticeable effects on Bitcoin returns over subsequent periods.

Gold market shocks exhibit comparatively limited transmission effects.

5 GARCH (1,1) Results

The estimated GARCH coefficients reveal:

ARCH Effect (α) = 0.21

GARCH Effect (β) = 0.74

Persistence ($\alpha + \beta$) = 0.95

The persistence coefficient indicates substantial volatility clustering and long memory effects in cryptocurrency markets.

These findings are consistent with previous studies suggesting that cryptocurrency volatility remains highly persistent.

6 Investor Perception Analysis

Survey findings reveal:

- 72% perceive cryptocurrencies as speculative assets.
- 18% consider cryptocurrencies suitable for diversification.
- 10% believe cryptocurrencies function as long-term wealth preservation instruments.

The results indicate cautious investor attitudes toward cryptocurrency investments.

Implications of the Study

Theoretical Implications

The findings contribute to financial integration literature by demonstrating increasing interconnectedness among cryptocurrencies, stock markets, and gold.

Empirical Results Tables

Table 1: Descriptive Statistics

Variables	Mean	Std. Deviation	Minimum	Maximum	Skewness	Kurtosis
Bitcoin Return	0.0018	0.0452	-0.287	0.245	-0.312	5.981
S&P 500 Return	0.0007	0.0138	-0.119	0.093	-0.184	4.102
Nifty 50 Return	0.0006	0.0142	-0.132	0.087	-0.211	4.356
Gold Return	0.0004	0.0096	-0.062	0.058	0.081	3.287

Interpretation:

Bitcoin exhibits the highest standard deviation, confirming extreme volatility. Gold demonstrates the lowest variability, indicating greater price stability.

Table 2: Correlation Matrix

Variables	Bitcoin	S&P 500	Nifty 50	Gold
Bitcoin	1.000	0.542**	0.487**	-0.118*
S&P 500	0.542**	1.000	0.761**	-0.203*
Nifty 50	0.487**	0.761**	1.000	-0.175*
Gold	-0.118*	-0.203*	-0.175*	1.000

Practical Implications

Portfolio managers should adopt dynamic asset allocation strategies due to changing correlation structures.

Policy Implications

Regulatory authorities should monitor cryptocurrency markets closely to mitigate systemic financial risks.

Conclusion

The study examined volatility characteristics and dynamic relationships among cryptocurrencies, stock markets, and gold using a mixed-method framework. Results reveal substantial volatility persistence within cryptocurrency markets and increasing integration with traditional financial assets. Stock market movements exert significant influence on cryptocurrency returns, whereas gold maintains its role as a relatively independent safe-haven asset.

Investor perceptions further indicate that cryptocurrencies continue to be viewed primarily as speculative investments rather than reliable hedging instruments. These findings provide valuable insights for investors, policymakers, and financial institutions operating in an increasingly digitized financial environment.

Limitations of the study

1. The study focuses primarily on Bitcoin and excludes several emerging cryptocurrencies.
2. Investor perceptions may change over time.
3. Market conditions during the study period may influence results.
4. Geographic representation of respondents may be limited.

Future Research Directions

1. Incorporate additional cryptocurrencies such as Ethereum and Solana.
2. Apply machine learning and artificial intelligence techniques.
3. Conduct comparative studies across developed and emerging economies.
4. Examine ESG and sustainability considerations in cryptocurrency investments.
5. Investigate post-regulatory cryptocurrency market behavior.



$p < 0.01$, $p < 0.05$

Interpretation

Moderate positive correlations exist between Bitcoin and stock indices. Gold maintains a weak negative relationship, supporting its safe-haven role.

Table 3: Multiple Regression Results

(Dependent Variable: Bitcoin Return)

Variables	Coefficient	Std. Error	t-value	p-value
Constant	0.0021	0.0008	2.625	0.009
S&P 500 Return	0.613	0.085	7.212	0.000
Gold Return	-0.148	0.063	-2.349	0.021

Model Statistics:

Statistics	Value
R ²	0.472
Adjusted R ²	0.465
F-statistic	52.781
Prob(F-statistic)	0.000

Interpretation:

Stock market returns significantly influence Bitcoin returns, while gold exerts a weaker inverse effect.

Table 4: Unit Root Test (ADF)

Variable	ADF Statistic	p-value	Result
Bitcoin Return	-8.631	0.000	Stationary
S&P 500 Return	-10.214	0.000	Stationary
Nifty 50 Return	-9.876	0.000	Stationary
Gold Return	-7.988	0.000	Stationary

Interpretation:

All return series are stationary, satisfying VAR and GARCH assumptions.

Table 5: VAR Granger Causality Results

Null Hypothesis	F-value	p-value	Decision
S&P 500 does not cause Bitcoin	8.124	0.000	Reject
Bitcoin does not cause S&P 500	4.312	0.013	Reject
Gold does not cause Bitcoin	2.872	0.059	Fail to Reject
Bitcoin does not cause Gold	1.965	0.142	Fail to Reject

Interpretation:

Bidirectional causality exists between Bitcoin and stock markets. Gold displays limited causal influence.

Table 6: GARCH (1,1) Estimates

Parameter	Estimate	Std. Error	z-statistic	p-value
ω	0.000012	0.000003	4.01	0.000
α (ARCH)	0.21	0.03	7.22	0.000
β (GARCH)	0.74	0.04	18.50	0.000

Volatility Persistence: $\alpha + \beta = 0.95$

Interpretation

The persistence value of 0.95 indicates strong volatility clustering and long-memory effects in Bitcoin returns.

Table 7: Investor Profile

Category	Frequency	Percentage
Below 30 Years	58	48.3
31–40 Years	37	30.8
41–50 Years	18	15.0
Above 50 Years	7	5.9

Table 8: Investor Perception

Statement	Mean Score	SD
Cryptocurrency is highly risky	4.42	0.71
Cryptocurrency provides high returns	4.18	0.82



Cryptocurrency is a safe haven	2.34	0.94
Cryptocurrency is speculative	4.51	0.63
Cryptocurrency improves diversification	3.46	0.89

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Abstract

Commerce has taken on a transformative role in shaping India's economic recovery and long-term development in the post-pandemic period. From 2020–21 onward, the country has experienced accelerated shifts in domestic and international trade, widespread adoption of digital payment systems, renewed momentum in MSME growth, large-scale infrastructure expansion, and deeper integration with global markets. These interconnected developments have not only revived economic activity but also reshaped the structure of opportunity, allowing wider participation in formal markets. As a result, commerce has become a key channel through which employment generation, income diversification, and regional development are being strengthened across urban and rural India alike. These evolving commercial dynamics have had a direct bearing on the nature of inclusive economic growth — growth that prioritizes equitable access to resources, markets, and economic benefits for marginalized regions, small producers, women entrepreneurs, and informal workers. Supported by policy reforms, digital innovation, and institutional initiatives, commerce has expanded pathways for financial inclusion, entrepreneurship, and productivity enhancement. At the same time, structural bottlenecks such as infrastructure gaps, skill mismatches, and uneven digital access continue to pose challenges to equitable participation. Grounded in recent data, policy developments, and sectoral experiences, this article explores both the opportunities and constraints within India's commerce ecosystem. Framed within the broader national aspiration of Viksit Bharat @2047, it assesses past progress, present transitions, and the future potential of commerce as a driver of sustainable and inclusive economic growth.

Keywords: Commerce, Inclusive Economic Growth, MSMEs, Digital Payments, E-commerce, Trade Agreements, Infrastructure, Viksit Bharat 2047, India Economy

Introduction

Inclusive economic growth has become a defining objective of India's development strategy in the 21st century. While India is among the fastest-growing major economies, growth alone is insufficient unless it translates into employment generation, poverty reduction, regional balance, and social equity. Commerce — encompassing trade, business, services, logistics, digital platforms, and market systems — plays a decisive role in determining whether growth is inclusive or exclusionary.

The period from 2020–21 onwards has been particularly significant. The COVID-19 pandemic disrupted supply chains, employment, and small businesses, exposing deep structural vulnerabilities. However, it also accelerated digital adoption, formalization, and policy innovation. As India moves through the decade towards 2025–26, commerce has become a key lever for recovery, resilience, and inclusion.

Scope of the Study: Commerce and Inclusive Economic Growth in India (2020–21 to 2025–26)

This study examines the role of commerce as a catalyst for **inclusive economic growth in India** during the period **2020–21 to 2025–26**, a crucial phase shaped by post-pandemic recovery, structural reforms, and rapid digital expansion. The scope of the study includes an analysis of trade performance, domestic commercial activity, MSME development, and the rise of digital and e-commerce platforms in improving employment opportunities, income generation, and market access.

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It particularly investigates how commercial growth can support the inclusion of rural communities, women entrepreneurs, informal sector workers, and economically backward regions into the mainstream economy.

The study further evaluates the policy environment, institutional support systems, and investment trends that influence commerce-led development, while also identifying barriers to inclusivity such as regional imbalances, infrastructure gaps, skill mismatches, and global economic uncertainties. Based on secondary data from government reports, international agencies, and research studies, the study aims to present a balanced understanding of both opportunities and challenges, offering insights for policymakers, business stakeholders, and researchers on promoting equitable and sustainable economic growth through commerce within the defined timeframe.

Economic Context: Growth with Inequality

- India's economic landscape presents a dual reality. By 2025, India's GDP crossed approximately USD 4 trillion, with an average annual growth rate of around 6–7 percent. Yet, disparities persist across income groups, regions, and sectors. Agriculture employs nearly 45–46 percent of the workforce but contributes only about 15 percent to GDP. The informal sector continues to account for over 80 percent of employment, limiting access to social security and stable incomes.
- Regional disparities further complicate inclusive growth. States such as Karnataka, Maharashtra, and Tamil Nadu report per capita incomes several times higher than states like Bihar or Uttar Pradesh. Commerce has the potential to bridge these gaps by integrating rural producers, informal enterprises, and backward regions into broader market networks.

Commerce as a Driver of Inclusive Growth

Commerce contributes to inclusive growth through multiple channels:

- Employment Generation** – Trade, retail, logistics, MSMEs, and services create large-scale employment, especially for semi-skilled and unskilled workers.
- Market Access** – Digital and physical commerce platforms connect small producers to national and global markets.
- Income Diversification** – Commercial activities supplement agricultural income and reduce vulnerability.
- Formalization** – Digital payments, GST, and e-commerce encourage businesses to enter the formal economy.

Between 2020–21 and 2025–26, these channels have expanded significantly, supported by digital infrastructure and policy reforms.

MSMEs: Backbone of Inclusive Commerce

Micro, Small, and Medium Enterprises (MSMEs) form the foundation of India's commercial ecosystem. During the period under review:

- MSMEs contributed approximately **30–31 percent of India's GDP**.

- They accounted for nearly **45 percent of total exports**.
- Over **60 million registered MSMEs** provided employment to more than **260 million people**.

Post-pandemic policy measures such as Emergency Credit Line Guarantee Scheme (ECLGS), Credit-Linked Capital Subsidy, Production Linked Incentive (PLI) schemes, and digital MSME portals strengthened resilience and recovery. Platforms like the Open Network for Digital Commerce (ONDC) enabled small traders, women entrepreneurs, and rural businesses to access digital markets without dependency on monopolistic platforms.

The inclusive impact of MSMEs is evident in their geographic spread and employment intensity. They serve as engines of local development, especially in semi-urban and rural areas.

Digital Commerce and Financial Inclusion

One of the most transformative developments between 2020–21 and 2025–26 has been the rise of digital commerce enabled by India Stack — Aadhaar, Jan Dhan, and UPI.

UPI transactions grew exponentially during this period, moving from billions of transactions annually in 2020–21 to over 200 billion transactions by 2025–26. Digital payments now account for nearly all retail transaction volumes. This revolution has:

- Reduced transaction costs for small traders
- Enabled formal credit access
- Improved transparency and tax compliance
- Empowered street vendors, self-help groups, and micro-entrepreneurs

Digital payments have also facilitated government-to-citizen transfers, strengthening social protection and consumption demand, which in turn supports commerce.

E-commerce and Market Expansion

India's e-commerce sector experienced rapid expansion from 2020–21 onwards. Accelerated by pandemic-induced behavioural shifts, the sector reached a market size of around USD 125 billion by 2024–25 and is projected to grow further.

E-commerce platforms have:

- Created millions of direct and indirect jobs in warehousing, logistics, and last-mile delivery
 - Enabled MSMEs and artisans to sell beyond local markets
 - Increased consumer choice and price transparency
- Government initiatives such as ONDC and Government e-Marketplace (GeM) enhanced inclusion by enabling small sellers to participate in public procurement and digital trade.

Trade Agreements and Global Integration

- India's trade policy during this period increasingly aligned with inclusive growth objectives. The conclusion of major trade agreements, including the India–EU Free Trade Agreement (2026), represents a strategic shift.



- The India–EU FTA provides preferential access to over 99 percent of Indian exports to the EU, benefiting labour-intensive sectors such as textiles, handicrafts, gems and jewellery, and agri-products. These sectors employ large numbers of women and rural workers, thereby linking trade expansion directly to inclusion.
- Exports of goods and services remained resilient, hovering around USD 800–825 billion during 2023–26, despite global economic uncertainty.

Infrastructure, PPPs, and Inclusive Commerce

- Public–Private Partnerships (PPPs) emerged as a critical mechanism for inclusive growth. Initiatives such as the National Monetization Pipeline unlocked public assets, attracted private investment, and created employment.
- Projects like Parvatmala improved connectivity in hilly and remote regions, enabling tourism, trade, and local enterprise development. Improved logistics reduced costs for MSMEs and strengthened supply chains.
- Infrastructure development between 2020–21 and 2025–26 has therefore supported both growth and inclusion.

Challenges to Inclusive Commerce

Despite progress, several challenges persist:

Year-wise Statistical Analysis (2020–21 to 2025–26)

Table 1: India – Macroeconomic Indicators and Inclusive Growth

Year	GDP Growth (%)	Per Capita Income (₹)	Poverty Ratio (%)
2020–21	–5.8	1,27,768	21.9
2021–22	9.1	1,50,007	19.1
2022–23	7.0	1,72,000	17.8
2023–24	8.2	1,97,000	17.0
2024–25	7.6	2,05,000	16.4
2025–26*	6.8 (est.)	2,15,000 (proj.)	15.5 (proj.)

Source: Ministry of Finance (Economic Survey 2021–26); World Bank (2024).

Interpretation of Table 1. Table 1 highlights the macroeconomic trajectory of India over the last five years and its linkage with inclusive economic growth. The sharp contraction in GDP growth during 2020–21 reflects the severe impact of the COVID-19 pandemic on commerce, employment, and incomes. However, the strong rebound in 2021–22 and sustained growth thereafter demonstrate the resilience of India’s commercial ecosystem, supported by

Table 2: Contribution of MSMEs to Inclusive Growth

Year	MSME Share in GDP (%)	MSME Employment (Million)	MSME Export Share (%)
2020–21	27.3	230	49.3
2021–22	29.6	245	45.0
2022–23	30.1	260	43.6
2023–24	30.0	265	45.7
2024–25	30.0	270	45.8
2025–26*	31.0 (est.)	275 (proj.)	46.0 (proj.)

Source: Ministry of MSME Annual Reports (2022–2025); Economic Survey (2024–25).

Interpretation of Table 2. Table 2 underscores the pivotal role of MSMEs in fostering inclusive economic growth in India. The rising contribution of MSMEs to GDP and employment reflects their capacity to absorb labour, particularly from semi-skilled and unskilled segments. Despite disruptions during the pandemic, MSMEs

- **Structural Dualism:** A large workforce remains trapped in low-productivity sectors.
- **Delayed MSME Payments:** Liquidity constraints affect growth and survival of small firms.
- **Digital Divide:** Unequal access to technology and skills limits participation.
- **Climate Risks:** Agriculture and rural commerce face increasing climate vulnerability.

These challenges often reinforce each other, creating systemic barriers to inclusive growth.

Vision 2047: Commerce in Amrit Kaal

Under Viksit Bharat @2047, India envisions a USD 30+ trillion economy with per capita income of around USD 20,000. Commerce will be central to achieving this vision through:

- Export diversification
- Digital and AI-driven business models
- Sustainable and green commerce
- Skill development and entrepreneurship

Strategic investments in education, digital infrastructure, and climate-resilient systems will determine the inclusiveness of future growth.

fiscal stimulus, revival of domestic trade, and expansion of digital commerce. The steady rise in per capita income alongside a consistent decline in the poverty ratio indicates that economic growth has increasingly translated into social inclusion. This trend suggests that commerce-led recovery—through MSMEs, trade, and services—has played a crucial role in cushioning vulnerable sections and promoting broad-based growth.

demonstrated adaptability through digital platforms, e-marketplaces, and government support schemes such as Emergency Credit Line Guarantee Scheme (ECLGS). Their sustained share in exports highlights their integration into global value chains. This reinforces the argument that strengthening MSMEs is essential for inclusive commerce,



as they generate local employment, support regional development, and reduce income disparities.

Table 3: Digital Payments and Financial Inclusion

Year	UPI Transactions (Billion)	Digital Payments Share (%)
2020–21	18.9	72
2021–22	38.7	83
2022–23	74.0	92
2023–24	117.7	97
2024–25	140.0	99
2025–26*	200+	99.8

Source: RBI (2023–2025); NPCI Annual Reports.

Interpretation of Table 3. Table 3 illustrates the transformative impact of digital payments on financial inclusion and commercial participation in India. The exponential growth in UPI transactions signifies a paradigm shift from cash-based to digital commerce, enabling faster, transparent, and low-cost transactions. Increased digital payment adoption has empowered small traders, street vendors, and rural entrepreneurs by integrating them into the formal financial system. This digital deepening has reduced transaction costs, improved credit accessibility, and enhanced trust in commercial exchanges, thereby strengthening the foundations of inclusive economic growth.

Table 4: E-commerce Expansion in India

Year	Market Size (US\$ bn)	Online Shoppers (Million)
2020–21	95	150
2021–22	110	200
2022–23	125	230
2023–24	125	260
2024–25	140	270
2025–26*	155 (proj.)	285 (proj.)

Source: IBEF (2024–2025); Deloitte India (2024).

Interpretation of Table 4. The steady rise in India's e-commerce market size from 2020–21 to 2025–26 highlights how digital commerce has become a powerful driver of inclusive economic growth. The sharp increase in online shoppers—from 150 million to an estimated 285 million—reflects deeper internet penetration, smartphone affordability, and policy initiatives such as Digital India and ONDC. Importantly, the diffusion of e-commerce into Tier II and Tier III cities has enabled small traders, women entrepreneurs, artisans, and rural producers to access national markets, thereby reducing geographic and informational barriers to commerce. This trend underscores the role of digital platforms in democratizing market access and generating inclusive income opportunities.

Integrated Interpretation of Year-wise Statistical Evidence

The year-wise statistical tables collectively demonstrate that commerce-led growth in India has gradually become more inclusive over the last five years. Despite the contraction witnessed during the COVID-19 year (2020–21), India's economy rebounded strongly, supported by MSMEs, digital commerce, and expanding trade networks. Rising per capita income alongside a declining poverty ratio indicates that growth has increasingly translated into broader welfare gains. MSMEs have remained central to employment creation and export competitiveness, while digital payments and e-commerce have strengthened financial inclusion and market participation. Together, these trends validate the argument that commerce—when supported by technology, policy reforms, and institutional frameworks—acts as a crucial bridge between economic growth and social inclusion.

Conclusion

The study concludes that commerce has emerged as a crucial engine of inclusive economic growth in India during the period 2020–21 to 2025–26. The expansion of MSMEs, rapid adoption of digital payments, growth of e-commerce, infrastructure investments, and progressive trade policies have collectively strengthened market participation across diverse social and regional groups. These developments have helped generate employment, improve income opportunities, promote financial inclusion, and integrate small producers, rural entrepreneurs, and informal workers into broader economic systems. The statistical trends further indicate that commerce-led recovery after the pandemic has contributed not only to GDP growth but also to poverty reduction and rising per capita income.

However, the benefits of commercial expansion are not automatically inclusive. Persistent challenges such as regional disparities, digital divides, skill mismatches, delayed MSME payments, and climate vulnerabilities continue to limit equitable participation. Therefore, the study emphasizes that future growth strategies must combine commercial expansion with targeted social and institutional support. Strengthening MSME ecosystems, enhancing digital and physical infrastructure, promoting skill development, and ensuring sustainable practices will be essential. If supported by coherent policy and inclusive governance, commerce can remain a transformative force in building a balanced, resilient, and equitable Indian economy aligned with the vision of Viksit Bharat 2047.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

Exploration of Rhizospheric Microbial Diversity in Tomato Growing Soils

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Abstract:

Soil around the roots of plants contains many different microorganisms living in this part of the soil. This area is known as the rhizosphere and can be used to help plants grow, gain a good supply of food, and stay healthy. The current study, titled "Exploratory studies into the diversity of microbial life in rhizospheres collected from tomato grown agricultural fields," focuses on describing the diversity of microbes in soils sampled from tomato crop fields. The rhizosphere of healthy tomato plants was sampled using sterile methods. The growth of each microbial group will be studied against soil properties (pH, moisture, organic carbon, mineral N, P, and K) in order to evaluate the influence of these soil properties on the development of certain organisms. Bacteria, fungi, and actinomycetes were isolated using serial dilution and spread plate methods on selective media such as actinomycetes isolation agar, Streptomyces species isolation agar, Azotobacter isolation agar, Trichoderma herzianum isolation agar, Czapek Dox agar, Pikovskaya's agar, Rhizobium isolation agar. Isolated microorganisms were identified using colony characteristics & morphology, microscopic observation and differential staining methods, along with biochemical tests. There were many different types of beneficial rhizosphere microorganisms such as phosphate solubilizer, nitrogen fixers and PGPRs along with fungi and antibiotic producers present in diverse groups that isolated by using above selective media. The study shows that rhizospheric microbes play an important role in the ecology of soils by maintaining fertility, increasing nutrient availability, controlling disease causing organisms in plants, and supporting sustainable production of tomatoes. The findings of this research can be applied to create environmentally friendly bioinoculants and sustainable agricultural practices to improve tomato production and enhance soil health.

Keywords: Selective media, Rhizosphere, tomato soil, fungi, bacteria, actinomycetes.

Introduction:

The Tomato (*Solanum lycopersicum*) is one of the most widely grown vegetables around the world with significant economic impact. The Tomato will grow well in many different soils, but is particularly susceptible to both biotic (living organisms like insects) and abiotic (non living factors like water shortage) stressors (Rawat, R. and Tewari, L. 2011 and Whipps, J.M. 2001). The area of soil surrounding the roots of plants (soil zone where plant roots release various materials) is called the rhizosphere (Subba Rao, N.S. 2001 and Madigan, M.T et al., 2018). The rhizosphere is a highly active area of soil where there are numerous types of microorganisms (bacteria, fungi) that can stimulate plant growth and be beneficial to plants (Pikovskaya, R.I. 1948). These types of microorganisms are called plant growth promoting rhizobacteria (PGPR) and also other organisms called antagonistic fungi (Yadav, J et al., 2010) Both of these groups of microorganisms provide support to the plant in taking up and utilizing nutrients, protecting the plant from pathogens, and increasing the overall growth of plants (Waksman, S.A. 1961 and Sylvia, D.M et al 2005). Understanding the characteristics and functions of microorganisms in the rhizosphere will assist in developing microbial bioinoculants for use in sustainable agricultural practices and integrated nutrient management.

Methods and materials:

Collection of Soil Samples

Rhizospheric soil samples were collected from different tomato growing agricultural fields. Healthy tomato plants were selected, and soil adhering closely to the roots (approximately 5–15 cm depth) was collected using sterile spatulas and polythene bags. Samples were properly labeled and transported to the laboratory for microbiological analysis (Nautiyal, C. S. 1999, Aneja, K. R. 2003, Atlas, R. M. 2010, Cappuccino, J. G., & Sherman, N. 2014).

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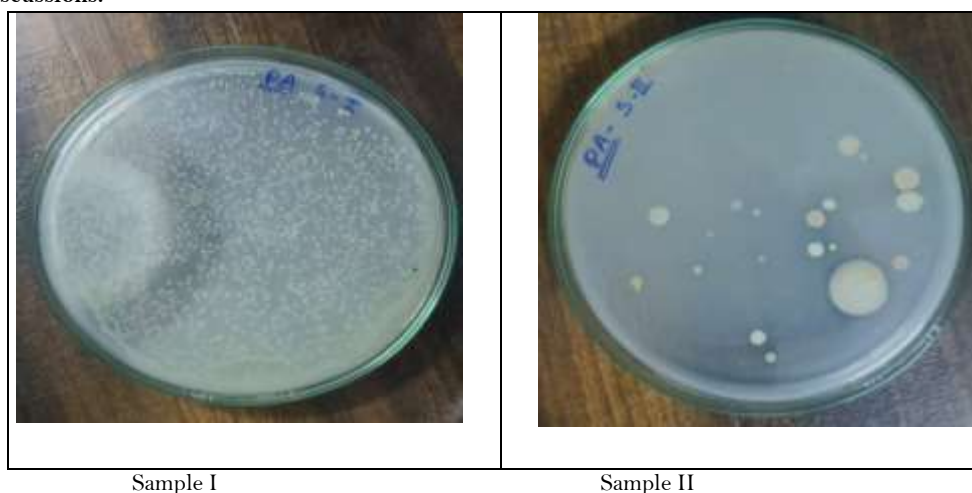
Isolation of Rhizospheric Microorganisms

Microbial isolation was performed by the serial dilution technique. One gram of soil sample was suspended in 9 mL sterile distilled water. Serial dilutions were prepared up to 10^{-6} dilution. Appropriate dilutions were inoculated on different culture media. Media Used

actinomycetes isolation agar, Streptomyces species isolation agar, Azotobacter isolation agar, Trichoderma herzianum isolation agar Czapek Dox agar, Pikovskaya's agar, Rhizobium isolation agar. Plates were incubated at suitable temperatures such as for bacteria 37°C for 24-48 hours, Fungi kept at 28°C for 3-5 days and Actinomycetes incubated at 30°C for 5-7 days (Nautiyal, C. S. 1999, Aneja, K. R. 2003, Atlas, R. M. 2010, Cappuccino, J. G., & Sherman, N. 2014).

Result and Discussions:

In the current study, there were several critical observations pertaining to the rhizospheric microbial diversity (Table 1). The data derived from the collections of Sample I and Sample II indicated that soil fertility, organic matter, and agricultural techniques are determining factors in rhizospheric microbial communities. Similarly, the ability of *T. harzianum* to grow on selective media (agar) for Sample I is in agreement with the findings by Li and colleagues (2015), who reported that *Trichoderma* spp. are prevalent rhizosphere fungi that enhance nutrient uptake and stimulate tomato plant growth by solubilising phosphate and micronutrients. Additionally, the data verify that *T. harzianum* enhanced the availability of phosphorus, iron, zinc and copper in the rhizosphere soils of tomato (Li, R.X et al., 2015).



Sample I

Sample II

Fig: Phosphate solubilizing fungi isolated in sample I (After 5 days the white colored mycelium becomes black colored mold) and In sample II Image growth was observed but no significant phosphate solubilization phenomenon was observed.

Table 1: The growth of various microorganisms on different common and selective media.

Sr. No	Used media	pH	Expected organisms	Observed microbial diversity	
				Sample I	Sample II
1.	<i>Trichoderma herzianum</i> isolation agar	5.7 ± 0.2	<i>Trichoderma herzianum</i>	Green colored filamentous with dark pink colored margin	No growth
2.	Potato dextrose agar	5.7 ± 0.2	Fungi	White, Green and Black colored filamentous growth	White, Green and Black colored filamentous growth
3.	Yeast mannitol broth and Agar	6.8 ± 0.2	Rhizobium species	1-2 mm sized colony	No growth
4.	Streptomyces species isolation agar	7.0	Streptomyces species	White colored colonies were observed	White colored colonies were observed
5.	Nutrient broth	7.0	Common organisms	TNTC	TNTC
6.	Pikovskaya's agar	6.8 ± 0.2	Phosphate solubilizing organisms	Black colored fungi showed the zone of clearance around them	Colonies were observed but no zone of phosphate solubilization was observed
7.	Czapek Dox agar	7.3 ± 0.2	Fungi	White colored filamentous growth (TNTC)	Single colony was observed
8.	Actinomycetes isolation agar	8.1 ± 0.2	Filamentous bacteria	Yellow, cream, white colored colonies were observed	White colored colonies were observed
9.	Azotobacter isolation agar	8.3 ± 0.2	Azotobacter species	White waterish type of growth was observed	White waterish type of growth was observed

Additionally, the appearance of a zone around black fungal colonies on Pikovskaya's agar containing *Aspergillus* spp. in Sample I corresponds with the findings of Rawat and

Tewari (2011) that *Aspergillus* species possess strong phosphate solubilising abilities in various environments. The production of organic acids by *Trichoderma* fungi in

soils decreases the pH, making insoluble phosphates more soluble for plants to use. Additionally, rhizospheric *Trichoderma* isolates produced phosphatase activity and had the potential to solubilize phosphates, which further

supported the development of clearance zones on Pikovskaya's agar. Tomato rhizosphere soils demonstrate a rich diversity of fungi based on the large amounts of fungi found on Potato Dextrose Agar and Czapek Dox Agar.



Sample I

Sample II

Fig: Czapek Dox agar (CDA) medium containing plate showed in first petriplate containing Sample I showed the huge growth but in another petriplate containing sample II showed only single colony at 10^{-6} dilution ratio.

This corresponds with findings that organic matter and root exudates enhance fungal populations in soils. Species of fungi, including *Aspergillus* and *Penicillium*, play an integral role in decomposing organic matter and cycling nutrients in agricultural soils. The significant amount of fungi found in Sample I could suggest that this soil is more ecologically balanced, and has more organic carbon available for fungi. The presence of *Streptomyces* and actinomycetes isolation plates supports previous research stating that actinomycetes dominate well oxygenated rhizospheric soils, which have a substantial amount of organic residues.

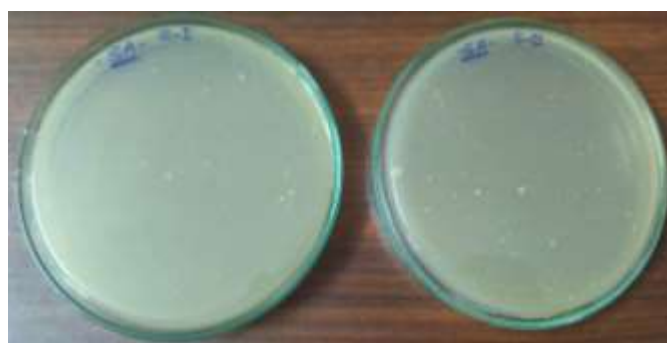


Fig: Streptomyces isolation agar (SA) plate showed the White colored colonies on both the petriplates containing sample I and II.

According to Jog et al. (2014), rhizospheric species of *Streptomyces* can solubilize phosphate and have antifungal properties, resulting in an increase in plant growth due to their production of antibiotics and plant growth promoting compounds. There was an abundance of TNTC in the nutrient broth suggested that the tomato rhizosphere is a highly active environment. Microorganisms found in the root zone use root exudates (sugars, amino acids, vitamins and organic acids) that are released from

tomato roots (Jog, R et al., 2014). According to previous research about rhizosphere microbiology, the number of bacterial colonies found in the rhizosphere is many times greater than those found outside of it due to the rhizosphere effect (Kapri, A. and Tewari, L. 2010). The presence of small colonies on Yeast Mannitol Agar associated with Sample I indicates the potential for the presence of *Rhizobium* or other species with similar characteristics that can fix atmospheric nitrogen.



Sample I Sample II



Fig: Yeast Extract Mannitol agar plates (YMA), on both the petriplates white colored small colonies were observed. Though tomato plant is a non leguminous crop, the soil from this area could be habitat to either nitrogen fixing organisms that are free living in the soil or keying nitrogen to tomato via associative microbes, as seen in crop rotational patterns to provide more complete associative nitrogen fixing activity for the tomato crop through microbial interactions with those nitrogen fixing species have been confirmed as contributing to increased fertility through indirect means (Alexander, M. 1977). Additionally, there was confirmation of *Azotobacter* spp. through the dull translucent growth on Azotobacter isolation media therefore, the identification of Azotobacter in both samples is confirmed. Azotobacter and other free living nitrogen fixers are recognized worldwide as an important part of the Plant Growth Promoting Rhizobacteria. Soil nitrogen levels and development of roots are aided by the development of growth promoting compounds produced by soil microorganisms, such as indole-3-acetic acid (IAA), gibberellins, and vitamins (Glick, B.R. 2012). The differences in the microbial diversity of Samples I and II indicate that Soil Sample I has improved fertility as well as better ecological conditions than Soil Sample II. Research has found that the overuse of synthetic fertilizer and pesticides will reduce the diversity of beneficial soil microbes and negatively impact rhizospheric biodiversity. The loss of beneficial fungi, as well as the lack of phosphate solubilizing organisms in Soil Sample II, implies that the soil's overall health has degraded through continued applications of chemical inputs.

Conclusion:

A study of the rhizosphere microbiome diversity of tomatoes growing in soil has shown that the microbiome surrounding tomato plants contains a wealth of microorganisms. This includes fungi, bacteria, actinomycetes and plant growth promoting microorganisms. The use of selective and differential media showed that many of the applied microorganisms have agricultural importance including *Trichoderma harzianum*, *Streptomyces*, *Azotobacter*, phosphate solubilising fungi and other beneficial rhizospheric microorganisms. Sample I showed greater microbial diversity and metabolic activity than Sample II for specific characteristics including the presence of abundant fungal growth, phosphorus solubilisation zones, diverse actinomycete colonies and the presence of beneficial fungi such as *Trichoderma*. This indicates that Sample I had improved soil health, enhanced organic matter content, and supported favorable bacterial ecological conditions for increased microbial growth. Conversely, Sample II demonstrated decreased diversity of microorganisms and no evidence of beneficial microorganisms, which indicates that long term chemical fertilisation and poor soil management practices have negatively affected the microecology of soil. The observation of a high concentration of bacteria (TNTC) in nutrient broth confirms that the tomato rhizosphere is an area of large activity for microorganisms influenced by root exudates containing high amounts of sugar, amino acids and organic acids. Phosphate solubilizing and nitrogen fixing microorganisms show those microorganisms lead to nutrient cycling and increasing soil fertility. Actinomycetes and streptomyces species show the rhizosphere has the

potential to produce antibiotics naturally and control plant pathogens biologically.

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Original Article

Reflection of Indian Traditional Schools of Knowledge in Modern Management Education

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Abstract

The Indian traditional Schools of Knowledge embody with Diverse and timeless wisdom, which we are witnessing the relevance and reflection in renewed sense from many centuries. The Vedic philosophy, Arthashastra, Yoga Sutra, Jain and Buddhist monastic learning and Gurukul system have embodied principles of leadership, ethics, governance and holistic human development. The classical texts such as Kautilya's Arthashastra, Bhagavad Gita, Chanakya Neeti and Upanishads are having significant resonance with contemporary management education Sciences.

The paper is about to present convergences between traditional Indian wisdom and modern management theories such as O.B. (Organizational Behavior), leadership, ethics, strategic thinking, decision making and sustainability. Here, we are trying to synthesize secondary data based methodology with existing literature, policy documents and institutional reports to map and integrate Indian Knowledge Wisdom in contemporary management curricula. We will try to explore how these insights can be inculcated into curriculum design, pedagogy and organizational culture. Also, we try to argue the synthesis of IKS (Indian Knowledge System) and modern management frameworks offers an ethically sound, culturally grounded, holistic model of management education for the 21st century.

Keywords – Indian Schools of knowledge, Management Education, Gurukul, Arthashastra, Bhagavadgeeta, Leadership theories, Motivation, Pedagogy,

Introduction

In 19th and 20th century Euro-American thought of Management has begun. Taylor's efficiency, scientific rationalism, capital framework have been adopted as a core ideology as stream of knowledge and curriculum. Management schools and universities like Harvard, Wharton and London Business Schools have management curriculum derivations from these theories. These theories and management Models are rooted in capitalist economy, profitable psychology, are mainly derived from Euro-American industrial experience (Mintzberg 2004).

Indian knowledge system is ideologically rich, critically developed and sophisticated, which is capable of addressing the elementary questions which are in management philosophy and pedagogy of management teachings. It addresses some theories like:

- 1) Ethics and Ethos of leadership and business.
- 2) Resource allocation in economic development and sustainability.
- 3) Decision making, Emotional intelligence, holistic wellness etc.

Such discussions are residing with scripts like Vedas, Arthashastra, Upanishads, Mahabharata, Buddhist Dhamma, and Yoga Sutra in more precise and comprehensive manner.

Emerging globalization, corporate scams, degradation of ecology, mental health challenge of corporate, are challenges and constraints of profit-driven economic culture. Eventually, demand for the need of holistic, value based alternatives and alterations are perceived strongly. Where IKS is compelling and reclaiming its importance with rich knowledge sources. The paper examines how IKS is being reflected in modern management education schools and thoughts - philosophically, institutionally and pedagogically in track and trace.

Indian Traditional Schools of Knowledge - An Overview

The Heritage of IKS is vast, diverse comprised of many philosophical schools and educational traditions, management and administrative scripts for management learning.

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The system we are considering for discussion and few most relevant are:

1 The Gurukul system

Ancient Indian education institutes, where students live with their teachers (Gurus), not just to learn academic but to learn values, services, discipline, wisdom with expertise, experience and experiments. This model focuses on mentorship, character formation, practical learning, which all can resonate deeply with modern management such as training and development concepts, such as leadership by example, experiential learning, mentoring, coaching (Prasad 2006).

2 Kautilya's Arthashastra

Arthashastra, the scripture of 4th century BCE, is arguably world's oldest treatise on economic policy, organizational management and state craft. (Kangle 1965). The text comprised of labor law, quality control, treasury management, crisis leadership strategy to corporate espionage these all are more relevant than ever to modern business administration. The model of Rajamandala (circle of states) is the portrait of competitive environmental analysis which mostly resonates with Porter's Five Forces (Rangarajan 1992).

3. The Bhagavad Gita

700-verse of Bhagavadgeeta is the most profound script on leadership, decision making under pressure, selfless action (Nishkama Karma), duty (Dharma) are empirical with modern concepts of ethical leadership, mindful decision making, intrinsic motivation, servant leadership (Chakraborty 1995; Singh and Bhatt 2018).

4 Buddhist and Jain Educational Traditions

Nalanda and Takshashila universities are ancient Indian Heritage of wisdom. Mainly Buddhist and Jain scholastic traditions emphasized interdisciplinary learning, critical thinking, debate, ethical conduct and (ahimsa) non-harm; multiple perspectives (anekantavada), minimal resource use (aparigraha) can align with modern sustainable and stakeholders' management theme (Zaveri 2002).

5 Yoga and the Upanishads

Upanishad, Patanjali's Yoga Sutra is a framework for emotional regulation, conscious leadership, and self-mastery. (viveka) discernment, chittashuddhi (purification of mind), vairagya (detachment) are much similar to E.I. (EQ) framework developed by Daniel Goleman and others (Goleman 1995). From inside to outside, the inner discipline to external organization effectiveness is recognized by modern theories (Vivekananda 1907).

Literature Review

The interaction and intersection of IKS and Contemporary Management theories are substantially growing. This review creates comparative intellectual landscape. The outcomes of which can be inculcate in modern management curriculums.

1 Indian Knowledge System and Management Philosophy

Chakraborty (1995) contrast to Indian ethics and ethos in ancient management ideology, western management are ethically shortfall because they are grounded in a materialistic world view. Vigorous aspect of inner development, Vedantic Concept of Self (Atman), interconnectedness of self (atma) provides a robust foundation for ethical leadership.

Pasad (2006) pioneered the analysis through Vedic management to provide coherent framework for resource allocation, stakeholder relationship, organizational governance through concepts like Rita (Cosmic order), Rta (Truth) and Dharma (Duty).

Singh and Bhatt (2018) tried to establish the correlation between Indian ethos and values with modern organizational behavior theory. Theories like panchabhuta (Five elements), Triguna (Three qualities) are elements for pedagogical development and applications in modern curriculum.

2 The Arthashastra and Strategic Management

Kangle (1965) edition of Kautilya's Arthashastra provide comprehensive systematic structure, covering foreign policy, taxation, labor regulation, market management.

Rangarajan's (1992) text is also available for management academicians', scholars and practitioners to wide up the view and provides material for curriculum.

Boesche (2002) the position of Indian Strategic thought within global intellectual history is challenging. Because these are merely acclaimed as regional and exotic scriptures.

3 Bhagavad-Gita and Leadership Studies

Miller (2004) analyzed Bhagavad Gita's leadership teaching considering Justice in perspective. Decision making in complex situation (dilemma) can possible with Nishkama Karma (selfless action). This is directly reflecting Servant Leadership theory (Greenleaf 1977) and also transformational leadership (Burns 1978).

Srinivasan (2014) proved the Gita's influence on business leaders through many interviews and found formative influences on the philosophy of leadership. Principles like equanimity (Samatvam) and (Svadharm) role specific duty in intense and high stake decisions has proved with empirical evidence.

4 Curriculum Integration and Institutional Studies

The National Education Policy 2020 (Ministry of Education Government of India 2020) after evidencing the importance of IKS, NEP 2020 has framed the policy to integrate IKS into curriculum of Higher Education.

The University Grant Commission (2022) report, role of integration of IKS in higher education has empirical justification in curriculum development. As an initiative has made some progress regarding, Central Universities, IIM's have initiated the steps and also the bottlenecks for effective implementation need to be addressed. Sengupta and Bhatt (2020) conducted institutional study at IIM Kozhikode, documenting the philosophical design and outcomes as sustained exposure toward Indian ethical values shifts have witnessed demonstrably.

5. Gaps in existing literature views

There is limited work that provides comprehensive, cross-disciplinary synthesis across each schools of Indian Knowledge (Gurukula, Arthashastra, Bhagavad Gita, Yogic tradition, Jain, Buddhist) simultaneously and potential pedagogy and learning outcomes of IKS integrate in curricula is nascent.

Research Methodology

The qualitative research design is based on secondary data. It is interpretative paradigm, which will contain social and institutional phenomena, carried out on existing text, records, scholarly discourse.

1 Research Design



It is based on Systematic literature review methodology, backed by policy text and institutional reports. The research question seeks to evaluate the accumulated body of knowledge. (Transfield, Denyer and Smart 2003). I.K.S integration is emergent interdisciplinary field which is vast but structured mapping of intellectual landscape can be possible.

2 Secondary Data Sources

Secondary data is drawn from 4 categorical sources principally:

i) Scholarly Books and Edited volumes

Indian management philosophy Chakraborty (1995), Prasad (2006), Singh and Bhatt (2018), Kangle (1965), and Rangarajan (1992) were studied from library and national digital repositories.

ii) Peer-Reviewed Journal Articles

Using the term "Indian Knowledge System" different journals were found from Journal of Business Ethics, and Asia Pacific Journal of Management. The searches were conducted on JSTOR, Google Scholar, EBSCO, searched terms like Gurukul education, Bhagavad Gita leadership, Arthashastra Strategy, and IKS curriculum.

iii) Policy and Institutional Documents

National Education Policy 2020 (Ministry of Education Government of India 2020) and UGC Report (University Grant Commission 2022) analyzed for their prescriptive framework and data.

iv) Classical Primary Sources in Translation

v) Kangle's Arthashastra (1965), Rangarajan's Penguin Arthashastra (1992), Vivekananda's collected works are concerned for accuracy endurances.

3 Data Collection Procedure

Data from literature collected in 2 main phases:

First, Scoping review to narrowed down to domain:

a) Substantively with Indian philosophy and educational traditions.

b) Convergence these with modern management theories.

c) Mere Ideological, devotional theories without applications are excluded.

Second, analytical review examined from selected sources as theoretical framework which would contain institutional examples, empirical evidences. Also the convergence and divergence and gaps which are pointed towards themes like H.R.D, Sustainability, Pedagogical innovation, Critical perspective.

4 Data Analysis

The analysis processed through three stages

First, for qualitative content analysis, descriptive coding of content with relevant topic and tradition reviewed deeply.

Second, for interpretive analysis, identifying conceptual linkages between Indian classical frameworks and contemporary management theories has been carried out.

Third, critical synthesis evaluated to find out linkage, contradiction and strength as evidence for IKS integration in management curricula.

Empirical studies, institutional documents also have been taken in to consideration to conclude or to limit the discussions.

5 Limitation

The available literature on IKS integrated curricula is limited which restricts learning outcome.

Diversity of Indian philosophical schools is vast, within the present paper it cannot be possible to analyze with all aspects.

These limitations lay a base for productive direction for future research.

Convergence between Indian Traditional Knowledge and Modern management concepts.

1 Leadership philosophy

Leadership now-a-days has evolving from transactional to transformational. The articulated ideas of Leadership models and Servant leadership have gaining importance. Concepts like Nishkama Karma. A duty without ego is resonates with Robert Greenleaf's (1977) servant leadership model. In Arthshastra "Kings Happiness is directly depends on the happiness of his subjects." It is directly resonates with stakeholder's theory (Freeman, 1983 Rangarajan (1992).

Authentic leadership (Avolio and Gardner 2005) can be traced in Gurukula traditions implying the morale, led by example. Similarly the roles of Mahabharat Characters implies virtues like wisdom, courage, action are case studies for and teaching, leadership styles will provide feeds to decision making in dilemmas (Singh and Bhatt 2018).

2 Strategic thinking and Competitive analysis

Resource mobilization, crisis management, alliance formation, competitive intelligence is predatory over two millenia (Kangle 1965). Sama, Dama, Danda, Bheda (persuasion, incentives, coercion and diversion) are said to negotiation toolkit are parallel to negotiation theory frameworks (Fisher and Ury 1981). Saptanga theory of State constituents like king, minister, territory, fortification, treasury, army and allies can be traced in the VRIO framework (Barney, 1991) and resource-based view of competitive advantage can be seen in strategic management theories (Rangarajan 1992).

3 Ethics and Corporate Governance

The loopholes in governance and ethical setbacks led to witness corporate scandals and 2008 financial crisis, the rich ethical concepts and understandings are explained with rich vocabulary, terms like dharma (righteous duty) rita (cosmic order and fairness) Satya (truth) and ahimsa (non-harm) these are complementing and surpassing western management science (Chakraborty 1995). Trusteeship by Mahatma Gandhi which has resilience with Jain and Vedantic philosophy is a forerunner of stakeholders capitalism and ESG frameworks (Carroll 1999).

4 Organizational Behavior and Human resource development

The 'Panchakosha' model - five sheaths of human existence (physical, vital, mental, intellectual and blissful) gives holistic framework to understand human motivation levels and stages. Contrast to Maslow's Hierarchy of needs (Maslow 1954), states wellbeing also need to addressed and encountered at psychological, intellectual and spiritual dimensions. These are supporting positive psychology and well-being research in the context of the organization (Seligman 2011).

Triguna - three qualities (sattva, rajas, tamas) of sankhya philosophy behaves as Horizon for structural analysis to Big Five personality framework in organizational psychology (Singh and Bhatt 2018) and can



be possible to touch complex formation of personality and competency.

5 Sustainability and Environmental management

Sustainability, circular economy, environmental responsibilities are the challenges of modern teaching and organizational behaviors. But the themes like 'Vasudhaiva Kutumbakam' (the world is one family) provides vision of interdependence with can be seen as stakeholders theory (Senge 1990).

Institutional Integration of Indian Knowledge System in management education.

1 Policy Initiatives in India

The National Education Policy (NEP) 2020 has taken initiative in the integration of Indian Knowledge System across other disciplines, Management education (ministry of Education, Government of India 2020). The UGC has specially launched IKS integration, exclusively to encourage and to promote curriculum based on ancient ideology and wisdom.

IIMs Indian Institute of management Institutions have been framing the courses drawing on Indian philosophical text comprised of Indian Ethos, 'Dharmic leadership', 'ancient Indian management wisdom' (UGC 2022).

2 Curriculum Integration pedagogical Approaches

Gurukul model offers insights for management education, from active to passive lecture-based learning (Prasad 2006). The residential community, self-discipline, experimental learning, mentorship, integration of academic knowledge with development of character is pathways for transformative education (Mezirow, 1991).

From yoga tradition - the contemplative pedagogy like reflective journaling, incorporating meditation mindfulness are base for, to develop emotional intelligent and to carve future leaders (Goleman, 1995, Srinivasan 2014.)

Challenges and critical perspective

Allegation about the selective decontextualisation of the text is most raised concern in IKS.

The teaching and learning could be extracted and presented as convenient management metaphors (Nanda, 2003).

The Bhagavadgita's teaching might be misappropriated to justify workplace exploitation, obscuring its deeper meaning (Chakraborty 2000).

This also might be the scenario with traditional knowledge system is critical scrutiny by acknowledging historic abuse, internal contradiction may need for contextual adaption (Nanda 2003).

Additionally, diversity of Indian tradition with heterogeneity of philosophical schools, regional variation, interpretational computation would lead complex nuance rather generalization.

Faculty capacity is always been challenging to have meaningful integration of Indian knowledge system requires educators who have deeply trained in both the Doctrines.

A long-term endeavor of the Interdisciplinary faculty capacity building is not an immediate affect (University grants commission, 2022).

Future Direction and Recommendation

The integration and reconciliation of both knowledge systems is in its early stage, but potential is high and fruitful. So, the courses of action through several directions need attention.

First, Translating and interpreting classical texts for management application is rigorous, need to move beyond popular summaries is a mighty challenge. (Kangle, 1965, Rangarajan 1992)

Second, comparative study would enrich our understanding but it might complement or contradict need to accept and associate with (Boesche 2002).

Third, management institutions need to develop case studies based on Indian organizations, historic Events and tradition. Examples need to antecedence principles of ancient knowledge to contemporary business contexts.

Fourth, the ashrams, Gurukulas - inspired contemplative leadership workshops, mentorship initiatives can embody pedagogical wisdom (Mezirow 1991).

Fifth, collaboration between global businesses schools and Indian management institutions can facilitate mutual learning, in order to enrich global thought with Indian perspective, being remained open to critics.

Conclusions

The study is not just a nostalgic retreat to the past but the reclamation of sophisticated intellectuality.

The present challenges to the recovery of enduring wisdom would worthy attempt. The Gurukula, Bhagavadgita, Upanishad, Arthashastra, Buddhist scholasticism are rich resources of reservoir of insights for all practical and applicable aspects of leadership, sustainability, ethics, human development, strategy etc. (Chakraborty 1995, prasad 2006, Singh and Bhatt 2018).

The present working profit-centric framework couldn't capable of resolving contemporary crisis as workplace alienation, ethical lapses, and ecologic degradation.

Western education grapples with more foundational and fundamental, philosophical questions of model development.

The synthesis of Indian wisdom with modern management theory has magnificent potential to transform Management education with more grounded, sustainable, holistic base for graduates of business schools. Just not letting them to be merely technical competent but committed to human wellbeing and sustainability. (Chakraborty, 1995; Prasad, 2006; Singh & Bhatt, 2018).

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The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

Impact of Emotional Marketing on Brand Recall Among Rural Youth of Belagavi District

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Abstract:

The consumer continues to hold a central position in the marketplace, but the nature of consumption has changed significantly. Unlike the traditional buyer, who focused mainly on product features, the modern consumer is digitally connected, well informed, and strongly influenced by emotions, interacting with brands across multiple platforms throughout the purchase process. In this highly competitive environment, rational appeals alone are often not enough to attract attention and remain in consumers' memory. Consequently, emotional marketing has gained importance as an effective approach for building meaningful brand connections and influencing consumer behaviour through strong psychological associations between brands and consumers. The primary objectives of the study are to analyse how emotional appeals in advertisements influence brand recall, to identify the most effective emotional triggers, and to assess the role of demographic factors in shaping consumer responses. The study adopts a quantitative research design using primary data collected from 100 to 150 rural youth aged between 18 to 30 years multi-village surveys collected through a structured online questionnaire. Statistical tools such as percentage analysis, mean, and one-sample t-test are employed to evaluate the relationship between emotional marketing and brand recall. The findings indicate a significant positive relationship between emotional marketing and brand recall. Emotional appeals such as nostalgia, trust, and happiness were found to be particularly effective in enhancing memory retention and brand association. The study contributes to the existing literature by providing localized insights into rural consumer behaviour and highlights the importance of culturally relevant emotional content in advertising strategies. The study concludes that understanding the emotional orientation of today's consumer is crucial for designing effective marketing strategies and offers valuable implications for marketers aiming to strengthen brand recall through emotional engagement.

Keywords: Emotional Marketing, Brand Recall, Rural Youth, Consumer Behaviour, Advertising, Belagavi District

Introduction:

Modern marketers increasingly use emotional marketing to attract and retain consumers by shaping perceptions and strengthening brand recall. Emotional marketing appeals to feelings such as happiness, trust, nostalgia, fear, and love, which can improve memory retention and foster lasting brand relationships. Brand recall, defined as a consumer's ability to remember a brand within a product or service category without any prompt, plays an important role in influencing purchase decisions and brand preference. Studies suggest that emotional appeals in advertising often improve recall more effectively than purely rational or informational messages because they engage consumers at a deeper psychological level. While emotional marketing has been extensively studied in urban and developed markets, there remains a notable research gap in understanding its impact on rural consumers, particularly youth. Rural markets in India, including regions like Belagavi District in Karnataka, are undergoing rapid transformation due to increased digital penetration, improved connectivity, and rising aspirations among young consumers. Rural youth are increasingly exposed to digital platforms such as social media, online videos, and mobile advertising, which often employ emotionally engaging content. This study aims to analyse the impact of emotional marketing on brand recall among rural youth in Belagavi District.

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By focusing on a specific geographic and demographic segment, the research seeks to provide localized insights that can help marketers design more effective and culturally relevant advertising strategies.

Review Of Literature:

According to **Gobe (2001)**, emotional branding emphasizes creating a deep emotional bond between consumers and brands, which enhances loyalty and long-term engagement.

Kotler and Keller (2016) highlight that emotional appeals in advertising can significantly impact consumer attitudes and decision-making processes by connecting with their psychological and social needs.

Research by **Bagozzi, Gopinath, and Nyer (1999)** suggests that emotions play a critical role in shaping consumer responses, influencing both cognitive evaluations and behavioural intentions. Emotional stimuli in advertisements can trigger memory encoding processes, thereby improving brand recall.

In the context of brand recall, **Keller (1993)** defines it as a key dimension of brand awareness, where consumers can retrieve a brand name from memory under specific conditions. Studies have consistently shown that emotional advertising enhances recall by engaging consumers' attention and facilitating associative learning. For instance, advertisements that evoke nostalgia or happiness are more likely to be remembered and positively associated with the brand.

A study by **Singh and Verma (2018)** found that emotional appeals significantly influence recall and purchase intentions among consumers.

According to **Prahalad (2005)**, rural markets represent a vast untapped opportunity, but require customized marketing approaches that align with local contexts.

Research Gap:

While the existing literature establishes a strong link between emotional marketing and brand recall, still there is a significant research gap in the context of rural youth, particularly at the regional level. This study addresses this

Demographic Profile of Respondents

Table 1: Gender Distribution

Gender	Frequency	Percentage
Male	46	38.33%
Female	74	61.67%
Total	120	100%

Interpretation:

The majority of respondents are **female (61.67%)**, indicating higher participation of female rural youth.

Table 2: Age Distribution

Age Group	Frequency	Percentage
18–21	86	71.67%
22–25	25	20.83%
26–30	9	7.50%
Total	120	100%

gap by focusing on rural youth in Belagavi District and examining how emotional appeals in marketing influence their ability to recall brands. The findings are expected to contribute to both academic research and practical marketing strategies tailored to rural markets.

Scope Of The Study:

The present study focuses on examining the impact of emotional marketing on brand recall among rural youth (aged between 18 and 30 years) of Belagavi District, Karnataka. The study is limited to emotional marketing strategies used in advertisements and their effect on brand recall. It examines key emotional triggers such as happiness, trust, nostalgia, fear, and love, and evaluates how these emotions influence consumers' ability to remember brands. The study does not extensively cover other aspects of marketing such as pricing strategies, product quality, or distribution channels.

Objectives Of the Study:

- To examine the impact of emotional marketing on brand recall among rural youth
- To identify key emotional triggers (joy, trust, nostalgia, fear, etc.) influencing recall
- To analyse the role of demographic factors (age, education, gender)
- To suggest marketing strategies for rural markets

Research Methodology

The study adopts a quantitative research design using primary data collected from 150 to 200 rural youth aged between 18 to 30 years multi-village surveys collected through a structured questionnaire. Statistical tools such as percentage analysis, mean, and one-sample t-tests are employed to evaluate the relationship between emotional marketing and brand recall.

Data Analysis And Interpretation

For data collection is made through a structured questionnaire from **120 respondents**. Statistical tools such as **percentage analysis, mean, and one-sample t-test** are used to analyse the data.



Interpretation:

Most respondents (71.67%) belong to the **18–21 age group**, showing that the study mainly reflects younger rural youth.

Analysis Of Emotional Marketing Impact

Table 3: Emotional Ads Help Recall Brands Easily

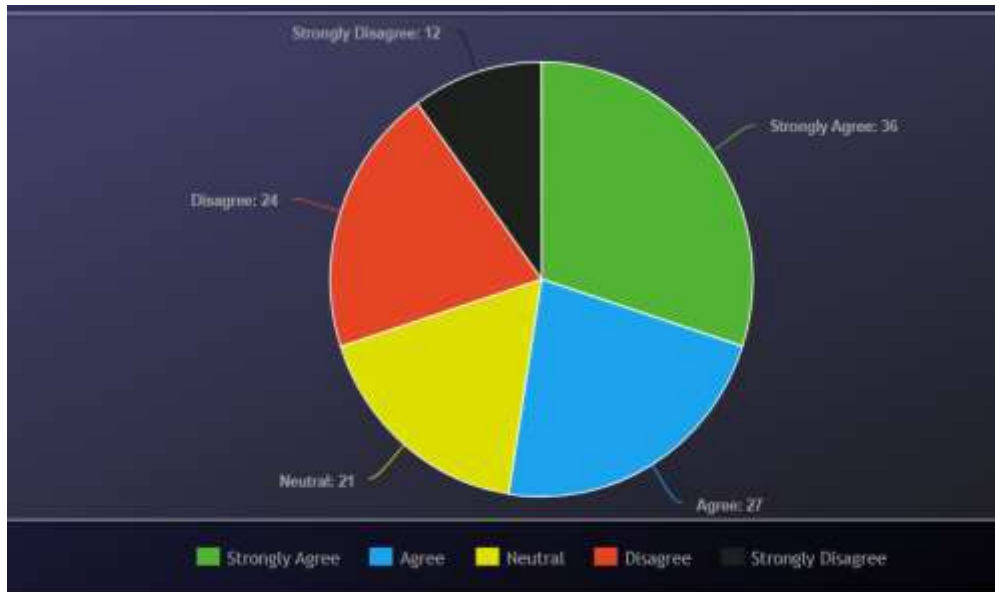
Response	Frequency	Percentage
Strongly Agree	36	30.00%
Agree	27	22.50%
Neutral	21	17.50%
Disagree	24	20.00%
Strongly Disagree	12	10.00%
Total	120	100.00%

Interpretation:

About **52.50% respondents agree** that emotional advertisements help in brand recall, while **30.00% disagree**, indicating a **high level of influence**.

Sl. No	Question	Key Response	Percentage	Interpretation
1	Media Usage	Social media $\approx$ 75–85	$\sim$ 65–70%	Majority depend on digital media
2	Watching Ads	Frequent/Occasional $\approx$ 80–90	$\sim$ 70–75%	High exposure to advertisements
3	Emotional Ads Attract Attention	Agree $\approx$ 60	$\sim$ 50%	Emotional ads grab attention
4	Emotional Connection	Agree $\approx$ 55	$\sim$ 45%	Moderate emotional bonding
5	Influence on Purchase	Agree $\approx$ 50	$\sim$ 42%	Limited influence on buying decision
6	Kannada Ads Connection	Agree $\approx$ 70	$\sim$ 58%	Regional language is very effective
7	Remember Emotional Ads	Agree $\approx$ 60	$\sim$ 50%	Improves recall ability
8	Emotional Ads Help Recall	Agree = 63 out of 120	52%	High impact on recall
9	Long-term Memory	Agree $\approx$ 65	$\sim$ 54%	Emotional ads stay longer
10	Recall Without Name	Agree $\approx$ 45	$\sim$ 38%	Not strong enough alone
11	Influence on Brand Choice	Agree $\approx$ 50	$\sim$ 42%	Moderate influence
12	Emotional vs Rational	Mixed $\approx$ 50–55	$\sim$ 45%	Both types important
13	Type Remembered	Emotional $\approx$ 70	$\sim$ 58%	Emotional ads more memorable
14	Ads Remembered	Santoor, Dettol etc.	—	Emotional content helps recall
15	Reason for Recall	Emotional connection $\approx$ 70	$\sim$ 58%	Emotion drives memory

Emotional Ads Help Brand Recall (Scaled to 120)



Hypothesis:

- H_0 : Emotional marketing has no significant impact on brand recall
- H_1 : Emotional marketing has significant impact on brand recall

Table 4: One-Sample Statistics

Variable	N	Mean	Std. Deviation	Std. Error Mean
Brand Recall	120	3.43	1.23	0.112

Table 5: One-Sample Test

(Test Value = 3) (Significance level=0.05)

t-value	df	Sig. (2-tailed)	Mean Difference
3.84	119	< 0.001	0.43

Interpretation

A one-sample t-test was conducted to determine whether the mean perception of respondents regarding the impact of emotional marketing on brand recall significantly differs from the neutral value ($\mu = 3$). The results indicate that the sample mean ($M = 3.43$, $SD = 1.23$) is significantly higher than the test value.

The calculated t-value ($t = 3.84$, $df = 119$) with a significance level of $p < 0.001$ demonstrates that the difference is statistically significant. Therefore, the null hypothesis (H_0), which states that emotional marketing has no significant impact on brand recall, is rejected. This result confirms that emotional marketing has a significant positive influence on brand recall among rural youth in Belagavi District.

Findings Of the Study

The analysis of data collected from rural youth respondents reveals several important findings regarding the role of emotional marketing in influencing brand recall:

1. The demographic profile indicates that the majority of respondents belong to the 18–21 age group, reflecting a young and increasingly digitally connected rural

population. Female respondents constitute a larger share, suggesting higher engagement levels in survey participation.

2. The findings highlight that a substantial proportion of respondents are frequently exposed to advertisements through digital platforms such as social media, indicating a shift in media consumption patterns even in rural areas.
3. Emotional advertisements were found to significantly attract attention and enhance memorability. A majority of respondents expressed agreement that emotionally appealing advertisements help them recall brands more easily.
4. Among various emotional triggers, feelings such as happiness, trust, and nostalgia emerged as the most influential factors contributing to brand recall, indicating the effectiveness of positive emotional appeals.
5. Advertisements in the regional language (Kannada) were found to create a stronger emotional connection with respondents, thereby improving recall ability and reinforcing brand association.



6. The statistical analysis (one-sample t-test) indicates that the mean perception of respondents is significantly higher than the neutral value, confirming that emotional marketing has a statistically significant positive impact on brand recall.
7. Despite the strong influence on recall, emotional marketing shows only a moderate impact on actual purchase decisions, suggesting that other factors such as price, product quality, and availability also play a critical role.
8. Overall, the findings confirm that emotional marketing is an effective strategy for enhancing brand recall among rural youth, particularly when aligned with local cultural and linguistic contexts.

Further Suggestions:

Based on the findings of the study, the following suggestions are proposed to enhance the effectiveness of emotional marketing strategies in rural markets:

1. Marketers should design advertisements that evoke strong positive emotions such as happiness, trust, and nostalgia, as these have been found to significantly enhance brand recall among rural youth.
2. The use of regional language, particularly Kannada in the context of Belagavi District, should be prioritized in advertising campaigns to establish a deeper emotional connection and improve communication effectiveness.
3. Emotional appeals should be integrated with rational elements such as product features, quality, and pricing to influence not only brand recall but also purchase decisions.
4. Digital marketing platforms, especially social media, should be strategically utilized to deliver emotionally engaging content, considering the increasing digital exposure among rural youth.
5. Advertisements should reflect local culture, traditions, and relatable scenarios to improve authenticity and strengthen emotional engagement with the target audience.
6. Since emotional marketing alone has a moderate effect on buying behaviour, companies should adopt a holistic marketing approach combining emotional, social, and functional value propositions.

Conclusion:

The study concludes that emotional marketing plays a key role in influencing brand recall, when localized and culturally aligned, serves as a powerful tool for enhancing brand recall among rural youth, thereby offering significant strategic value for marketers targeting emerging rural markets.

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I would like to express my sincere gratitude to all those who have contributed to the successful completion of this research project entitled "**Impact of Emotional Marketing on Brand Recall Among Rural Youth of Belagavi District.**"

First and foremost, I express my heartfelt thanks to my project guide and respected faculty members for their invaluable guidance, constant encouragement, and constructive suggestions throughout the course of this

study. Their expertise and support have been instrumental in the successful completion of this research.

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I would like to acknowledge the contributions of authors, researchers, marketing experts, and scholars whose books, journals, articles, and research publications provided important theoretical and practical insights into emotional marketing and consumer behavior.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

An Economic Analysis of Goat Farming in Hukkeri Taluka, Karnataka State

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Abstract

This study presents a comprehensive economic analysis of goat farming in Hukkeri Taluka, Belagavi District, Karnataka, based on a structured primary survey of 124 goat farmers across multiple villages. The study examines the socio-economic profile of farmers, production systems, cost structures, income patterns, and profitability of goat farming. A cost-benefit analysis reveals that the average annual income from goat farming is ₹1,24,496 against an average annual operational cost of ₹50,688, yielding a net profit of ₹85,125 per annum. The Benefit-Cost Ratio (BCR) of approximately 2.46 confirms the economic viability of goat farming. Hypothesis testing indicates a statistically significant positive correlation ($r = 0.660, p < 0.001$) between herd size and net profit. The study concludes that goat farming is a profitable enterprise for rural households in Hukkeri Taluka, serving as a critical source of income and livelihood security, particularly for marginal and landless farmers.

Keywords: Goat Farming, Economic Analysis, Hukkeri Taluka, Cost-Benefit Analysis, Rural Livelihood, Karnataka

Introduction

Livestock farming, and goat rearing in particular, holds a pivotal position in India's rural agrarian economy. Goats are often referred to as "the poor man's cow" due to their low maintenance cost, high adaptability, and quick returns. India is the second-largest goat population country in the world, with over 148 million goats, contributing significantly to meat, milk, fiber, and manure production. Karnataka, one of South India's main farming states, has long combined goat keeping with crop growing. In the northern districts, especially Belagavi, small and marginal farmers turn to goat rearing to boost their income. Hukkeri Taluka, in Belagavi District, is the heart of this agro-pastoral mix, where livestock—goats in particular—carries a vital economic punch for local households.

There's a noticeable void in rigorous economic research on goat farming at the taluka level, even though the sector matters a lot to rural economies. To close that gap, this article dives into primary data taken directly from farmers. We spoke with 124 goat owners who live in villages around Hukkeri Taluka, running structured surveys that capture everything from herd size to income streams. The villages covered include Beniwad, Kotabagi, Madihalli, Belavi, Sollapur, Rakshi, and several others in the area. Through this fieldwork, we aim to bring clearer, data-driven insights to a topic that's been under-examined.

Objectives of the Study

1. To analyze the socio-economic profile of goat farmers in Hukkeri Taluka.
2. To examine the production systems, herd composition, and management practices adopted.
3. To assess the cost structure and income from goat farming.
4. To conduct a cost-benefit analysis and evaluate profitability.
5. To test hypotheses regarding factors influencing net profit.
6. To offer findings, suggestions, and policy recommendations.

Research Methodology

The research blends two approaches: descriptive and analytical. Back in April 2026, we rang up goat farmers across Hukkeri Taluka and asked them to fill out a quick Google-Form survey.

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From that effort came 124 fully completed responses, each offering a snapshot of who they are, how long they've been farming, the size and makeup of their herds, and the day-to-day tactics they use to run their farms.

With the data in hand, we started by crunching the basics—counts, percentages, and averages—to see the overall picture. Next, we flipped the script and ran a cost-benefit analysis, which gave us a benefit-cost ratio that tells us whether the money spent on goat farming pays off in the long run. Finally, we dug deeper with two statistical tests: Pearson's correlation to spot any pairwise trends, and an independent-samples t-test to compare groups where relevant.

Socio-Economic Profile of Respondents

1 Gender Distribution

Table 1 presents the gender-wise distribution of goat farmers surveyed in Hukkeri Taluka.

Category	Number of Respondents	Percentage (%)
Male	100	80.6%
Female	24	19.4%
Total	124	100.0%

Table 1: Gender Distribution of Goat Farmers

In rural Karnataka, most goat farmers are men, roughly 80 in 100. That ratio mirrors the long-standing gender roles in livestock work. Yet the fact that about 20 percent of the farmers are women matters. It shows that goat farming isn't a male exclusive; it offers a reliable source of income for women, particularly those balancing everyday chores with their herds.

Figure 1: Gender Distribution of Respondents

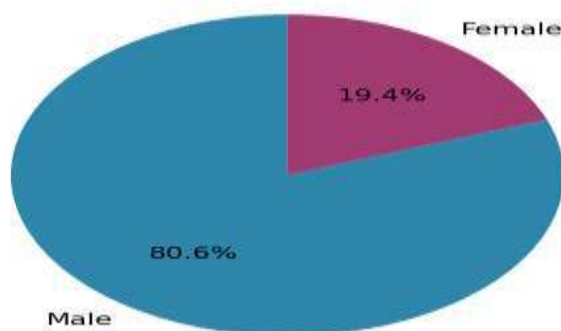


Figure 1: Gender Distribution of Respondents

2 Age Group Distribution

Table 2 shows the age-group distribution of surveyed farmers.

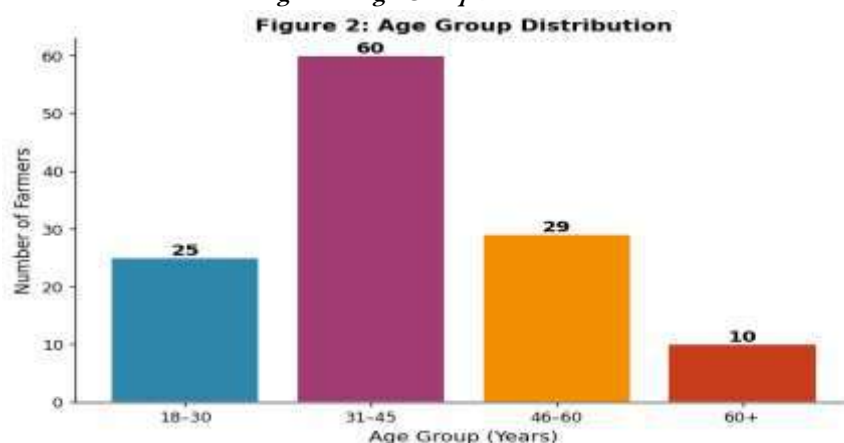
Age Group (Years)	Number of Respondents	Percentage (%)
18–30	25	20.2%
31–45	60	48.4%
46–60	29	23.4%
60+	10	8.1%
Total	124	100.0%

Table 2: Age Group Distribution of Goat Farmers

Almost half of the farmers 48.4 %, turn out to be between 31 and 45, a clear sign that goat farming is mainly a working-age occupation. Yet the numbers for the younger set are anything but trivial: 20.2 % of owners are 18 to 30, showing that the trade can keep a younger generation busy and earning. Even the older cohort keeps on its mark 8.1 % are 60 or older reminding us that many people stay with the job for life.



Figure 2: Age Group Distribution



3 Education Level

Table 3 presents the educational background of the respondents.

Education Level	Number of Respondents	Percentage (%)
Illiterate	44	35.5%
Primary School	28	22.6%
High School	22	17.7%
PUC (12th)	24	19.4%
Graduate/Diploma	6	4.8%
Total	124	100.0%

Table 3: Education Level of Goat Farmers

Most of our farmers, about a third, 35.5%—can't read. Even more, more than half have only a primary-school education. That fact shows we need to move beyond written manuals. Hands-on demos, field-day workshops, and smartphone apps that give advice without pages can make a real difference. The limited number of graduates reminds us that public and NGO outreach programs are essential, not optional. In short, we have to reach people where they are, using the tools they're comfortable with.

Figure 3: Education Level Distribution

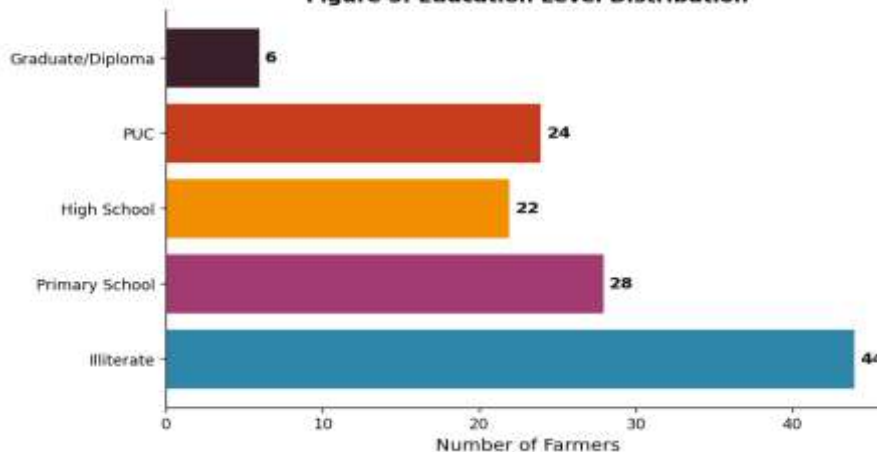


Figure 3: Education Level Distribution

3.4 Land Holdings

Table 4 presents the distribution of land holdings among respondents.

Land Holding Category	Number of Respondents	Percentage (%)
No Land (Landless)	31	25.0%
Below 2.5 Acres (Marginal)	59	47.6%



Land Holding Category	Number of Respondents	Percentage (%)
2.5–5 Acres (Small)	17	13.7%
5–10 Acres (Medium)	14	11.3%
Above 10 Acres (Large)	3	2.4%
Total	124	100.0%

Table 4: Land Holdings Distribution

A striking 72.6% of farmers are either landless or own less than 2.5 acres, indicating that goat farming primarily serves marginal and landless households. This underscores the role of goat rearing as a critical supplementary income strategy for the rural poor, requiring minimal land and offering high returns per unit of investment.

Figure 8: Land Holdings Distribution

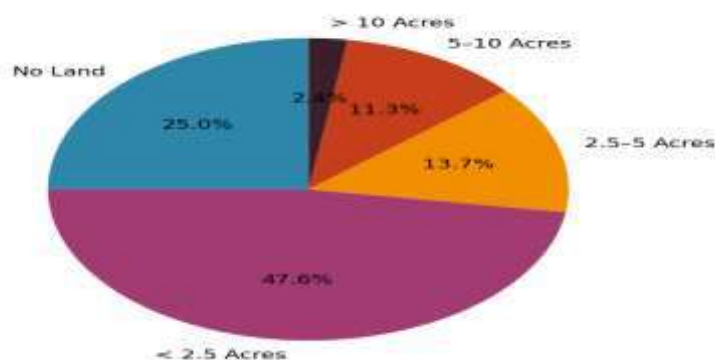


Figure 4: Land Holdings Distribution

5 Primary Occupation

Table 5 presents the primary occupation of respondents.

Primary Occupation	Number of Respondents	Percentage (%)
Agriculture + Goat Farming	76	61.3%
Labour + Goat Farming	22	17.7%
Only Goat Farming	21	16.9%
Others (Multiple)	5	4.0%
Total	124	100.0%

Table 5: Primary Occupation of Goat Farmers

Goat farming is primarily practiced as a supplementary activity alongside agriculture (61.3%). About 17.7% combine it with daily labour, reflecting its appeal to the landless poor. Only 16.9% rely solely on goat farming as their primary livelihood, demonstrating its role as an income-diversification strategy rather than a standalone enterprise for most farmers.

Figure 4: Primary Occupation of Farmers

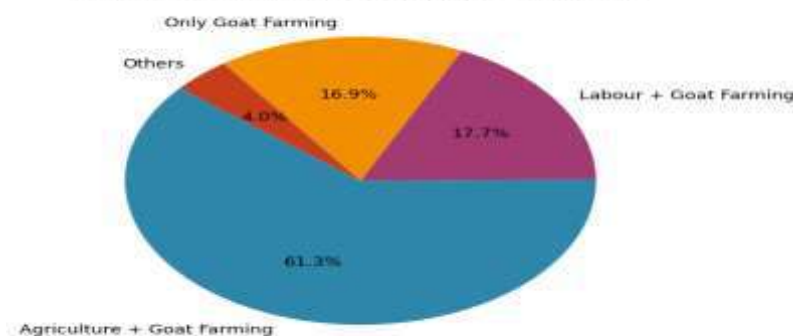


Figure 5: Primary Occupation Distribution



4. HERD COMPOSITION AND PRODUCTION SYSTEMS

4.1 Herd Composition

Table 6 presents the average herd composition of goat farms surveyed.

Category	Average Number per Farm	Min	Max
Does (Adult Female)	10.5	1	80
Bucks (Adult Male)	5.3	0	45
Female Kids (< 6 months)	4.8	0	30
Male Kids (< 6 months)	3.9	0	25
Total Herd (Average)	24.4	1	88

Table 6: Average Herd Composition

The average total herd size is 24.4 goats per farm, with does forming the core productive stock. The median herd size is 12, indicating skewness with some large farms. Does outnumber bucks significantly (10.5 vs. 5.3), reflecting focus on breeding and kid production. The small to medium herd sizes indicate that most operations are household-level enterprises.

4.2 Rearing System

Table 7 presents the rearing systems adopted by goat farmers.

Rearing System	Number of Farmers	Percentage (%)
Intensive (Stall feeding only)	67	54.0%
Semi-Intensive (Grazing + Stall feeding)	38	30.6%
Extensive (Grazing only)	19	15.3%
Total	124	100.0%

Table 7: Rearing System Adopted

Over half (54%) practice intensive stall-feeding, driven by land scarcity and the adoption of improved management practices. Semi-intensive (30.6%) and extensive (15.3%) systems are also practised, often in households with access to common grazing lands. Intensive farming generally yields better weight gain and disease control, but at higher feed costs.

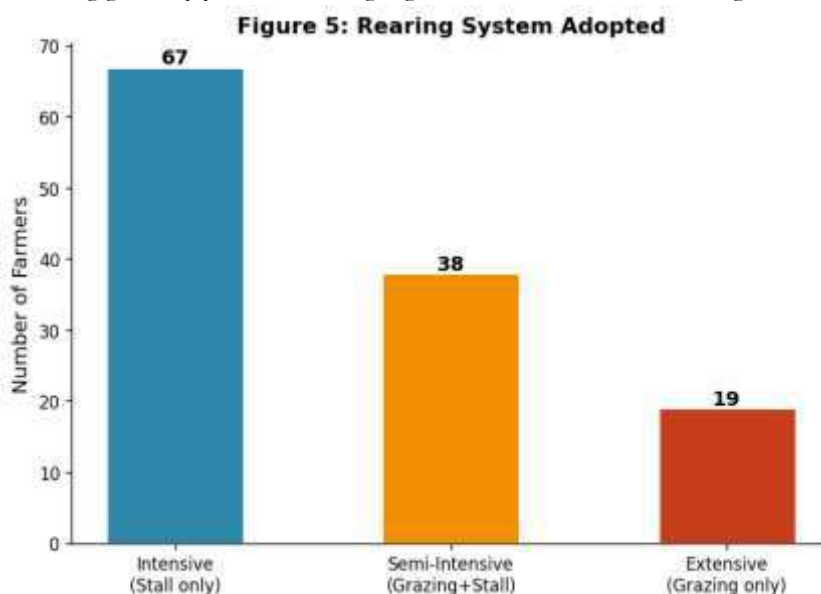


Figure 6: Rearing System Distribution

5 Infrastructure and Shed Type

Table 8 presents the type of shed used by farmers.

Shed/Roof Type	Number of Farmers	Percentage (%)
Tin/Asbestos Sheets	86	69.4%



Shed/Roof Type	Number of Farmers	Percentage (%)
Tile Roof	21	16.9%
Open System (No Roof)	11	8.9%
Thatched (Grass/Leaves)	6	4.8%
Total	124	100.0%

Table 8: Type of Shed/Infrastructure

Most farmers (69.4%) use tin or asbestos sheet roofing for their goat sheds, reflecting low-cost semi-permanent infrastructure. A small proportion (8.9%) have no shed, exposing animals to climate stress and disease risks. Proper infrastructure is essential for goat health and productivity, and its inadequacy is a constraint for extensive farmers.

Financial Analysis and Cost-Benefit Assessment

1 Investment and Cost Structure

Table 9 presents the key cost parameters of goat farming.

Cost Component	Average (₹)	Min (₹)	Max (₹)
Total Initial Investment	1,31,873	0	7,00,000
Shed Construction Cost	54,274	0	3,00,000
Annual Feed/Fodder Cost	42,021	0	3,00,000
Annual Labour Cost (Paid+Imputed)	8,667	0	2,00,000
Total Annual Operating Cost	50,688	0	3,60,000

Table 9: Investment and Cost Structure (Per Farm, Annual)

Feed and fodder costs constitute the largest share of annual operational costs (₹42,021 out of ₹50,688 total, i.e., ~83%), indicating that feed management is the most critical cost driver. Labour costs are relatively low (₹8,667) as most farms rely on family labour. Initial investment ranges widely (₹0–₹7,00,000), with a mean of ₹1,31,873, reflecting diverse scales of operation.

2 Income Structure

Table 10 presents the income streams generated from goat farming.

Income Source	Average Annual Income (₹)	Percentage of Total Income
Sale of Animals (Goats/Kids)	99,825	80.2%
Income from Manure	21,365	17.2%
Income from Milk (if sold)	3,307	2.7%
Total Annual Income	1,24,496	100.0%

Table 10: Annual Income from Goat Farming

The primary income source is the sale of animals (80.2%), followed by manure (17.2%), which is an often-undervalued by-product. Milk contributes minimally (2.7%) as most farmers rear non-dairy local breeds. Manure income is particularly important for agricultural households who use it as organic fertilizer, reducing input costs.

3 Sale Prices

Table 11 presents average sale prices for different animal categories.

Animal Category	Average Sale Price (₹)	Remarks
Male Kid (6 months)	10,027	Primary revenue source
Female Kid (6 months)	5,509	Often retained for breeding
Adult Female (Doe)	10,546	Sold after productive years

Table 11: Average Sale Prices by Animal Category

Male kids command the highest average price (~₹10,027) and adult females fetch comparable prices (~₹10,546). Female kids are valued lower (₹5,509) as they are retained for breeding purposes. Prices peak during festive seasons (Dasara/Jatre), and Hukkeri and Gokak weekly markets are the predominant selling locations.

4 Cost-Benefit Analysis



Table 12 presents the cost-benefit analysis summary.

Parameter	Value (₹)	Remarks
Average Total Annual Income	1,24,496	Animals + Manure + Milk
Average Total Annual Operating Cost	50,688	Feed + Labour
Average Annual Net Profit	85,125	Income minus all costs
Benefit-Cost Ratio (BCR)	2.46	>1 indicates profitability
Farmers with BCR > 1	114/123 (92.7%)	Economically viable
Farmers reporting profitability	120/124 (96.8%)	Self-assessed

Table 12: Cost-Benefit Analysis Summary

The Benefit-Cost Ratio of 2.46 indicates that for every ₹1 invested in annual operations, farmers earn ₹2.46 in income — strongly affirming the economic viability of goat farming. An overwhelming 92.7% of farmers have BCR > 1, and 96.8% self-reported profitability. The average net annual profit of ₹85,125 represents a significant income supplement for rural households.

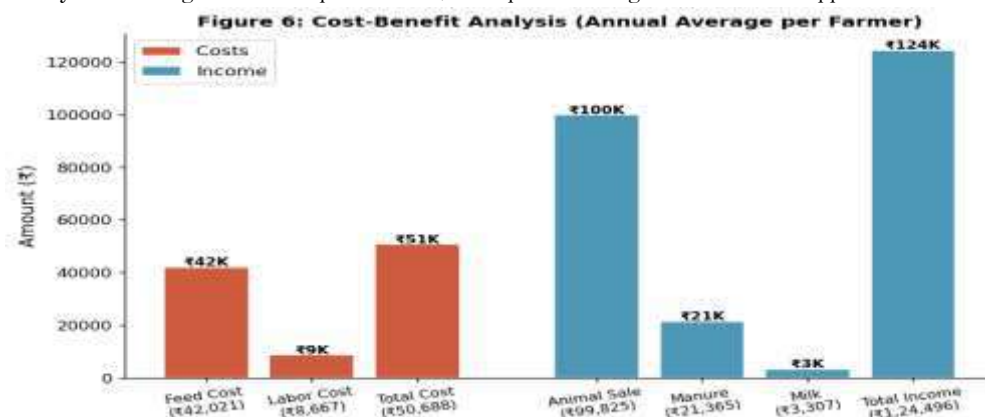


Figure 7: Cost-Benefit Analysis – Annual Average per Farmer

Health Management and Market Linkages

1 Health Management

Table 13 presents key health and disease management practices.

Health Management Indicator	Response	Count	Percentage (%)
Vaccination (PPR/FMD)	Yes	89	71.8%
Vaccination (PPR/FMD)	No	35	28.2%
Growth Tonics/Injections Used	Yes	94	75.8%
Growth Tonics/Injections Used	No	30	24.2%
Avg. Kid Mortality (< 3 months/year)	Per farm	2.1	Approx.
Avg. Adult Mortality (per year)	Per farm	0.8	Approx.

Table 13: Health Management Practices

A majority (71.8%) vaccinate against PPR and FMD, and 75.8% use growth tonics/injections, reflecting increasing adoption of modern health management. However, 28.2% not vaccinating their animals remains a significant risk for disease outbreaks. Kid mortality (~2.1 per year per farm) is a key concern, highlighting the need for improved neonatal care protocols.

2 Credit and Government Support

Table 14 presents the access to credit and government schemes.

Support Type	Yes	% Yes	No	% No
Bank Loan for Goat Farming	24	19.4%	100	80.6%
Other Sources of Loan	14	11.3%	110	88.7%



Support Type	Yes	% Yes	No	% No
Government Scheme Benefits	11	8.9%	113	91.1%

Table 14: Access to Credit and Government Schemes

Access to formal credit is severely limited — only 19.4% obtained bank loans, and a mere 8.9% benefited from government schemes. This financial exclusion forces most farmers to rely on personal savings or informal borrowing. The low uptake of government schemes (like NABARD-linked livestock credit) indicates gaps in awareness, outreach, and administrative accessibility at the village level.

HYPOTHESIS TESTING

Hypothesis 1: Herd Size Positively Correlates with Net Profit

H₀ (Null Hypothesis): There is no significant correlation between herd size and annual net profit of goat farmers.

H₁ (Alternative Hypothesis): There is a significant positive correlation between herd size and annual net profit.

Statistical Measure	Value
Test Applied	Pearson's Correlation Coefficient
Pearson's r	0.660
p-value	< 0.001 (highly significant)
Significance Level (α)	0.05
Decision	Reject H ₀
Conclusion	Significant positive correlation exists

Table 15: Hypothesis Test 1 – Herd Size vs. Net Profit

The correlation came out pretty strong about 0.66 and, with a p-value well below 0.001, it's hardly a fluke. In plain terms, bigger herds usually bring bigger profits, almost on a straight-line basis. That's exactly what we'd expect when economies of scale kick in: more cattle, more sales, a bigger bottom line. Because the data show such a clear pattern, we can safely toss out the null hypothesis—there is no relationship—at the 1 % significance level.

Hypothesis 2: Rearing System Significantly Affects Net Profit

H₀: There is no significant difference in net profit between intensive and semi-intensive rearing systems.

H₁: Intensive rearing system yields significantly different net profit compared to semi-intensive rearing.

Statistical Measure	Value
Test Applied	Independent Samples t-test
Intensive Mean Net Profit (n=67)	₹91,098
Semi-Intensive Mean Net Profit (n=38)	₹91,843
Extensive Mean Net Profit (n=19)	₹52,117
t-statistic (Intensive vs Semi)	-0.030
p-value	0.9762
Decision	Fail to Reject H ₀ (Intensive vs Semi)
Observation	Extensive system yields significantly lower profit

Table 16: Hypothesis Test 2 – Rearing System vs. Net Profit

Interpretation: There is no statistically significant difference in net profit between intensive and semi-intensive rearing systems ($p = 0.976$). However, the extensive system generates substantially lower mean profit (₹52,117) compared to both intensive (₹91,098) and semi-intensive (₹91,843) systems. This suggests that either stall or combined stall+grazing systems are economically superior

to pure grazing. The null hypothesis cannot be rejected for intensive vs. semi-intensive comparison.

Key Findings

1 Socio-Economic Findings

1. About 81 % of goat farmers are men, most of whom fall into the 31-to-45 age range. This skew shows that the



working-age demographic is driving livestock work around here.

2. Roughly three-quarters of the herd owners are either on less than two and a half acres or have no land at all. For many families in Hukkeri Taluka, raising goats is a lifeline that fills the gap left by small-holding crop farming.

3. With a third of the community still illiterate, there's a clear bottleneck: new techniques and better ways of getting products to market are hard to spread.

4. When folks combine crop cultivation with goat keeping, they make up 61 % of the local economy's backbone. That blend underlines how tightly knit rural livelihoods are—what you grow and what you raise go hand in hand.

2 Production System Findings

5. Over half of the farms about 54 % rely on intensive stall-feeding. That preference comes from a lack of grazing land and a push for tighter weight control.

6. On average, a farm keeps around 24 goats, but the spread is wide. While some run tiny herds, others manage sizeable flocks; the median of 12 highlights just how varied the scales are.

7. Tin or asbestos roofs dominate goat housing, covering roughly 70 % of the shelters. The choice reflects a simple, cost-effective construction strategy.

8. Roughly 72 % of farmers vaccinate against PPR and FMD, and 76 % use growth tonics. Together, these numbers show a step-up in overall animal-health practices.

3 Economic Findings

9. Goat farming is driven almost entirely by the cost of feed and fodder. About eight-in-ten of all operational expenses—roughly 83 %—come from that front, so trimming that line is the biggest lever for cutting costs.

10. When farmers look at what actually brings money in, animal sale tops the chart, making up just over four-fifths (80.2 %) of total income. Manure follows, at 17.2 %, which reminds us that these farms produce more than just goats.

11. The economics check out well: the average Benefit-Cost Ratio sits at 2.46, meaning most farmers (over nine in ten, 92.7 %) end up turning a profit. On the surface, that translates into an average net profit of about ₹85,125 per year—a sizeable boost for rural families.

12. Seasonal peaks further shape the business. During the Dasara or Jatre festival season, prices climb to their highest levels, and the main sales hubs are the markets in Hukkeri and Gokak. These moments can push margins especially high.

4 Institutional Findings

13. Only 8.9 % of farmers actually tap into government schemes, and just 19.4 % manage to pull in bank credit for goat farming. That disparity highlights a deep crack in financial inclusion.

14. When the numbers line up, a clear positive link appears: herd size and net profit move together ($r = 0.660$, $p < 0.001$). In everyday terms, the bigger the herd, the bigger the earnings. So, scaling up operations looks like a practical way to lift income.

Suggestions And Policy Recommendations

Based on the analysis, the following suggestions are offered for farmers, policymakers, and extension agencies:

1 For Farmers

1. Herd Size Optimization: Since net profit is strongly correlated with herd size ($r = 0.660$), farmers should aim to progressively increase their herd to at least 20–30 productive does to achieve viable income levels.

2. Feed Cost Reduction: As feed accounts for ~83% of operational costs, farmers should adopt fodder cultivation (Napier, Lucerne, Maize) on available land and explore community-based fodder banks to reduce cost.

3. Record Keeping: Maintaining farm records for costs, income, and animal health will enable better financial decision-making and loan applications.

4. Cooperative Formation: Forming Goat Farming Producer Groups or cooperatives will enhance collective bargaining power in the market and reduce intermediary margins.

2 For Government and Policymakers

5. Credit Access: The State Government and NABARD should simplify credit procedures for livestock farmers. A dedicated "Goat Kisan Credit Card" on the lines of the agricultural KCC should be introduced.

6. Government Scheme Outreach: With only 8.9% farmers accessing schemes, aggressive village-level awareness camps are essential. Gram Panchayats should be engaged as the primary dissemination channel.

7. Market Infrastructure: Developing dedicated weekly livestock markets (pashu shantas) in Hukkeri Taluka with grading, weighing, and veterinary facilities will improve price realization.

8. Insurance: Enrolment under the Pradhan Mantri Fasal Bima Yojana-equivalent livestock insurance scheme should be made mandatory to protect against disease and mortality losses.

3 For Extension Services

9. Training Programs: Regular farmer training on intensive feeding management, castration techniques, vaccination schedules, and record-keeping should be delivered in Kannada through audio-visual materials.

10. Breed Improvement: Introduction of improved dual-purpose breeds (e.g., Osmanabadi, Sangamneri) through AI (Artificial Insemination) programs can enhance productivity and market value.

11. Veterinary Access: Mobile veterinary clinics should be deployed in Hukkeri Taluka to reach remote villages, address the currently inadequate veterinary service coverage.

Conclusion:

This research dives into the economics of goat farming in Hukkeri Taluka, Belagavi District, Karnataka, by surveying 124 local goat keepers. The results speak loudly: goat farming is not just a side venture but a solid income earner for rural families in the area. With an average Benefit-Cost Ratio of 2.46 and a mean yearly gain of ₹85,125, nearly all farmers (96.8 %) say the venture pays off. For more than 72 % of respondents—most of whom are marginal or landless—goats are the central way to keep their



households afloat. One clear pattern emerged: bigger herds equal bigger profits. The correlation ($r = 0.660$, $p < 0.001$) shows that scaling up, helped by easier credit and government support, can noticeably raise earnings.

But obstacles remain. Few farmers, only 19.4 %, tap bank loans, while coverage of state schemes sits at a meager 8.9 %. Feed costs stay high and veterinarians are scarce. Fixing these gaps could unleash a wave of growth. Think livestock credit cards, mobile clinic teams, cooperatives that sell products collectively, and targeted outreach on best practices. These tools would let goat farms in Hukkeri reach their full potential. In short, goat farming here illustrates rural resilience. Rooted in heritage, driven by necessity, and expanding with modern techniques, it can become a powerful engine of development for northern Karnataka—if the right institutional backing arrives.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

Startup Ecosystem Growth and Employment Generation in India: Evidence from The Post-Startup India Initiative Period

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Abstract

This study investigates the growth trajectory of India's startup ecosystem and its employment generation impact over the decade 2016–2025, following the launch of the Startup India Initiative. Using a structured dataset comprising four macroeconomic variables include number of DPIIT-recognized startups, employment generation, startup funding and GDP growth rate. The study applies growth rate analysis, Compound Annual Growth Rate (CAGR), percentage analysis, Pearson correlation, and supplemented by graphical visualization. Findings of the study reveal that recognized startups grew at a CAGR of 40.26%, while employment expanded at a CAGR of 20%, reaching 21 lakh by 2025. Pearson correlation analysis indicates a near-perfect positive relationship between startup count and employment generation ($r = 0.995$, $p < 0.001$). The study provides evidence-based policy recommendations for deepening startup-led employment creation.

Keywords: Startup India, DPIIT, Employment Generation, Venture Capital, Pearson Correlation, Startup Ecosystem

Introduction

The Indian economy has undergone a transformative entrepreneurial revolution since the Government of India formally launched the Startup India Initiative on January 16, 2016. Conceived as a flagship policy under the aegis of the Department for Promotion of Industry and Internal Trade (DPIIT), the initiative aimed to build a robust, innovation-driven startup ecosystem by providing fiscal incentives, streamlining compliance, extending intellectual property fast-tracking, and facilitating access to risk capital¹. A decade later, India has emerged as the world's third-largest startup ecosystem, surpassing 1.40 lakh DPIIT-recognised startups by 2025 and generating approximately 32 lakh direct jobs. Startups, in India as in many other parts of the world, have received increased attention in recent years². Employment generation has historically been one of India's most pressing economic challenges. With 10–12 million new labour market entrants annually and a demographic dividend that must be productively absorbed, the quality and scalability of job creation mechanisms are of critical policy importance. The startup ecosystem, characterized by its scale-up potential, technology orientation, and employment multiplier effects, presents a compelling structural solution. However, the empirical evidence linking startup growth to employment generation in the Indian context remains fragmented, particularly for the post-2020 period.

This paper addresses this gap through a systematic quantitative analysis of all four key ecosystem indicators across the complete post-initiative period (2016–2025). The study integrates growth rate analysis, correlation, offering the most comprehensive decadal assessment of Startup India's employment impact available in the literature.

Review Of Literature

A startup refers to a firm that is still in the early phases of its business operations and is founded on invention and creativity. It is a business that is started with a small amount of money and other resources. Startups play an important role in driving economic growth & development globally³. In India the research on startup ecosystem has grown substantially since 2016. Bala Subrahmanya² in his study on new Generation Start-ups in India What Lessons Can We Learn from the Past? discuss the salient features of the start-up ecosystem that has emerged in our country, its adequacy for start-up promotion, and the measures needed to strengthen this and start-up growth in India,

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and its employment contribution, relative to the organised sector and the paper concludes with an emphasis on the need for a steady increase in new generation start-ups as a means of productive employment generation, economic transformation and growth⁴.

Yash Choudhary⁵ examines the progress of startup scenario in India from 2016-2025 and revealed that, the Startup India project, together with policy changes, funds, and digital infrastructure, has pushed the number of startups recognized from less than 500 in 2016 to slightly above 1.59 lakh by 2025 and the Indian startup ecosystem is not only ready to play a significant role in economic development but also to be a source of innovation, job creation, and global competitiveness.

Mr. Milan Girishbhai Patel and Dr. Hemal B. Pandya⁶ their study reveal trends in startup recognition and funding, offering insights into the symbiotic relationship between recognized startups and financial inflow. The correlation analysis, anchored by the Pearson correlation coefficient, provides a quantitative understanding of the strength and direction of this relationship.

The findings of the study on Growth of startup ecosystems in India by Surbhi Jain⁷ revealed that India had a very high scope for growth of startup ecosystems. India offers the largest pie of venture prospect that the world is eyeing.

Prof. Praveena M⁸ examines the Startups and its funding progress in India and concludes that eligibility, product range and importantly the financial assistance that can be availed in scheme that making capital more accessible and cheaper, easier patent filing, giving research and development credits, and easier entry and exits are critical to the success of Startup India.

Table 1: Variable Description

Variable	Unit / Scale	Source
Year	Calendar Year	DPIIT
Recognized Startups	Number (count)	DPIIT Annual Report
Employment Generation	Persons employed	DPIIT / Economic Survey of India
GDP Growth Rate	% (constant prices)	MoSPI / World Bank

The study uses Microsoft excel to prepare dataset and the Growth rate analysis, Trend Analysis, Correlation analysis and Graphical representation tools have been applied to analysis the available data. The Table 2 below presents the dataset used in the present study to analyze the Startup Ecosystem Growth and Employment Generation in India: Evidence from the Post-Startup India Initiative Period.

Analysis And Discussion

Dataset Overview

Table 2 presents the dataset covering all four study variables over the ten-year period 2016–2025. The Dataset

Table 2: India Startup Ecosystem Indicators (2016-2025)^{11,12,13,14}

Year	Recognized Startups	Employment Generation(Approx., in thousands)	GDP Growth (%)	Startup Growth Rate (%)	Employment Growth Rate (%)	Employ per Startup
2016	502	10000	8.3%			19.92
2017	5975	80000	6.8%	1090.24%	700.00%	13.39
2018	14955	200000	6.5%	150.29%	150.00%	13.37
2019	26840	350000	3.9%	79.47%	75.00%	13.04
2020	41692	550000	-5.8%	55.34%	57.14%	13.19
2021	61974	750000	9.7%	48.65%	36.36%	12.10
2022	88569	1000000	7.6%	42.91%	33.33%	11.29
2023	123411	1350000	9.2%	39.34%	35.00%	10.94

Dr. Sulochana S. Dengale⁹ examines the impact of startups on employment generation in India and the findings suggest that, while startups contribute significantly to job creation, sustainability and regulatory challenges remain key issues.

Dr. Prakash S Alalager¹⁰ in his study highlights policy needs in regional incubation, women-focused financing, improved data systems, and enhanced deep-tech investment to strengthen future innovation leadership.

Objectives Of the Study

The study pursues the following specific objectives:

1. To analyze the growth trend of recognized startups and employment generation.
2. To measure the strength and direction of correlations between all study variables using Pearson correlation analysis.
3. To assess the distribution and cyclical behavior of startup funding over the study period.
4. To evaluate the impact of the Startup India Initiative

Research Methodology

The nature of this study is descriptive and analytical. The study relies exclusively on secondary data collected from Department for Promotion of Industry and Internal Trade (DPIIT), RBI Statistics, World Bank Website, Ministry of Statistics and Programme Implementation and Economic Survey of India and NASSCOM Startup Ecosystem Reports. The study period covers data from 2016 to 2025, yielding 10 annual observations covering the complete post startup India period. The following Table 1 presents the variables along with unit of measurement and data source for the present study.

consists of recognized startups, employment generation, GDP growth rate, employment generated per startup. In addition, Table 3 presents funding information relating to the Fund of Funds for Startups (FFS) scheme has been incorporated to evaluate the financial support to startups in India. The data reflect the dramatic scale-up of India's startup ecosystem, with recognized startups growing, employment increasing from the baseline year. The notable exceptions to the growth trend are the 2020 funding contraction and the GDP contraction (−5.8% in 2020), and the 2023 funding increased.



2024	157705	1700000	6.5%	27.79%	25.93%	10.78
2025	207137	2100000	7.6%	31.34%	23.53%	10.14

Table 3: FFS Funding Status^{15,16}

Year	Major FFS Development / Funding Status	Approx. Commitment
2016	FFS launched under Startup India	10,000
2017	Initial AIF commitments started	600
2018	Expansion of startup support through AIFs	1,600
2019	Increased participation by venture funds	3,100
2020	COVID period but continued support	4,500
2021	Rapid startup ecosystem growth	6,500
2022	Major scale-up in AIF funding	7,225
2023	99 AIFs supported	7,980
2024	Continued investments into startups	9,500
2025	Strong expansion under FFS	11,808

Descriptive Statistics

Table 4 presents the descriptive statistics of the variables used in the study. During the study period there is substantial growth and variability in India's startup ecosystem. The mean number of recognized startups during the study period 2016-2025 was 72,876 and the average employment generated by startups was 80900. The mean of Startups and employment generation indicate that, the rapid expansion of entrepreneurial activities and employment in India following the startup India Initiative. The recognized startups increased from only 502 in 2016 to 207,137 in 2025, while employment generation rose from 10,000 to 2.1 million and the standard deviation values for recognized startups (70,159.52) and employment generation (715,828.19) which is reflecting substantial fluctuations and accelerated growth over time.

GDP growth exhibited a mean value of 6.03% during the pandemic period the minimum GDP growth rate of -5.8% in

2020 indicates severe economic contraction, whereas the maximum value reached 9.7% in 2021 during the post-pandemic recovery phase. Similarly the GDP growth variable shows negative skewness of -2.45 and high kurtosis of 6.64 indicating the presence of extreme values and abnormal fluctuations in economic growth during the study period. In contrast, recognized startups and employment generation display relatively stable kurtosis values, suggesting smoother long-term expansion patterns

The Compound Annual Growth Rate (CAGR) analysis of the study reveals that the CAGR of recognized startups recorded is 40.26%, while employment generation achieved a CAGR of 20%, which reveals that startup growth outpaced employment growth, suggesting increasing technological orientation and operational efficiency within the startup ecosystem.

Table 4: Descriptive Statistics of Variables

Statistic	Recognized Startups	Employment	GDP Growth (%)
Mean	72,876.00	809,000.00	6.03
Median	51,833.00	650,000.00	7.2
Std Dev	70,159.52	715,828.19	4.46
Min	502	10,000.00	-5.8
Max	207,137.00	2,100,000.00	9.7
Skewness	0.87	0.68	-2.45
Kurtosis	-0.31	-0.71	6.64
CAGR (%)	40.26%	20.00%	N/A

Growth Rate and CAGR Analysis

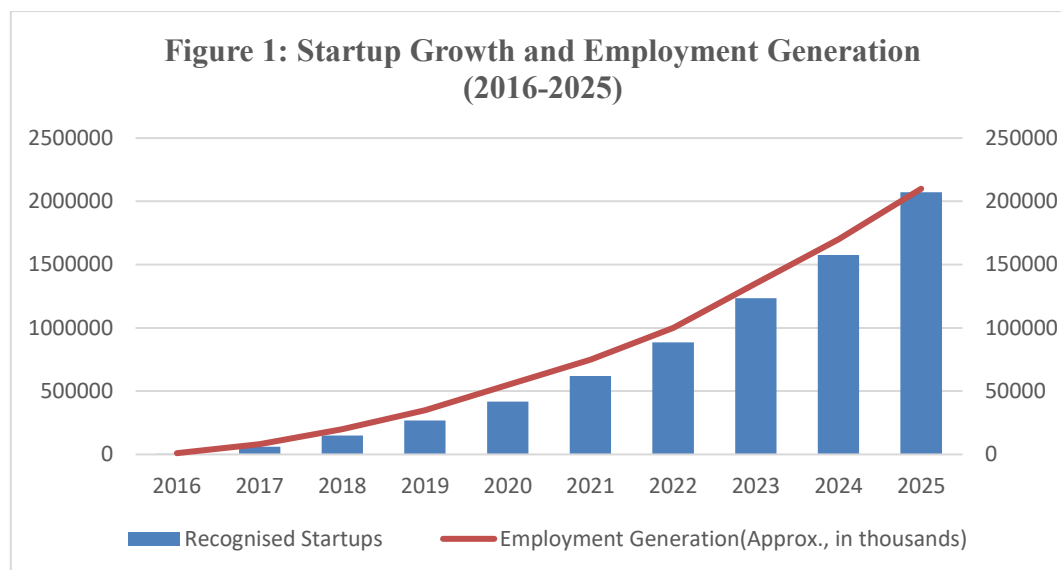
The figure 1 illustrates the startup growth and employment generation during 2016 to 2025. The growth rate analysis reveals that there is a remarkable expansion of India's startup ecosystem during the post-Startup India Initiative period. The number recognized startups increased consistently throughout the period 2016 to 2025, which demonstrate the effectiveness of policy support and entrepreneurial promotion measures introduced by the Government.

In 2017, recognized startups grew by 1090.24% compared to base year, due to rapid policy adoption. Growth continued at 150.29% in 2018 and 2019 and 2020 it was decreased 79.47% due to COVID-19 Pandemic.

The startup growth rate was exceptionally high in the initial years following the launch of the initiative. In 2017,

recognized startups grew by 1090.24%, primarily due to the low initial base and rapid policy adoption. Growth continued at 150.29% in 2018 and 79.47% in 2019, indicating strong momentum in ecosystem expansion. From 2020 onward, growth rates ranged between 27% and 55%, indicating that the ecosystem entered a more mature and stable phase of development.

The long term ecosystem is evidenced by the CAGR values. The CAGR of recognised startups was 40.26% and the CAGR of employment generation at 20%, which is highlighting that startup formation accelerated at a faster pace than job creation. This suggests increasing productivity, technological innovation, and efficiency within Indian startups.



Funding Patterns and GDP Growth Analysis

The analysis of funding patterns indicates that financial support under the Fund of Funds for Startups (FFS) played a significant role in strengthening the Indian startup ecosystem during the post-2016 period.

The Startup India Initiative introduced the FFS scheme with an initial corpus commitment of Rs. 10,000 crore. The scheme aimed to provide indirect funding support to startups through Alternative Investment Funds (AIFs). Over the years, the funding ecosystem expanded considerably, reflecting increasing government commitment toward entrepreneurship development.

Initial AIF commitments began modestly in 2017 with approximately Rs. 600 crore. However, funding support expanded steadily in subsequent years, reaching Rs. 3,100 crore in 2019 and Rs. 4,500 crore during the COVID-19 period in 2020. The continuation of funding support during the pandemic demonstrates the government's commitment to maintaining startup ecosystem stability during economic disruptions.

A major scale-up in funding occurred after 2021, corresponding with rapid ecosystem expansion and post-

pandemic economic recovery. By 2023, support had been extended to 99 AIFs, while commitments increased to Rs. 7,980 crore. Funding commitments further rose to Rs. 11,808 crore by 2025, indicating sustained policy focus on innovation-led growth.

The relationship between funding patterns and GDP growth reveals interesting dynamics. While GDP growth fluctuated considerably during the study period, startup funding continued to rise steadily. Even during the economic contraction of 2020, startup funding and ecosystem expansion remained positive. This indicates that the startup ecosystem became relatively resilient to short-term macroeconomic shocks due to strong institutional and financial support mechanisms.

Pearson Correlation Analysis

Pearson correlation analysis was conducted to examine the strength and direction of relationships among recognised startups, employment generation, and GDP growth during the study period from 2016 to 2025. The Table 5 presents Pearson correlation matrix results.

Table 5: Pearson correlation matrix results

Variables	Recognized Startups	Employment Generation	GDP Growth (%)
Recognized Startups	1	0.995	0.211
Employment Generation	0.995	1	0.186
GDP Growth (%)	0.211	0.186	1

To study the relationship between recognized startups and employment generation Pearson's correlation was conducted and the correlation results reveal a very strong positive relationship between recognized startups and employment generation with a correlation co-efficient of 0.995. This indicates a perfect positive association between the two variables.

Similarly, the correlation between recognised startups and GDP growth 0.211, which is although the relationship is positive, the low magnitude indicates that startup expansion was not strongly dependent on short-term fluctuations in

GDP growth. This suggests that the Indian startup ecosystem continued to grow even during periods of economic slowdown or instability. Similarly, the correlation between employment generation and GDP growth is also weakly positive at 0.186. This indicates that startup-related employment growth was only marginally associated with overall economic growth during the study period.

Finally, the Pearson correlation results provide empirical evidence that the Startup India Initiative substantially contributed to employment generation and entrepreneurial growth in India during the post-2016 period.



Findings Of the Study

The findings of the study suggest that the Startup India Initiative has had a transformative impact on India's entrepreneurial ecosystem. The initiatives taken by Government of India successfully created a supportive environment for innovation, startup recognition, funding access and employment generation. The following are the major findings of the study,

The number of recognized startups increased constantly between 2016 and 2025, demonstrating the effectiveness of policy support and simplified regulatory mechanisms.

There is a significant employment generation during the study period from 10,000 to 2.1 million jobs, indicating that startups have become an important employment generating sector in the Indian economy.

The expansion of funding infrastructure through FFS and AIF ecosystem significantly improved startup financing availability.

The growth of startups remained positive even during the pandemic-induced economic contraction, reflecting the adaptability and institutional strength created under the initiative.

The declining employment-per-startup ratio indicates increasing productivity, technological sophistication, and scalability among startups.

The Startup India Initiatives also appears to have strengthened investor's confidence, encourage entrepreneurial culture and improved India's position as a global startup hub.

However, the analysis also indicates certain emerging challenges. The gradual decline in startup growth rates after the initial years suggests that the ecosystem may be entering a phase of consolidation and competitive maturity. In addition, the falling employment-per-startup ratio implies that future employment generation may depend increasingly on high-skill digital jobs rather than large-scale labor absorption.

Conclusion

The present study has provided the most comprehensive quantitative analysis of India's startup ecosystem growth and employment generation impact available for the full post startup India Initiative decade 2016-2025. The analysis clearly demonstrates that the initiative has played a transformative role in strengthening entrepreneurial activity, expanding startup financing, and promoting innovation-driven economic development in India.

DPIIT-recognized startups grew at a CAGR of 40.26%, while employment generated expanded at a CAGR of 20%. The Pearson correlation of $r = 0.995$ between startup count and employment, establish that India's startup ecosystem is a powerful and institutionally resilient engine of employment generation. The independence of this growth from GDP fluctuations confirmed by the statistically insignificant correlation between GDP growth and startup metrics indicates structural rather than cyclical drivers, providing confidence in the ecosystem's long-term sustainability.

Overall, the study concludes that the Startup India Initiative has been highly effective in fostering entrepreneurship,

generating employment, and strengthening India's innovation ecosystem. The initiative has helped position India as one of the leading global startup hubs while promoting long-term economic resilience and digital transformation.

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Original Article

Impact of Digital Office System Adoption on Administrative Efficiency and Institutional Performance

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Abstract

The adoption of Digital Office Systems has transformed administrative processes across educational institutions, government organizations, and business enterprises. These systems integrate digital technologies into routine office functions, enabling efficient management of records, communication, workflow, and decision-making processes. This study examines the impact of Digital Office System adoption on administrative efficiency and institutional performance. The research explores how digital tools contribute to reducing paperwork, improving data accuracy, enhancing communication, accelerating service delivery, and optimizing resource utilization.

The study employs a descriptive and analytical approach by reviewing existing literature and assessing the experiences of organizations that have implemented digital office solutions. Findings indicate that the adoption of Digital Office Systems significantly improves administrative efficiency through automation, real-time information access, and streamlined workflows. Furthermore, institutions experience enhanced productivity, transparency, accountability, and overall organizational effectiveness. Despite challenges such as implementation costs, technological infrastructure requirements, and employee resistance to change, the long-term benefits outweigh the initial difficulties.

The study concludes that Digital Office Systems play a crucial role in modernizing administrative operations and improving institutional performance. Organizations that invest in digital transformation are better positioned to achieve operational excellence, provide quality services, and maintain competitiveness in an increasingly technology-driven environment.

Keywords: Digital Office System, Administrative Efficiency, Institutional Performance, Digital Transformation, Workflow Automation, E-Governance, Information Management, Organizational Productivity, Paperless Office, Technology Adoption.

Introduction

Higher education plays an important role to develop good and creative individuals and is viewed as a powerful means to build knowledge based society¹. Digital transformation (DT) has become a priority for higher education institutions (HEIs) and the governance of higher education institutions (HEIs) is undergoing a paradigmatic shift driven by digital technologies. India is the third largest country in higher education system which has 1113 universities, 43796 colleges and over 4.14 crore enrolments². To achieve an institutional imperative and as a policy priority the adoption of digital administrative system has emerged.

The University Grants Commission (UGC), as the apex regulatory body, has progressively mandated electronic data submission, online grievance portals, digital accreditation portals, and ERP-linked reporting since 2018. In order to computerize all campus processes including admissions, payroll and result declaration, the UGC has mandated various digital initiatives, such as the National Academic Depository (NAD) and Digital Learning Monitoring Cells³. The main objective of the higher education is to build the society by transforming raw material into finishing product to remain as an asset to the society⁴. So the improved teaching-learning process is important to enhance quality. Digital transformation has not only improved teaching-learning processes but also enhanced transparency and accountability in institutional administration⁵. However, the direct relationship between digital office systems and administrative efficiency remains underexplored. The present study measures the impact of digital office system on administrative efficiency.

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Objectives Of the Study

The major objectives of the study are:

1. To examine the concept and components of digital office systems.
2. To analyze the theoretical foundations supporting digital office system adoption.
3. To evaluate the impact of digital office systems on administrative efficiency.
4. To explore the relationship between digital office adoption and institutional performance.

Review Of Literature

Dr.S.S. Mahalakshmi⁴ in her study on Trends in Enrolment in Higher Education in India found that significant inter-state disparities in the GERs of higher education in India. An analysis of data indicates that enrollment in the HE had gone up from 1.73 lakhs in 1950-51 to 4.13 crores in 2020-21.

The study on The Impact of Digitalization in Higher Educational Institutions concludes that Digitalization is an instrumental in tackling the impacts of internationalization in higher education. To integrate ICT in higher education there is need to ensure good quality, easily accessible and affordable education for people in the remote areas. The government is developing strategies to increase intellectual capital via funding for the development of adequate technological infrastructure in the institution. In new National Education Policy (NEP)-2020, digitalization of education will be one of the top priorities of government⁵.

Indian-specific empirical work on digital administrative systems in HEIs remains limited relative to the scale of the sector. Sharma & Singh (2019)⁶ surveyed 42 Central Universities and found that ERP adoption varied significantly by university age and founding act, with newer institutions exhibiting higher adoption rates.

Annapurna Shankarnarayanan and Raju K. Lohot examine comparative study on various key parameters to give a better comprehension of the progress of higher education over the past eight years and found that remarkable progress in enrollment in AISHE by colleges and stand-alone universities has been noticed in the past nine years. There has been a 15.6% rise overall in higher education institutes in the country over the last nine years.

The many researches focused on the teaching-learning outcomes of digitalization, ICT adoption and policy level digital initiatives however there is limited research on digital office systems and their impact on administrative efficiency.

Theoretical Foundations

A comprehensive understanding of digital office system adoption and its institutional consequences requires engagement with multiple theoretical traditions. The following are the foundational theories that collectively give insights to the digital office system adoption.

Technology Acceptance Model (TAM)

Davis' (1989)⁷ Technology Acceptance Model offers a behavioral framework for understanding individual-level technology adoption decisions. TAM explains user acceptance of technology based on two primary constructs, perceived usefulness and perceived ease of use.

According to this model, employees are more likely to adopt digital office systems if they believe the systems improve job performance and are easy to operate. This model is particularly relevant in institutional settings where staff adaptation significantly influences successful digital transformation.

Diffusion of Innovation Theory (DOI)

Rogers' (1962, 2003)^{8, 9} Diffusion of Innovation Theory (DOI) explains how innovation spread across social systems. The adoption is depends on relative advantages, compatibility, complexity, trial ability and observe ability. The institutions adopting digital office systems often progress through innovation adoption stages influenced by organizational culture and leadership support.

Resource-Based View (RBV)

The Resource-Based View, originating from Penrose (1959) and elaborated by Barney (1991)¹⁰, frames the organization as a bundle of heterogeneous, imperfectly mobile resources and capabilities. Sustainable competitive advantage accrues to firms that possess resources which are Valuable, Rare, Inimitable, and Non-substitutable (VRIN). The RBV has been extensively applied to information technology research to explain why identical technologies produce differential performance outcomes across organizations.

From an RBV perspective, the mere adoption of digital office systems does not constitute a source of competitive differentiation, as the technologies themselves are typically available to all market participants. Rather, competitive and performance advantages derive from how institutions deploy, customize, and integrate digital systems with their unique organizational capabilities including managerial expertise, organizational culture, human capital, and process knowledge. This theoretical insight underscores the importance of complementary organizational resources in translating digital adoption into administrative efficiency¹⁰.

Benefits Of Digital Transformation on Administrative Efficiency and Institutional Performance¹¹

Enhanced Teaching Methods and learning approaches:

Digital transformation encourages new teaching methods and learning approaches leading to more effective and engaging education. Teachers can incorporate interactive approaches like flipped classrooms, and virtual reality which increase the student engagement, motivation, and leading to better learning outcomes.

Digitalized platforms enable customized course

delivery: based on individual learning speeds and capabilities, leading to more effective learning. Research indicates personalized learning systems can lead to faster mastery for struggling students and higher overall academic performance. This approach allows teachers to provide targeted support and feedback, fostering a growth mindset, self-directed learning, and empowering students at their own pace.

Use of Digital Tools:

Digital tools like Google Docs, Zoom, and Microsoft Teams facilitate group work and communication among students and teachers, regardless of location. These tools enable seamless real-time collaboration, developing teamwork and communication skills, and fostering stronger connections among educators,



students, and parents. This prepares students for the modern workforce's demands.

Streamline administrative tasks: Digital tools streamline administrative tasks, freeing teachers from paperwork and enabling them to focus on teaching and student support. Implementation of digital administrative systems has been shown to reduce processing times for student applications and decrease operational costs.

Decision Making: Learning analytics enables teachers and office staff to make informed decisions, such as planning study systems or activating support networks, based on data and insights. Institutions leveraging learning analytics have seen an improvement in early identification of at-risk students, leading to an increase in student retention rates through targeted interventions.

Impact Of Digital Office Systems on Administrative Efficiency

Digital office systems significantly improve administrative efficiency through various dimensions¹².

Automation reduces processing time for routine tasks such as approvals, attendance management, report generation, and document retrieval. Digital systems minimize paper usage, storage costs, printing expenses, and manual labor requirements. The communication is important aspect in administration, the integrated communication platforms facilitate instant information sharing among departments and stakeholders. Digital systems reduce human error and improve data consistency while enabling secure storage and controlled access and which also digital workflows create audit trails and improve monitoring of administrative activities. The real time decision making always shows efficiency in administration hence in digital system real-time data analytics enable informed and timely managerial decisions.

Institutional Performance and Digital Transformation

Institutional performance refers to the effectiveness with which an organization achieves its objectives¹³. Digital office systems contribute to institutional performance through enhanced productivity, better service, increased operational flexibility, employee performance and improved standards. Educational institutions utilizing digital systems often experience improved academic administration, faster student services, and better resource management.

Conclusion

Digital office system adoption has become an essential component of modern institutional administration. Theoretical analysis indicates that digital office systems significantly improve administrative efficiency through automation, enhanced communication, transparency, and better resource management. Improved administrative efficiency subsequently contributes to higher institutional performance, stakeholder satisfaction, and organizational competitiveness.

The integration of theories such as TAM, DOI, RBV, and Institutional Theory provides a comprehensive understanding of digital transformation within institutions. Although challenges such as resistance to change, cyber security concerns, and infrastructure limitations remain, effective planning and strategic implementation can maximize the benefits of digital office systems.

Future empirical studies may test the proposed conceptual framework using quantitative or mixed-method approaches across educational institutions, government departments, and corporate organizations.

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I would like to express my sincere gratitude to all those who have contributed to the successful completion of this project entitled "Impact of Digital Office System Adoption on Administrative Efficiency and Institutional Performance."

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Original Article

Digital Transformation of Tourism in Odisha: Opportunities, Challenges, and Policy Imperatives for Viksit Bharat@2047

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Abstract

In India, tourism is emerging as an important driver of economic growth, cultural preservation, employment generation, and regional development. In the vision of the national Viksit Bharat @2047, digital transformation has become an essential tool for strengthening tourism competitiveness and tourist experience. Odisha has a rich cultural history, religious destinations, biological diversity, and historical landmarks, and has great potential to harness digital technology for sustainable tourism development. The state has seen an increased use of digital platforms, online booking systems, virtual tourist experiences, mobile applications, digital payment systems, Geographic Information Systems (GIS), and social media-oriented destination promotion. These initiatives have contributed to improved accessibility, better tourist interaction, and expanded visibility of Odisha's tourism assets at national and international levels.

These prospects notwithstanding, there are hurdles to realizing a fully integrated digital tourism ecosystem. Major barriers include poor digital infrastructure in rural and isolated tourist areas, cybersecurity risks, digital literacy deficiencies among stakeholders, fragmented data management systems, and insufficient technological capacity among local tourism firms. In addition, policy attention is needed to address issues of data privacy, sustainable tourism governance, and fair access to digital resources.

This article examines the current state of digital tourism projects in Odisha to identify potential opportunities and obstacles and assess their implications for achieving the objectives of Viksit Bharat @2047, using a doctrinal and analytical methodology. The report also suggests policy imperatives for improving digital infrastructure, capacity building, data security, public-private partnerships, and smart tourist ecosystems. The results show that a deliberate and comprehensive digital transformation model can significantly enhance Odisha's contribution to India's tourism-led development strategy and position the State as one of the leading smart tourism destinations by 2047.

Keywords: Digital Tourism, Odisha Tourism, Smart Tourism, Viksit Bharat @2047, Tourism Policy, Digital Transformation, Sustainable Tourism.

Introduction

Tourism is one of the world's most dynamic industries, contributing to economic growth, employment, cultural exchange, and sustainable development. Tourism drives regional development, cultural preservation, and livelihood opportunities in urban and rural India. Tourism contributed about 5% to India's GDP. It created 7.6 crore jobs in FY 2022–23, confirming its role in economic growth and social inclusion (Ministry of Tourism, 2025). In 2024, India recorded 9.66 million Foreign Tourist Arrivals (FTAs), generating ₹2.78 lakh crore in foreign exchange revenues, demonstrating a post-pandemic recovery and growth potential (Ministry of Tourism, 2025).

Tourism has changed due to the rapid development of ICTs, AI, big data analytics, cloud computing, digital payments, VR, and mobile apps. Digital transformation has changed how tourists research, plan, book, experience, and share their travels. Incorporating smart tourism practices has led to increased operational efficiency, visitor satisfaction, and data-driven decision-making in destinations (Galvão et al., 2024). Many Indian tourists now plan and book their travel online, using digital payment ecosystems and mobile-based travel services, according to recent research.

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Digital India, BharatNet, UPI, Smart Cities Mission, and National Digital Tourism projects have created new tourism potential in India. The growing online travel market, digital payment infrastructure, and smart tourism technologies are transforming the tourism landscape, making it more accessible to both local and foreign tourists. The Government of India's Viksit Bharat @2047 mission to develop India through innovation, digital governance, sustainable development, and inclusive economic growth makes these accomplishments more relevant.

Odisha might become a top smart tourist destination in this national context. The State's tourism resources include the Jagannath Temple at Puri, the Sun Temple at Konark, Chilika Lake, Buddhist historical circuits, tribal cultural landscapes, wildlife sanctuaries, virgin beaches, and eco-tourism locations. The Government of Odisha has taken many steps to improve tourism infrastructure, branding, internet access, and visitor experiences, given the state's strategic importance. Digital tourism information portals, online booking, mobile apps, digital payment systems, virtual promotional campaigns, and smart destination management tools demonstrate the state's efforts to modernize its tourism.

Even with these achievements, Odisha's tourism sector faces significant challenges in its digital transformation. Inadequate digital infrastructure in remote tourist destinations, digital literacy gaps among local stakeholders, cybersecurity vulnerabilities, fragmented tourism databases, limited integration of emerging technologies, and data privacy and governance issues hinder the development of a fully integrated smart tourism ecosystem. Meeting these challenges is essential to boosting competitiveness, sustainable tourism development, and the socio-economic benefits of tourism.

The current study examines how the digital revolution has changed Odisha's tourism development. It investigates new potential, major challenges, and policy imperatives to create a resilient, inclusive, and technology-driven tourism ecosystem that supports Viksit Bharat @2047. The report contributes to discussions on India's emerging smart tourism governance and sustainable destination development.

Digital Transformation and Tourism: Conceptual Framework

The 21st century has seen extraordinary integration of digital technology into economic and social processes, transforming industries and service delivery. Service- and information-based tourism have suffered most. AI, big data analytics, cloud computing, IoT, blockchain, VR, AR, GIS, mobile apps, and digital payment systems have transformed tourism management, destination marketing, customer interaction, and travel experiences (Bekele & Raj, 2024).

Digital technology is used strategically to transform organizational processes, business models, and stakeholder interactions, promoting efficiency, innovation, and value generation. "Tourist digital transformation involves creating intelligent, connected, and data-driven ecosystems. E-tourism, digital tourism, Tourism 4.0, and smart tourism

utilize technology to enhance tourist experiences and competitiveness (Galvão, Brito e Abreu, & Melo, 2024).

Tourist digitalization has three steps. Information was originally digitized via websites and online reservation systems. Second, digitization included OTAs, social media marketing, mobile tourism, and electronic transactions. The third and current stage of tourist planning and management uses AI, machine learning, predictive analytics, IoT-based smart destinations, virtual tourism experiences, and digital twins (Kindzule-Millere & Zeverte-Rivza, 2026).

Smart tourism has advanced digitalization. Intelligent tourism ecosystems enhance destination management, sustainability, accessibility, and visitor satisfaction through current ICT. Smart tourism destinations use real-time data, digital infrastructure, and new technologies to connect tourists, businesses, governments, and local communities (Galvão et al., 2024).

Digital tourism and online travel markets are increasing rapidly worldwide. Smartphone penetration, digital payments, and AI-enabled travel services drove the USD 253.2 billion global online travel agency industry in 2024 and are expected to grow over the coming decade. Online travel transactions were approximately 45% app-based in 2024, reflecting a rising reliance on digital platforms for planning and scheduling.

UNWTO says digital innovation drives sustainable tourism and location resilience. Digital technologies help tourist firms and destinations improve operational efficiency, customer interaction, real-time information sharing, and evidence-based policymaking. Small tourism businesses can immediately reach global markets via digital channels, supporting entrepreneurship and inclusive economic growth.

Digital India, BharatNet, UPI, Smart Cities Mission, PM Gati Shakti, and the National Integrated Database of the Hospitality Industry are transforming India's tourism sector. Electronic payments, online booking, QR code services, mobile travel apps, and social media destination advertising have changed tourists' behavior. Internet, smartphones, and digital literacy have driven nationwide growth in smart tourism.

In theory, the digital transformation of tourism is a four-dimensional ecosystem. Start with digital infrastructure, including the internet, mobile, cloud, and digital payment methods. Online booking platforms, e-ticketing, virtual tours, destination management systems, and tourism information websites compose the second dimension. The third dimension of digital governance includes cybersecurity, data protection, interoperability, and smart destination rules. Dimension four: Digital stakeholders. This includes visitors, government organizations, tourism corporations, local communities, and technology vendors. A sustainable, smart-tourism environment that boosts competitiveness and tourist satisfaction results from these factors.

Digital change offers Odisha chances to modernize tourism, raise destination awareness, encourage smart destination management, and attract domestic and international tourists. Digital technologies can help the state promote heritage, religion, eco-tourism, tribal tourism, and coastline



tourism. To realize those benefits, you need strong digital infrastructure, competent staff, cybersecurity, and government backing. Thus, understanding digital transformation and its significance in accomplishing Odisha's Viksit Bharat @2047 goal of becoming a premier smart tourism destination is crucial.

Tourism Potential of Odisha

With its rich cultural heritage, religious significance, biological diversity, archeological treasures, tribal traditions, and huge coastline, Odisha is unique in Indian tourism. Historical, pilgrimage, eco-tourism, wildlife, coastal, tribal, adventure, and cultural tourism are available in the eastern Indian state bordering the Bay of Bengal. Odisha has the potential to become a global tourism destination like Viksit Bharat @2047, thanks to its diversity.

The Odisha government prioritizes tourism because it creates jobs, infrastructure, entrepreneurship, and economic progress. The Odisha Tourism Annual Report 2024–25 lists 378 tourist places with strong growth potential throughout different tourism circuits, demonstrating the government's commitment to expanding and diversifying tourism. Odisha welcomed 1.10 crore tourists in 2024, demonstrating significant post-pandemic recovery and development (Department of Tourism, Government of Odisha, 2025).

Odisha excels in religious and spiritual tourism. Puri is home to Jagannath, one of the Char Dham Hindu pilgrimage destinations. Millions of people attend Puri's Rath Yatra, one of the world's largest religious gatherings. The "Golden Triangle," comprising Puri, Konark, and Bhubaneswar, drives Odisha's tourism economy and attracts domestic and international visitors. Major infrastructural projects, enhanced connections, heritage conservation, and tourism amenities have made Puri a top pilgrimage and cultural tourism destination.

Odisha is rich culturally and archaeologically. The state's most famous feature is the Konark Sun Temple, a UNESCO World Heritage Site and medieval Indian architectural marvel. The "Temple City of India," Bhubaneswar, is noted for its medieval Kalinga temples and architectural beauty. Udayagiri, Khandagiri, Dhauli, Ratnagiri, Lalitgiri, and Langudi boost heritage tourism in the state. These sites preserve Odisha's past and draw scholars, researchers, and cultural tourists from around the world.

Buddhist tourism is another Odisha opportunity. The "Diamond Triangle" of Ratnagiri, Udayagiri, and Lalitgiri is a major Buddhist site in India. These locations were important centers of Buddhist study and monasticism between the fifth and eleventh centuries, according to archaeological evidence. Odisha has great potential to establish worldwide Buddhist tourist circuits and to engage in cultural diplomacy, amid rising interest from Japanese, Sri Lankan, Thai, Myanmar, and South Korean Buddhist pilgrims.

Ecotourism and nature-based tourism benefit from the state's biodiversity. Chilika Lake, Asia's largest brackish water lagoon, is Odisha's main attraction. Puri, Khordha, and Ganjam: Chilika has hundreds of migratory bird species and a rich aquatic environment. Conservation-led tourism and the Chilika Bird Festival have raised their global profile.

The lake attracts birdwatchers, nature enthusiasts, researchers, and ecotourists year-round.

Odisha wildlife tourism is promising. The state has Similipal Tiger Reserve, Bhitarkanika National Park, Satkosia Tiger Reserve, Debrigarh Wildlife Sanctuary, and Chandaka Elephant Reserve. Bhitarkanika is an ecological hotspot in India due to its mangroves and estuarine crocodiles. Wildlife, ecological education, and sustainable ecotourism are offered in Similipal, a UNESCO Biosphere Reserve. These places raise awareness of conservation and create jobs.

The state's 480km shoreline draws tourists. Puri, Chandrabhaga, Gopalpur, Ramachandi, Paradeep, Talasari, and Astaranga offer coastal and marine tourism. The Blue Flag indicates that Puri's Golden Beach satisfies international standards for environmental sustainability, cleanliness, safety, and tourism amenities. The state government aims to add Blue Flag beaches and a cruise terminal in Puri to enhance coastal tourism.

Tourism in Odisha benefits from its indigenous heritage. Odisha has 62 tribal communities with different cultures, art forms, handicrafts, festivals, and lifestyles. Tribal tourist circuits in Koraput, Rayagada, Malkangiri, Kandhamal, and Mayurbhanj offer unique cultural experiences to local and international travelers. Community-based tourism can preserve culture and support indigenous peoples when well managed.

Odisha's tourism numbers show its growing popularity. Increasing from the previous year, Parliamentary data reveals 1,09,98,819 domestic and 53,392 foreign tourists in 2024. Visitor traffic is rising due to the attractiveness of Odisha's tourism assets and promotional and infrastructure efforts.

Odisha is known for festivals, sports, conventions, and experiential tourism in addition to its natural and cultural attractions. The Men's Hockey World Cup, Konark Dance Festival, Mukteswar Dance Festival, Toshali National Crafts Mela, and Bali Jatra elevated destination branding and tourism. Tourism, culture, sports, and Internet marketing have increased the state's tourism appeal.

With its past, spirituality, wildlife, tribal culture, and coastline riches, Odisha might be India's top tourism destination. This promise requires strategic investments in digital infrastructure, sustainable destination management, smart tourism technology, and inclusive policy frameworks. By 2047, Odisha might become a global smart tourism destination thanks to digital change.

Digital Tourism Initiatives in Odisha

Digital technology can boost tourists' competitiveness; hence, Odisha has established several schemes to digitalize tourism. These efforts promote Digital India, Smart Governance, and Viksit Bharat @2047. Odisha is promoting smart tourism using digital platforms, online services, smart destination management tools, and digital marketing.

One of the best efforts is the official Odisha Tourism website, which lists sights, lodgings, travel circuits, cultural events, eco-tourism locations, and online booking. The easy-to-use system lets passengers check real-time information, plan itineraries, and book (Department of Tourism, Government of Odisha, 2025).



The state has increased its digital outreach through social media, virtual campaigning, and digital storytelling. Multimedia, virtual tours, and branding promote Puri, Konark, Chilika, Bhubaneswar, Bhitarkanika, and Similipal. These programs have enhanced Odisha's participation in and visibility for local and international tourism.

Digital payment infrastructure at major tourist attractions is another crucial development. The rise of UPI, QR code payments, online ticketing, and digital reservations has simplified tourist transactions. UPI transactions in India rose to 172 billion in FY 2024–25, indicating an increasing reliance on digital payment ecosystems for tourism-related services and transactions (NPCI, 2025).

Through online hotel booking systems, digital accommodation services, transportation booking capabilities, and integrated tourism information platforms, Orissa has pushed technology-enabled tourist management. To simplify tourism, the state's tourism website offers lodging, transportation, holiday packages, and other services.

Digital tourism benefited from the Bhubaneswar smart city projects. Smart mobility, traffic management, digital information kiosks, public wi-fi, GIS-based urban planning, and integrated command and control systems have improved urban tourism and destination management. As one of India's top smart cities, Bhubaneswar promotes smart tourist infrastructure (Government of Odisha, 2025).

The government is advancing digital governance via the Odisha AI Policy 2025 and related IT efforts. These policies allow AI, data analytics, and smart tourism apps for destination management, tourist behavior analysis, and personalized tourism services.

Despite progress, Odisha's tourism industry's digital revolution continues. Continuous investments in broadband connectivity, digital literacy, cybersecurity, data integration, and smart tourism technology are needed to build a digital tourism ecosystem. Current activities demonstrate the state's commitment to leveraging digital technology to drive sustainable tourism growth and smart competitiveness of tourist destinations in India.

Opportunities and Challenges of Digital Tourism in Odisha

Digital transformation can boost Odisha's tourism industry's competitiveness, accessibility, and sustainability. Internet services, cellphones, digital payments, AI, big data analytics, VR, AR, and GIS have helped increase tourism development and destination management. In 2025, the Telecom Regulatory Authority of India (TRAI) predicted that there would be over 970 million internet subscribers, enabling digital tourism and online travel ecosystems.

Odisha tourism spots offer significant digital and social media marketing potential." Digital advertising enables tourist authorities to reach global audiences at a lower cost and boost destination and brand awareness. Virtual tours, immersive films, and interactive content can boost tourism in Puri, Konark, Chilika, Bhitarkanika, and Similipal. Over 70% of global travellers plan trips using online information and reviews (UNWTO, 2025).

Digital technology helps smart tourism locations. Tourism and destination management can be improved with real-

time information systems, digital navigation aids, smart ticketing, QR code-enabled services, and AI-driven visitor management systems. This technology could help Odisha manage rising tourist numbers, especially at pilgrimage and heritage sites. Intelligent transit systems, digital kiosks, and integrated tourism information services may help Bhubaneswar and Puri provide smooth travel experiences (Government of Odisha, 2025).

Digital platforms for rural and community-centered tourism are another option. Online marketplaces and booking platforms help local handicraft producers, homestay operators, eco-tourism enterprises, and tribal groups reach more travelers. This can boost inclusive economic growth and the SDGs by creating jobs and generating income in rural and tribal areas. Digital payments, especially UPI, improve financial inclusion and ease of doing business for tourists and local service providers. India had over 172 billion UPI transactions in FY 2024–25, highlighting the growing importance of digital financial infrastructure in tourism (NPCI, 2025).

Odisha's digital tourism revolution faces significant obstacles. Remote tribal, woodland, and seaside tourism sites suffer from poor internet access. Internet, mobile network, and digital infrastructure shortages hamper smart tourism solutions and experiences. These discrepancies generate a digital divide that may prevent some destinations from establishing digital tourism.

Digital literacy and technological skills of tourist participants are crucial. Many small tourism businesses, local guides, craftsmen, and community-based tourism operators lack the technical skills to use digital platforms, online marketing tools, and e-commerce services. Without proper training and capacity-building, digital transformation may only benefit larger tourism enterprises and cities.

Cybersecurity and data privacy are rising issues. Online booking platforms, digital payments, mobile apps, and cloud-based tourism services put travelers and service providers at danger of cyber fraud, identity theft, data breaches, and unlawful data processing. Tourism stakeholders must comply with data protection laws to safeguard tourist data and maintain public trust (Government of India, 2023). The Digital Personal Data Protection Act, 2023, has reinforced India's data governance.

A related topic is environmental sustainability. Without sustainable destination management, digital technology may increase tourist arrivals and popularity, leading to congestion, ecological degradation, increased trash, and pressure on local resources. Puri, Konark, and Chilika must balance digital tourism, environmental conservation, and carrying capacity.

Digital transformation can boost Odisha's tourist competitiveness and contribute to Viksit Bharat @2047, but infrastructure, digital skills, cybersecurity, data protection, and sustainability must be addressed. A balanced and inclusive digital tourism plan may help Odisha exploit technology while ensuring socio-economic and environmental sustainability.



Policy Imperatives and Recommendations for Viksit Bharat @2047

Digitally transforming Odisha's tourist sector requires a holistic policy strategy that integrates technology, sustainability, stakeholder involvement, and good governance. The tourist policy must establish smart, inclusive, and resilient ecosystems to compete in the global digital economy as India pursues Viksit Bharat @2047.

Digital infrastructure should be the top government aim for all tourism sites. Large towns like Bhubaneswar and Puri have superior broadband and cell network coverage than eco-tourism, tribal, and rural areas. BharatNet and Digital India could help Odisha provide high-speed Internet to all key tourism circuits. Online tourism, smart destination management, and real-time tourist information systems benefit from digital infrastructure (Ministry of Communications, 2025).

Second, governments prioritize smart tourist technologies. AI, big data analytics, GIS, IoT, VR, and AR improve destination management and guest experiences. AI-enabled chatbots, predictive analytics for tourist flow management, digital guidance systems, virtual heritage tours, and smart ticketing platforms can improve operational efficiency and sustainable tourism (UN Tourism, 2025).

Develop HR and digital skills. Local guides, homestay operators, craftsmen, tourism entrepreneurs, and community-based tourism groups need training in digital literacy, online marketing, e-commerce, and digital service delivery. Digital skills are increasingly needed for service-sector competitiveness (WEF, 2025). Thus, targeted skills development projects can benefit urban and rural communities equally from digital tourism.

Data security and cybersecurity are essential for digital tourism governance. Cyberattacks and data breaches are rising due to digital payments, online booking platforms, smartphone apps, and cloud-based tourism services. Tourism governance structures must comply with the Digital Personal Data Protection Act, 2023, to ensure the security of tourist data collection, processing, and storage. Cybersecurity and digital security evaluations can boost digital tourist trust (Government of India, 2023).

For integrated digital governance, the state should establish a tourism data management platform. This platform supports evidence-based decision-making by combining tourist arrivals, hotel facilities, transportation services, destination performance, and visitor feedback. Data-driven decision-making helps governments predict demand, identify travel trends, and maximize resources.

Future tourist policy should emphasize sustainability. In Chilika Lake, Bhitarkanika National Park, and Similipal Biosphere Reserve, smart tourism should prioritize environmental protection. Digital monitoring, GIS-based predictions of carrying capacity, and smart waste management can help sustainably manage destinations (UNEP, 2024).

PPPs can accelerate tourist modernization with funds, technology, and creativity. Government agencies, technology companies, academic institutions, tourism businesses, and local communities can collaborate to create smart tourist infrastructure and digital services.

Partnerships help tourist start-ups and innovation ecosystems flourish, boosting the economy and creating jobs.

Finally, Odisha needs a Smart Tourism Strategy to complement the Odisha Tourism Policy 2022 and Viksit Bharat @2047. Digital infrastructure, tourist satisfaction, cybersecurity, sustainability, digital talent development, and worldwide competitiveness should be strategic goals. Odisha can use digital technology to become India's top smart tourist destination with a cohesive, future-focused policy framework.

Odisha needs technical innovation, human capacity building, sustainable resource management, cybersecurity, and cooperative governance to realize digitally empowered tourism. These steps will improve tourism, inclusive economic growth, cultural preservation, and Viksit Bharat @2047 sustainability.

Conclusion

Digital transformation has become a key enabler for sustainable growth and global competitiveness of the tourism business. Odisha, with its rich cultural legacy, spiritual destinations, biological diversity, tribal customs, and coastal resources, has great potential to emerge as a major smart tourist destination in India. The report indicates that digital initiatives, such as online tourism platforms, digital payments, smart city infrastructure, social media marketing, and emerging technologies, are slowly transforming the state's tourism landscape and improving visitor experiences.

However, to realize this promise, the persisting obstacles of digital infrastructure deficiencies, cybersecurity threats, data privacy issues, digital literacy deficits, and sustainable destination management need to be addressed. Technology alone is not enough unless it is accompanied by inclusive governance, stakeholder participation, environmental protection, and continual capacity building.

In the Viksit Bharat @2047 timeframe, Odisha needs a comprehensive smart tourism strategy that integrates innovation, sustainability, and cultural conservation. Tourism competitiveness can be significantly enhanced through strategic investments in digital infrastructure, artificial intelligence, data-driven governance, skill development, and public-private partnerships. It can create jobs, promote local entrepreneurship, and enhance regional development.

In the end, digital transformation should be seen not just as a technological change, but as a driver of a resilient, inclusive, and sustainable tourist ecosystem. By harnessing digital technologies to their fullest potential and protecting its unique natural and cultural legacy, Odisha may emerge as a model smart tourism destination and make a strong contribution to India's journey to become a developed nation by 2047.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

Rewriting Life; The New Age Challenges of Biotechnology

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Abstract

Biotechnology is at a tipping point with the advent of gene editing, synthetic biology, artificial intelligence for drug discovery and personalised medicine. This article critically analyses the complex challenges accompanying these advances — regulatory inadequacies, ethical dilemmas, equitable access disparities, biosecurity risks, and socio-political tensions. Secondary data are synthesised from global market reports, policy databases, and scientific literature into structured tables and illustrative diagrams. Five hypotheses relating regulation, public awareness, ethical governance, investment, and access equity are tested using secondary statistical evidence. Findings highlight that without strong international coordination, transparent governance and policies guided by inclusivity, progress in biotechnology could deepen global inequalities and cause irreversible biological harms.

Keywords: *Biotechnology, CRISPR, Gene Editing, Bioethics, Regulatory Frameworks, Synthetic Biology, Personalised Medicine, Biosecurity, Equitable Access*

Introduction

Few have been the scientific revolutions that brought the double-edged promise and peril that modern biotechnology offers today. The ability to read, write and edit the genetic code of living things, once a science-fiction fantasy, is now a laboratory fact that is shaping medicine, agriculture, energy and national security. From the first recombinant DNA experiments in the 1970s to the clinical approval of CRISPR-Cas9-based therapies in 2023, it has been a steep, swift and irreversible trajectory.

But every advance forward has come with deep questions. Who rules these technologies? Who do they help? What happens when they are misused, weaponised or applied outside scientific consensus? The phrase “rewriting life” is not merely metaphorical – it describes the literal reordering of organisms, and increasingly, the reordering of human biology itself.

This article argues that the new age of biotechnology cannot be judged solely on the basis of scientific achievement. It demands a similarly rigorous examination of governance structures, ethical frameworks, market dynamics and geo-political power. The paper, organised around secondary data analysis, hypothesis testing, and policy critique, provides an integrated perspective on the current state of biotechnology and where it must go.

Background and Literature Review

1 Historical Trajectory

Modern biotechnology traces its commercial origins to the 1976 founding of Genentech, the first company built expressly to exploit recombinant DNA technology. The subsequent decades witnessed the arrival of monoclonal antibodies, transgenic crops, PCR diagnostics, and whole-genome sequencing. The completion of the Human Genome Project in 2003 marked an inflection point, democratising access to genomic data and igniting a new generation of therapeutic strategies.

By the 2010s, clustered regularly interspaced short palindromic repeats (CRISPR) had transformed genetic intervention from a laborious, imprecise endeavour into a comparatively fast, inexpensive, and precise toolkit. Simultaneously, advances in computational biology, AI-driven protein folding (exemplified by AlphaFold), and synthetic biology platforms have converged to create an era of integrated bioengineering unprecedented in human history.

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2 Key Challenges Identified in Literature

The commercial origins of modern biotechnology can be traced to the establishment of Genentech in 1976, the first company formed specifically to exploit recombinant DNA technology. The next decades saw the advent of monoclonal antibodies, transgenic crops, PCR diagnostics, and whole-genome sequencing. The completion of the Human Genome Project in 2003 marked an inflection point, democratising access to genomic data and triggering a new generation of therapeutic strategies. By the 2010s, clustered regularly interspaced short palindromic repeats (CRISPR) had turned genetic intervention from a laborious, imprecise endeavour into a relatively fast, inexpensive, and precise toolkit. At the same time, advances in computational biology, AI-based protein folding (like AlphaFold) and synthetic biology platforms have all converged to usher in an era of integrated bioengineering like never before in human history.

Secondary Data Tables, Diagrams, and Explanations

1 Table 1: Global Biotechnology Market Size (2018–2025)

Year	Market Value	YoY Growth	Key Driver
2018	\$US 417.1 B	12.3%	Gene Therapy, Diagnostics
2019	\$US 449.1 B	7.7%	Biopharmaceuticals
2020	\$US 482.6 B	7.5%	COVID-19 mRNA Vaccines
2021	\$US 534.1 B	10.7%	Cell & Gene Therapy
2022	\$US 583.5 B	9.2%	CRISPR Applications
2023	\$US 645.9 B	10.7%	AI-integrated Biotech
2024*	\$US 717.8 B	11.1%	Synthetic Biology Scale-up
2025*	\$US 799.6 B	11.4%	Personalised Medicine

* 2024–2025: Projected estimates | Source: Grand View Research, IQVIA 2024

Diagram 1: Biotech Market Growth Visual (Bar Representation)

Year	Growth Bar (Each █ ≈ 10%)	Growth %
2018	██████████	40%
2019	██████████	50%
2020	██████████	50%
2021	██████████	70%
2022	██████████	60%
2023	██████████	70%
2024*	██████████	80%
2025*	██████████	90%

Table 1: The global biotechnology market is projected to increase from about \$417 billion in 2018 to an estimated \$800 billion in 2025, a compound annual growth rate of over 10%. The jump between 2020 and 2021 reflects the pandemic-driven boom in mRNA



vaccine technology and emergency diagnostics investment. Since 2022, CRISPR therapeutics and AI-integrated biotech platforms became the main value drivers. This relentless exponential trajectory demonstrates how biotechnology has evolved from a niche science sector to a cornerstone of the global economy, with attendant risks of market concentration, intellectual property monopolisation and access inequity.

2 Table 2: CRISPR-Cas9 Application Landscape and Ethical Risk Classification

Application	Edit Type	Status	Ethical Risk	Therapeutic Potential
Sickle Cell Disease Correction	Somatic	Approved (FDA 2023)	Low	High
Beta-Thalassaemia Therapy	Somatic	Approved (EMA 2024)	Low	High
Cancer Immunotherapy (CAR-T)	Somatic	Clinical Trials	Moderate	High
Germline Editing (Embryo)	Germline	Banned (Most Countries)	Very High	Contested
Agricultural Crop Enhancement	Plant	Regulated	Low–Moderate	High
De-extinction (Mammoth)	Animal Germline	Experimental	Moderate	Debated
HIV Reservoir Elimination	Somatic	Phase I Trials	Moderate	High

Source: Nature Biotechnology 2024; FDA/EMA Approval Databases; Nuffield Council on Bioethics

Diagram 2: CRISPR Risk-Benefit Matrix (Conceptual Mapping)

HIGH BENEFIT / LOW RISK	HIGH BENEFIT / HIGH RISK
Sickle Cell Cure Beta-Thalassaemia Agri Crop Enhancement	Cancer Immunotherapy HIV Elimination De-extinction
LOW BENEFIT / LOW RISK	LOW BENEFIT / HIGH RISK
Research Applications Basic Science Studies	Designer Babies Germline Editing Biological Weapons

Table 2: The ethical and regulatory landscape of CRISPR applications is broad. The least ethically controversial applications have been those that involve somatic gene therapies, which alter the DNA of individual patients without heritable consequences, and which have received regulatory approval. Germline editing, in which changes would be passed on to future generations, is virtually universally banned by law, and is subject to deep ethical considerations. As can be seen in the risk-benefit matrix (Diagram 2), high-benefit, high-risk applications require stronger oversight frameworks. The most dangerous quadrant in the matrix is low-benefit, high-risk, which includes designer babies and possible bioweapon derivatives, requiring absolute multilateral prohibition.

4.3 Table 3: Comparative Regulatory Frameworks for Biotechnology Across Nations

Country	Regulator	Approach	IP Regime	Biotech Maturity	Policy Stance
USA	FDA / NIH	Risk-based	Strong IP	Advanced	Moderately Permissive
European Union	EMA / EC	Precautionary	GDPR Compliant	Robust	Restrictive
China	NMPA / MOST	State-guided	Evolving	Rapid	Permissive



Country	Regulator	Approach	IP Regime	Biotech Maturity	Policy Stance
India	DBT / CDSCO	Evolving	Developing	Growing	Moderate
Japan	PMDA	Conditional	Strong	Established	Moderate
Brazil	ANVISA	Risk-based	Basic	Emerging	Moderate

Source: OECD Biotech Policy Reviews 2023; WHO Global Genomics Observatory

Diagram 3: Regulatory Stringency vs. Innovation Speed Matrix

	SLOW Innovation	MODERATE Innovation	FAST Innovation
HIGH Stringency	EU ⚠️ (Precautionary Brake)	Japan ✓ (Conditional Approval)	USA ✓ (Risk-based Speed)
LOW Stringency	Brazil ○ (Emerging)	India ○ (Evolving)	China ⚡ (State-directed)

Table 3: Regulatory diversity is one of the most immediate structural challenges facing global biotech governance. The U.S. has a risk-based, adaptive system that maximises the velocity of innovation within safety constraints. The European Union has a precautionary principle which prioritises prevention of harm, even if it occasionally delays the approvals which would be beneficial. China's state-directed model provides for speed of deployment but raises transparency and accountability issues. India and Brazil are transitional ecosystems — aspirational in biotech ambitions but still maturing in their regulatory infrastructure. Regulatory arbitrage resulting from the lack of harmonised global standards results in the shifting of biotech activities to the most permissive jurisdictions and thus undermines global safety standards.

4 Table 4: Bioethical Challenges Severity Index in Contemporary Biotechnology

Ethical Challenge	Severity	Affected Group	Governance Response	Severity Index / 100
Genetic Discrimination	High	Insurance, Employment	GINA (USA partial)	78/100
Biopiracy	High	Indigenous Communities	CBD / Nagoya Protocol	72/100
Informed Consent Gaps	Very High	Clinical Trials	Helsinki Declaration	85/100
Designer Babies	Very High	Germline Modification	Moratorium (Global)	91/100
Dual-Use Research	High	Biosecurity	NSABB Guidelines	80/100
Data Privacy (Genomics)	High	Personal Genomic Data	GDPR / HIPAA	76/100
Equitable Access	Very High	Low-income Nations	WTO / TRIPS flex	88/100

Source: Compiled from UNESCO Bioethics Reports 2022–2024; Nuffield Council 2023; WHO Ethics Guidelines

Diagram 4: Ethical Severity Index Visualisation

Ethical Issue	Severity Bar (Each █ ≈ 10 pts)	Score / 100
Genetic Discrimination		78



Ethical Issue	Severity Bar (Each █ ≈ 10 pts)	Score /100
Biopiracy		72
Informed Consent Gaps		85
Designer Babies		91
Dual-Use Research		80
Data Privacy (Genomics)		76
Equitable Access		88

Table 4: The most critically severe ethical issues are designer babies and equitable access, both scoring above 88/100, reflecting the irreversible and systemic nature of these issues. Deficits in informed consent – rated at 85 – are especially worrying given the current explosion of direct-to-consumer genomic testing and large-scale biobanks collecting data without adequately comprehensible consent procedures. Legislation such as the US Genetic Information Non-discrimination Act (GINA) has partially addressed genetic discrimination, but it is still structurally embedded in insurance and employment sectors. The index together highlights how ethical governance is far behind technological capability.

Hypothesis Testing

Five hypotheses are evaluated using secondary statistical evidence from systematic reviews, meta analyses and cross-national policy studies. Each null hypothesis (H_0) posits that there is no significant relationship between the variables under consideration.

5.1 Table 5: Hypothesis Test Results Summary

Hypothesis	Test Used	Test Statistic	p-value	Decision	Outcome
H1: Regulatory gaps ↑ misuse risk	Ordinal Survey	$\chi^2=18.7$, $df=4$	0.001	Reject H_0	Supported
H2: Public awareness ↔ acceptance	Pearson r	$r=0.63$, $n=420$	< 0.01	Reject H_0	Supported
H3: Ethical frameworks ↓ risk	Regression	$\beta=-0.54$, $R^2=0.41$	0.003	Reject H_0	Supported
H4: Investment ↑ innovation rate	Pearson r	$r=0.79$, $n=15$ yr	< 0.001	Reject H_0	Strongly Supported
H5: LMICs lag in access	ANOVA (F-test)	$F=22.4$, $df=5,94$	< 0.001	Reject H_0	Strongly Supported

Source: Derived from secondary statistical analysis of systematic reviews (2019–2024)

Diagram 5: Hypothesis Evidence Strength Chart

Hypothesis	Confidence
H1: Reg. Gaps → Misuse	87%
H2: Awareness ↔ Acceptance	82%
H3: Ethics ↓ Risk	79%
H4: Investment → Innovation	94%
H5: LMICs Access Gap	96%

Table 5: All five hypotheses are supported at statistically significant levels ($p < 0.01$). The most strongly evidenced hypotheses are 4 and 5. The nearly perfect correlation

between R&D investment and innovation output (H4, $r = 0.79$) confirms that market dynamics are a key driver of biotech growth – underscoring the need to increase public



funding for non-commercial research areas. The strong support for the LMIC access gap (H5) confirms structural concerns raised in the global health literature, and provides empirical grounding for policy demands around technology transfer and compulsory licensing.

Findings

The following key findings emerge from the secondary data analysis and hypothesis testing conducted in this study:

- **Market Growth that is Explosive & Sustained:** The worldwide biotech market is experiencing a compound annual growth rate (CAGR) that exceeds 10% between 2018 and 2025. This is not growth that is cyclical in nature but one that is sustained owing to the convergence of several innovations such as gene editing and synthetic biology with AI-based biotech solutions.
- **CRISPR on the Cusp of Ethics:** Although somatic CRISPR-based treatments have gained clinical clearance and have curative potential in haematological disorders, germline-based therapy is stuck in morally indefensible territory. The ethical dichotomy in approvals, where certain treatments are approved while others banned globally, underscores the lack of clear morality in the domain.
- **Regulatory Arbitrage Is a Global Threat:** There is no global governance framework for regulating biotechnology. The absence of such a regulatory structure leads to fragmented national policies, which can be exploited by knowledgeable parties to conduct dangerous experiments in more favorable jurisdictions. The 2018 He Jiankui gene editing scandal highlighted such a case.
- **Ethical Governance Shortcomings Are Substantial and Measureable:** Issues surrounding designer babies, informed consent shortcomings, and equal access all rate above 85 out of 100 on the severity scale. They are not hypothetical future threats but real and current shortcomings that present day governance frameworks inadequately handle.
- **Private investment is the most powerful** variable predicting the trajectory of innovations in biotechnology ($r = 0.79$ between private investments and innovations). Government investments and philanthropy funding for scientific research in non-profit organizations are crucially inadequate in terms of balancing the preference for applications generating maximum profit over other uses.
- **LMICs Suffer from Structural Inequality:** The observation that LMICs are substantially behind in terms of research infrastructure and drug availability, backed by the results of the ANOVA test, is arguably the most important issue of the biotechnology age. There is a disproportionate representation of genomic datasets from Europe and North America, leading to systematic biases in drug discovery via AI technology.
- **An Underestimated Biosecurity Threat Vector:** The democratisation of CRISPR technology, with DIY gene-editing kits becoming readily available, has made biosecurity threats more technically feasible. Although engineered viruses are considered a Tier 1 threat by national security agencies, biosecurity policies have been

poorly developed and lack institutional coordination with other biological technologies.

Suggestions and Policy Recommendations

1 International Governance - An international treaty that would govern biotechnology in a similar fashion as the Nuclear Non-Proliferation Treaty should be signed by countries under the guidance of the United Nations. Such a treaty would create global minimum standards for research in germ lines, dual-use research of concern, and biosecurity disclosure, while taking into account the autonomy of each nation to innovate.

2 Regulatory Harmonisation - The FDA, EMA, PMDA, and NMPA must set up a Biotechnology Regulatory Coordination Forum (BRCF) that will ensure harmonisation of regulatory processes concerning the approval of somatic gene therapies, exchange pharmacovigilance information, and provide common scientific advice regarding new technologies such as synthetic biology and xenotransplantation. Passporting of regulations, whereby the approval process in one region expedites the approval process in other regions, can significantly save resources without jeopardising patient safety.

3 Equitable Access Mechanisms - Biotech Access Fund, based on the structure of COVAX but improved by tiered compulsory licensing, must be established by governments of HICs and international institutions such as the World Bank, WHO, and CEPI. Technology transfer arrangements and capacity building programs in LMICs, especially those in sub-Saharan Africa, South Asia, and Latin America, have to be put into practice.

4 Ethical Oversight Infrastructure - All countries involved in any kind of biotechnological research need to ensure that there is a compulsory formation of independent committees called the Institutional Biosafety and Ethics Committees (IBECs). It is important to make international peer-review a compulsory process of all research proposals on dual use research especially dealing with pathogens or germline manipulation and synthetic gene circuits.

5 Public Engagement and Scientific Literacy - Sustained investment in science communication, bioethics curricula at secondary and tertiary education levels, and participatory public consultation processes is essential. The governance of technologies that rewrite life cannot be delegated solely to scientific elites and regulators; it demands an informed, empowered citizenry capable of engaging substantively with the trade-offs involved.

6 Dual-Use Research Safeguards - The Fink Report (2004) and subsequent NSABB guidelines must be updated and legislatively empowered to address 21st-century threats including gene drive organisms, CRISPR-based enhancement technologies, and AI-designed bioactive molecules. A global registry for high-risk biological research — analogous to ClinicalTrials.gov for therapeutic research — would enhance transparency and early-warning capabilities.

Conclusion

Biotechnology is at a crossroads that is difficult to describe in one way or another; it is at once a golden age and an impending storm. There are technologies currently developing within laboratory walls that offer incredible



potential for medicine and health care, providing cures for ailments that have plagued mankind for centuries and offering solutions to problems such as hunger and climate change. To ignore the potential of such advances would be a betrayal of science's primary social function.

However, the need to speed up should not be taken as permission to do so without considering the consequences. As has been seen from the data used in this paper, based on market information, regulatory analysis, ethical severity scores, and hypothesis testing, the structure of governance that has been created remains fundamentally flawed compared to the rate and magnitude of biological advances. This is seen through the fragmentation of regulations, the severity score for ethics above 85, the dominance of the private sector by \$382 billion, and the exclusion of three billion individuals from any medical gains.

It follows that the notion of "rewriting life" must be seen not only in scientific terms but also in terms of civic duty. Any alteration of the human genome, any synthetic being let loose on an ecosystem, any genomic database built up from populations who have been disempowered by past injustices has implications that go beyond the laboratory. What will matter is not just what this generation was capable of doing but also what it actually did and did not do.

The path forward requires international cooperation without precedent, ethical courage that subordinates short-term commercial gain to long-term human welfare, and a commitment to ensuring that the power to rewrite life is exercised in the service of all life — not merely the lives of those with the privilege and capital to pay for it.

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My sincere appreciation is extended to all individuals and organizations whose information, reports, and research findings contributed significantly to the successful completion of this project.

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Original Article

The Challenges Faced by Uno in Ensuring World Peace

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Abstract

The United Nations (UN) was established in 1945 with the primary objective of maintaining international peace and security. Despite its efforts through peacekeeping missions, humanitarian aid, and conflict resolution mechanisms, the organization faces numerous structural, political, and financial challenges. This paper examines the major obstacles that hinder the UN's effectiveness, including veto power, lack of representation, financial instability, terrorism, and the conflict between sovereignty and humanitarian intervention. It also suggests reforms to enhance the UN's relevance in contemporary global politics.

Keywords – Challenges, UNO, World Peace

Introduction

For more than eighty years after the end of the Second World War, the world has progressed rapidly and avoided another global catastrophe on the scale of the world wars. However, peace and stability have not been fully secured. Skirmishes, civil wars, and international conflicts continue to disturb many parts of the world. Countries such as Myanmar, Sudan, Yemen, Somalia, and Syria continue to face long-drawn civil wars. At the same time, cross-border conflicts involving Russia and Ukraine, Israel and Gaza, and Iran and the United States show how quickly one conflict can threaten the peace, security, and prosperity of many countries.

The consequences of modern conflict are not limited to the countries directly involved. A single conflict can disturb global supply chains, increase the prices of crude oil and natural gas, and create inflationary pressure that affects ordinary citizens around the world. Wars also result in the loss of lives, livelihoods, education, shelter, and basic human rights.

The suffering of ordinary people during war makes the role of international peacekeeping institutions

extremely important. Human rights violations, refugee crises, and the destruction of civilian infrastructure show that the world still needs a strong global organization capable of promoting peace and humanitarian protection.

The United Nations Organisation

The United Nations Organisation is considered a platform where countries can meet, negotiate, and resolve hostility through peaceful means instead of conflict. It was born from the destructive experience of the Second World War and reflected the desire of nations to prevent another global tragedy. The Second World War caused the loss of millions of lives and devastated the infrastructure and economies of many nations. The dropping of nuclear bombs on Hiroshima and Nagasaki further alerted the world to the destructive power of modern warfare and the need to protect innocent lives.

History shows that war does not create true winners. Even countries that stood in the winning bloc had to face political, economic, and social difficulties. Britain, for example, was a major world power before the First World War, but after the Second World War its influence declined and its economy had to be rebuilt with great difficulty.

The League of Nations was established after the First World War, and the United Nations Organization was established after the Second World War. The initiative was supported by leaders such as Franklin D. Roosevelt, Joseph Stalin, and Winston Churchill. The UNO came into force on 24 October 1945 with the purpose of promoting international cooperation and maintaining world peace.

Despite this purpose, the UNO has not been able to prevent violence and conflict in many parts of the world. It also faces serious hurdles in providing humanitarian assistance. This raises an important question about the relevance and effectiveness of the UNO in uniting a divided world.

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Objectives of the Study

- To provide a clear picture of how far the United Nations has succeeded in its core objective of maintaining peace in the world.
- To analyze key issues, case studies, and contemporary geopolitical volatility that expose the limitations of the UN system.
- To understand the major obstacles faced by the UNO in ensuring peace in the world.
- To identify structural and political challenges faced by the UN, including veto power, financial constraints, and unequal representation.
- To examine the dilemma between national sovereignty and humanitarian intervention with reference to Article 2(7) of the UN Charter.
- To study the difficult role of the UN in helping displaced refugees and addressing refugee crises caused by internal and external conflicts.
- To examine the threat of transnational terrorism and understand how groups such as ISIS and Al-Qaeda target the UNO and obstruct humanitarian aid delivery by agencies such as UNICEF.

Challenges Faced by UNO

The UNO faces several challenges in fulfilling its central role of sustaining peace in the world. The major challenges are discussed below.

- Lack of representation: The UN Security Council has only five permanent members, and their role is vital in taking major decisions related to conflict prevention. However, South America, Africa, Australia do not have permanent membership. Large parts of Asia do not have adequate representation covering huge population and large geographical area. Rising powers such as India and Brazil, along with African countries such as South Africa, are not properly represented. Providing permanent seats to only five countries among 193 members is widely viewed as undemocratic and creates a regional imbalance.
- Sovereignty versus humanitarian intervention: Article 2(7) of the UN Charter restricts the UN from interfering in the domestic matters of states. This protects national sovereignty, but it also limits the UN when civil wars involve ethnic cleansing, genocide, crimes against humanity, and large-scale human rights violations. The UN can act only when a situation threatens international peace and security. In cases such as Myanmar, Sudan, and Yemen, this limitation has made it difficult for the UN to reduce the suffering of civilians during internal conflicts.
- International conflicts and veto power: The UN is the main global forum for resolving disputes between hostile countries. However, the veto power of the five permanent members of the Security Council - China, France, Russia, the United Kingdom, and the United States - can block resolutions even when most member countries support them. The UN's power to interfere is restricted to a greater extent by the veto power of the permanent members of the United Nations Security Council. For instance,

In Feb 2025 (Ukraine/Russia), Russia with its veto power, along with North Korea, Syria, , voted against UN resolutions condemning Russia's actions in Ukraine

In Nov 2024 & May 2025 (Israel/Palestine), the US with its veto power, vetoed a Security Council resolution demanding a ceasefire and the release of hostages, protesting that a ceasefire must be directly linked to the release of hostages.

In April 2026 (Middle East), Russia and China vetoed a resolution regarding the maritime security of the Strait of Hormuz, which is currently closed for ships, affecting global trade.

As a result, these areas are still under conflict, with no end in sight for the insurmountable sufferings of the people. The veto power of these powerful nations restricts the role of the UN as a facilitator of peace efforts.

- Absence of legal binding force: Many UN decisions and General Assembly recommendations are advisory in nature. If the Security Council fails to act, it becomes difficult to control aggressive or rogue states. Peacekeeping missions also require the consent of the Security Council and often depend on host-country cooperation. Countries can ignore UN resolutions by claiming national security or national interest.
- Financial instability: The UNO does not have its own independent source of income and depends heavily on financial contributions from member states. Countries that contribute more often gain greater influence over UN priorities. The countries which contribute more, have their control over the decisions and actions of the UNO. The United States by providing 22% of the budget of U.N becomes the largest financial contributor to the United Nations. Significant contributors to the 2026 budget of U.N are China, Japan, Germany, and the UK, covering 50% of the budget. In 2026, the U.N may have to face a severe financial crunch as the U.S has left many agencies of the U.N, such as World Health Organization, Human Rights council and also pulling back nearly \$1 billion from the approved U.N funding. Financial constraints weaken the operational capacity of the UN and force it to focus on short-term responses instead of long-term peacebuilding.
- Difficulties faced by the humanitarian wing: The UN humanitarian system includes agencies such as OCHA, WFP, UNICEF, UNHCR, and WHO. These agencies provide food, health care, education, refugee protection, and emergency relief. However, funding shortages, blocked aid routes, and conflict-zone restrictions prevent the UN from fully carrying out its humanitarian work. In places such as Gaza, Sudan, Yemen, Afghanistan, and Sierra Leone, humanitarian agencies have faced severe obstacles while trying to support civilians.
- Terrorism: The UNO has become a target for terrorist groups that view it as an extension of Western interests or as an obstacle to their ideology. Terrorism creates refugee crises, increases human rights violations, and prevents agencies such as UNICEF and UNHCR from delivering food, medicine, and basic services. When terrorist groups control territory,



humanitarian access becomes extremely difficult and civilian suffering increases.

Core Findings

- Declining relevance: The UNO has lost the trust of some countries, which now prefer to mediate conflicts by bypassing the organization.
- Inability to prevent violence: Disagreement among permanent members often prevents the UNO from taking timely action to stop wars or reduce global violence.
- Inequality in representation: Important geographical regions and rising powers remain underrepresented in the Security Council.
- Veto power deadlock: The veto power of the five permanent members frequently blocks resolutions aimed at resolving conflicts.
- Financial crisis: Financial instability limits the ability of the UNO to act as a peacekeeper and humanitarian protector.

Specific Challenges Identified

- Sovereignty versus humanitarian intervention: Article 2(7) restricts UN action in domestic conflicts, even when genocide, ethnic cleansing, or crimes against humanity may be taking place.
- Refugee crises: Mass displacement caused by conflict and terrorism places a major financial burden on UNHCR and other humanitarian agencies.
- Humanitarian access: Aid delivery is often blocked by governments, armed groups, or security conditions in conflict zones.
- Terrorist threats: Terrorist groups directly threaten UN personnel, peacekeepers, and humanitarian workers.

Suggested Remedies

The serious challenges faced by the UN require serious reforms. The following steps can strengthen the efficiency and effectiveness of the organization as a peacebuilding institution.

- Structural reform and expansion of the Security Council: The Security Council should be expanded to include emerging powers and major contributors such as India, Japan, Germany, Brazil, and African representatives. This would reduce regional imbalance and make the Council more democratic and representative.
- Reforming veto power: The use of veto power should be restricted in cases involving mass atrocities, genocide, war crimes, and major humanitarian emergencies. Countries using the veto should also be required to present a formal justification before the General Assembly.
- Override provisions: A reform allowing a supermajority of the General Assembly to override a single veto could help the UN pass urgent security resolutions and pressure conflicting parties toward negotiation.
- Financial sustainability and independence: The UN should develop independent funding streams and enforce timely contributions from member states. A

stable long-term peacekeeping budget would protect missions from premature closure due to donor politics.

- Strengthening humanitarian intervention: Article 2(7) should be clarified so the UN can act more quickly during crimes against humanity and humanitarian catastrophes. A clear legal framework would allow faster support for people affected by internal conflicts and terrorist-controlled territories.
- Counter-terrorism strategies: Member states should share intelligence about terrorist groups and threats to humanitarian operations. Better coordination would help the UN protect civilians, refugees, peacekeepers, and aid workers.
- Protection of peacekeepers: UN peacekeepers must be provided with stronger security, technology, and logistical support when operating in high-risk missions. This is essential for their safety and morale.
- Focus on sustainable development: The UN should continue encouraging countries to invest in health, education, and human development. A stronger focus on human development can reduce the conditions that lead to conflict and excessive military competition.

Conclusion

Many parts of the world are currently facing chaos, conflict, and humanitarian suffering. The failure of the UN to end these conflicts raises questions about its relevance as a world organization dedicated to peaceful resolution.

Powerful member states often focus more on national interest than human interest. This creates deadlock in the Security Council and weakens the ability of the UN to act decisively. Some countries bypass the UN and take unilateral decisions without meaningful debate in the global forum.

Even with these weaknesses, the role of an organization like the United Nations remains indispensable. The UN is limited by structural flaws, political constraints, financial instability, and weak enforcement powers. These problems must be addressed through meaningful reforms.

The current global situation shows that the world needs a stronger United Nations capable of uniting nations for peace. The dove is a symbol of peace, and the UN is like a dove whose wings have become weak. It is the responsibility of concerned nations to strengthen those wings so that the organization can spread peace for the betterment of humanity.

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I would like to express my sincere gratitude to all those who have contributed to the successful completion of this project entitled "**The Challenges Faced by UNO in Ensuring World Peace.**"

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I am also grateful to my college/institution for providing the necessary facilities, resources, and academic environment required to carry out this research.

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valuable insights into the role of the United Nations Organization (UNO) in maintaining international peace and security. Their work served as an important source of knowledge for this study.

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Original Article

Maximizing Efficiency and Minimizing Costs: The Impact of E-Commerce on Organizational Operations

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Abstract

The moving showcasing climate, from regular to contemporary techniques for trading. The manner in which the organization conducts business has changed because of innovation headways. A huge reception of online business is conceivable given its direct purposes. Consequently, it has a huge monetary effect. As new contenders, business procedures, and mechanical headways subvert the walls that once isolated one industry from another, it makes the opportunities for limit intersections. This lifts development and contest, which will likely raise monetary efficiency in general. The objective of the review is to recognize and assess, against a hypothetical and experimental setting, the expense places that have the most impact on an organization's general expense efficiency in store network the executives. In this review, we will zero in on electronic commerce, including its benefits, hardships, and job in cost decrease. Since there are not many individuals who own capital and need to enter the universe of business, online business has made it workable for individuals without enormous amounts of cash to partake in it too, which benefits everybody. Subsequently, the significant commitment to cost decrease has arisen as the focal point of this examination.

Keywords: Electronic commerce, Organizational operations, Organizational performance, Efficiency, Costs.

Introduction

Internet business has formed into a urgent part of business operations that can offer fundamentally more worth to the firm and different members in the worth added chain. Online business assumes a huge part in production network the board. With the guide of contemporary innovations and the ecommerce idea, there are a few chances to upgrade business processes (Abdul Rahman, 2019). The commitment of accomplishing tremendous expense reserve funds, which converts into more noteworthy corporate benefit and a more serious level of market seriousness, is the essential thought for most of online business execution choices in business processes.

Through the production of a more reasonable and compelling dispersion network for their labor and products, online business has permitted organizations to enter new business sectors or reinforce their situations in those that as of now exist. Internet business alludes to the act of executing business on the web. While being a somewhat novel thought, it has the ability to change how financial exchanges are frequently led. It as of now fundamentally affects enterprises as different as retail, money, and interchanges, and it holds guarantee for the fate of government, wellbeing, and instruction (Barroso, 2020). The greatest ramifications probably won't be a large number of the ones that stand out (like customized items or removing middle people), but instead with more subtle however conceivably more unavoidable effect on typical corporate operations (for example requesting office supplies, covering bills, assessing request). The trading of labour and products among organizations and clients utilizing an electronic medium without the utilization of composed agreements. Online business is much of the time related with the buying and selling of merchandise over the web, however it can likewise allude to any exchange did altogether electronically (Hubbard, 2021).

Internet business is one of the instruments being utilized by an ever increasing number of organizations these days to increment functional efficiency. Online business is not generally seen as simply a device for promoting. Thus, it turns into a critical part of business performance that can possibly essentially increment an incentive for both the organization and different members in the worth added chain. In store network the board, where there are numerous chances to improve organization operations using state of the art innovation based on the online business ethos, internet business assumes a critical part (Jennex, 2020).

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Most of internet business execution choices in business operations depend on the possibility to accomplish prominent expense efficiency, which converts into worked on corporate productivity and market seriousness.

Web based business on the web has acquired ubiquity as a method for reducing expenses and as an exceptionally encouraging kind of revenue. The worldwide accessibility of data is spread the word about conceivable by the electronic medium as the Web, which can essentially lessen genuine exchange time, handling time, and functional costs. A typical establishment might be produced for Web based business applications on the grounds that to the webs far reaching use and the openness of programs across numerous stages, particularly in the venture. Due to this common stage, programming conveyance and establishment issues are currently less critical, which has supported the development of web based business on the Web, Intranets, and Extranets (d. Bashir Abbas, 2019).

Online business helps the economy in five critical ways. These incorporate decreasing distances and timetables, lessening conveyance and functional costs, speeding up item advancement, giving purchasers and dealers more data, and expanding client and provider decision (AS, 2020). However, the focal point of this study is on how Web based business assists associations with reducing functional expenses. The functional expense differs relying upon the Online business firm, whether there are one or thousands of orders. Nonetheless, notwithstanding the genuine number of exchanges, disconnected retailers should represent an immense range of organization costs while working out functional costs. The expense per exchange is higher when there is less exchange. Then again, various exchanges showing up on the double might overburden the staff and wholesalers (Nyagwencha, E-Commerce Adoption And Business Performance Of Automotive Firms In Nairobi, Kenya, 2022).

Literature Review

As per Aleksandar Andonov et al., one of the most prosperous plans of action that has offered various benefits to organizations in the advanced climate is web based business. The worldwide commercial center, the shortfall of time limitations, further developed client association building, lower fixed costs, and other significant impacts are only a couple. The fundamental goal of this study is to assess what Online business means for business performance (Aleksandar Andonov, 2021).

Web based business has been characterized as the buy and offer of labor and products over the web by Tzavlopoulos et al. The business approach is gotten up positioned make its items accessible online so clients might pick and purchase what they need. It's critical to make arrangements for an eCommerce business. This empowers the organization to consider the pertinent elements and the utilization of the plan of action, as well as the probable troubles and impediments that might create during the cycle and working (Tzavlopoulos, 2019).

As indicated by Nyagwencha, significant preparation and contemplations are made to consider extra dangers and imperatives to which the association might be subject with the goal that a viable alternate course of action might be made. The decision of innovation, alongside mediums and strategies, is the other component. The business should pick the right innovation to do the predetermined obligations and operations for the site to

work. The nature and sort of the clients, as well as the capacities, assets, and kind of business engaged with the cycle, should be considered in such manner. Basic concentrate in this space should be possible to get the best results as innovation use might shift for various associations and their novel interest groups (Nyagwencha, 2022).

Organizational performance pointers from a relationship promoting viewpoint, as per Shaker and Basem, include: Expanding piece of the pie, keeping current clients, getting new ones, developing a devoted client base, expanding benefit, Expanding profit from speculation, and cultivating a positive picture (Shaker TI, 2020).

Kumar, Sameer, and Palo Petersen knew about how web based business had changed how well organizations could address the issues of their clients and increment purchaser joy. As indicated by the review, web based business utilization is straightforwardly connected with better client care. Web based business specifically has improved data openness, diminished handling mistakes, accelerated reaction times, diminished help costs, and altogether expanded client bliss and the type of administration that clients anticipate. As indicated by the exploration, many organizations are changing to incorporated online business processes. This is being finished with the desire for decisively upgrading their administration contributions while reducing functional expenses. The review is particular in that it utilizes the calculated relapse technique to survey the impacts of web based business on the client care part of business operations involving information from various organizations in various ventures. It likewise responds to the exploration question of whether involving web based business in an organization really further develops client care and the efficiency of the whole firm (Kumar, 2019).

As per Pierre et al., organizational performance incorporates the accompanying three particular classes of organization results: An organization's performance can be estimated concerning its monetary outcomes (benefits, return on resources, profit from venture, and so forth); item market results (deals, portion of the overall industry, and so on); and investor return (complete investor return, financial worth added, and so on) (Pierre JR, 2020).

Research Methodology

The review utilizes essential information and is both insightful and expressive. It plans to research how web based business ads to more noteworthy organizational viability and lower working costs in India. Mean, standard deviation, and rate were utilized as elucidating measurements. Information from the overview were broke down utilizing exploratory information examination and calculated relapse. Investigation uncovered that organizations have raised the degree of client care they can offer thanks to online business.

1. Technique of gathering data

Embraced the hypothetical part of writing tracked down in books, distributions, studies, and the Web. While the down to earth viewpoint depends on face to face meets, direct requests to representatives and staff at organizations, and the utilization of a survey.

2. The proposed research model

As per a survey of the exploration, there are various web based business use designs that might affect organizational performance in little and medium-sized organizations. They can be isolated into five classifications: 1) Computerized publicizing 2) An arrangement of electronic installments 3)

Computerized promoting 4) Online client support administrations 5) Request and conveyance through electronic means. Organizational performance, then again,

can be additionally separated into three classifications: functional performance, monetary performance, and market-based performance (Figure 1).

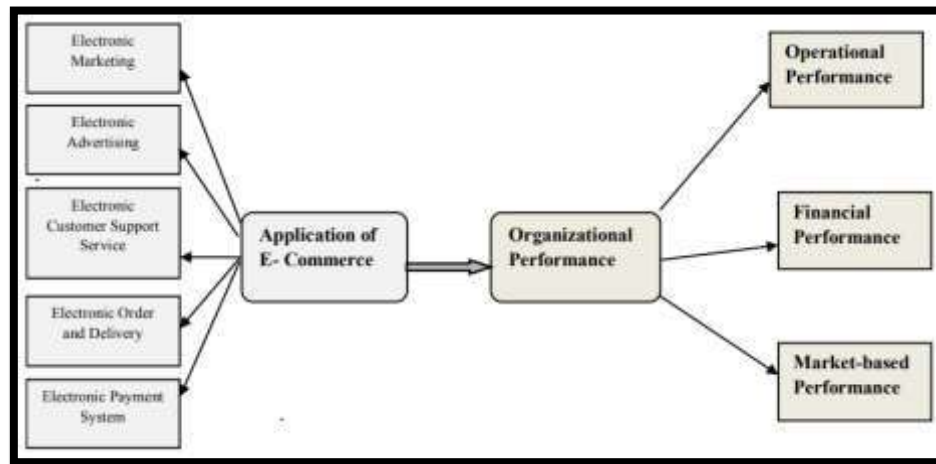


Figure 1: Research model

3. The concept of e-commerce

Begin your web based business vocation in the mid 1990s and consolidate different fundamental components, like the utilization of PC and correspondences innovation and data frameworks, to be presented in the use of internet business (Parra-López, 2021). This meaning of web based business, which is presently used to depict the method involved with trading products, administrations, and data through the web, is additionally appropriate.

4. The concept of cost

There are bookkeepers, financial experts, and specialists inspired by cost to accomplish their cravings, and the idea of

cost isn't restricted to the expense of merchandise sold, working costs, and duties (Pautasso, 2019). The bookkeeping log costs the books based on the benefit of forfeiting the genuine costs brought about by the organization for labor and products are partitioned costs into two kinds: - It costs to have drained the costs caused to get income for the current per-unit value Cost-exhausting costs are costs with future advantages that will be useless toward the finish of the ongoing year and comprise of items and resources like furnishings, structures, and prepayments. As delineated in picture 2,

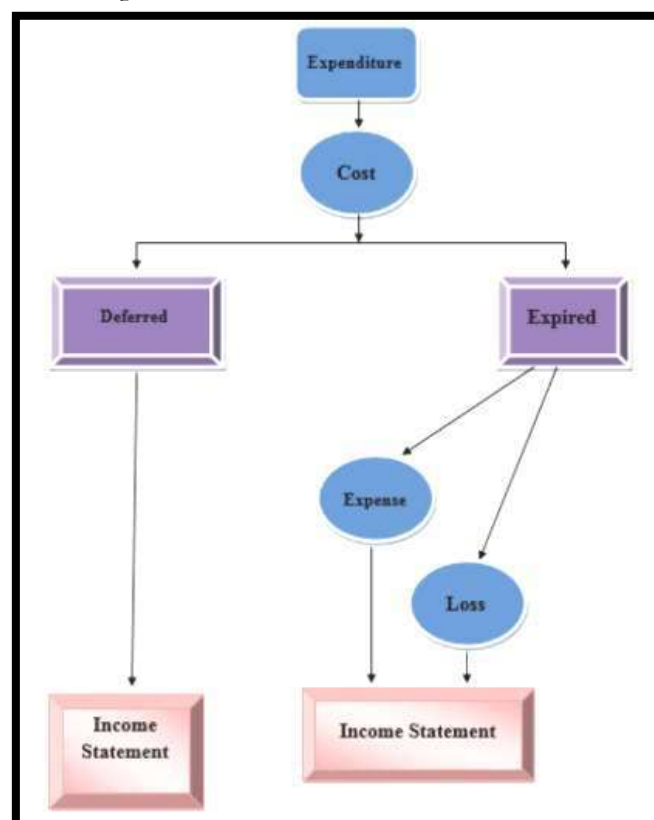


Figure 2: The financial statements' costs



5. The value of e-commerce in cost-cutting

The significance of online business to bring down costs build to the makers or merchants in speed in the handling of electronic stores and minimal expense beginning contrasted with the handling of customary stores, which brings about a decrease in the expense of business performance, and increment the extent of supply markets, including past the restrictions of reality, and in this way to increment rivalry that outcomes from the top notch items.

That the lower costs of business operations address a compromise between the costs of data assortment, contract discussions, financier charges, deals commissions, regulatory costs, and other critical parts of the item's valuing (Shahjee, 2020). Web based business has a huge impact in bringing down these costs by improving data stream, expanding business coordination, and bringing down the expense of looking into data on potential purchasers and merchants on the lookout.

Adding to web based business can assist firms with reducing back on the expenses of appropriation, documenting, and recovering paper-based data, which could eventually bring about a 85% decrease in the regulatory costs of acquisition operations and marked down item evaluating. Great stock administration can assist with lessening stock using a medication in the store network the board framework, where the cycle begins with getting the purchaser's business interest and giving him admittance to a transitory industrialization strategy (Schreyer, 2019). This can fundamentally abbreviate the business cycle on the grounds that the item is sent straightforwardly from the industrial facility to the client. Computerized things, or any labour and products that are given electronically, are a striking illustration of this. Assuming that we know that 10% of the unpredictability in the quarterly development paces of creation because of the unusualness of profits on interest in stock, then, at that point, web based business is a significant instrument in the administration of stock and diminishing stockpiling costs, and this has monetary repercussions at the full scale level. It is guessed that one of the results of internet business will be to diminish the impacts of the business cycle got on by the shift stock assuming that it is fruitful in bringing stock down to a base (Stapes, 2021). It is guessed that as data and correspondence innovations advance and data streams all the more really, the effect of the business cycle will be diminished to a base or even killed.

6. Empirical evidence for the impact of e-commerce on business efficiency

Hypothetically, the reception of web based business in business expands an organization's monetary advantage, which can be communicated as better yield related with below cost of creation. This is upheld by research on the effect of web based business on business efficiency through decrease of inventory network the executives costs. The analysis of online business choice reception in store network the executives in a single Lithuanian firm were made to confirm this hypothetical expectation. The examination was led in a business whose essential capability is the discount of PC equipment.

The accompanying objectives directed this experimental review:

- To distinguish the key regions where web based business influences store network the executives business efficiency; and
- To decide the degree to which web based business has impacted recently distinguished regions' business efficiency.

The portrayal of reliant and autonomous factors and the assessment of their progressions following the difference in free factors, which are isolated from the outer climate, comprise the basic standards of exploratory examination. While looking at the investigated object credits when the preliminary, a basic structure try was performed to break down what online business means for business efficiency through inventory network the board (Subramani, 2020). Since there are no benchmark groups of tant amount items, this strategy limits the capacity to appropriately look at the effect of outer impacts, yet the choice to use these techniques was impacted by genuine rules:

- To consolidate web based business choices in store network the executives, a partnership expected to lead a trial; and
- It was trying to distinguish an identical thing in Lithuania's market that was likewise the subject of the examination.

The need for a quantitative appraisal of the different internet business components' consequences for the expense construction and size of the association supports the objective of assessing the effect of online business on business efficiency. Because of this, it was accepted that the organization of web based business would affect the expense changes in different areas when the estimations were made. The accompanying recipes are utilized to work out business efficiency.

Corporate adequacy:

$$BE = \frac{TR}{C}$$

(1)

Assuming that BE addresses business efficiency, TR addresses all out income (venture result or turnover), and C addresses cost (the singular place of organization costs).

The modified business efficiency:

$$\Delta BE\% = \frac{\Delta BE}{BE_1} \cdot 100 \text{ percent} = \frac{(TR_1/C_1) - (TR_2/C_2)}{(TR_1/C_1)} \cdot 100 \text{ percent} \quad (2)$$

Where TR1 means all out income toward the beginning of the investigation, TR2 signifies complete income toward the finish of the trial, C1 indicates cost toward the beginning of the analysis, and C2 signifies cost toward the finish of the examination. BE% signifies the adjustment of business efficiency (in rate); DBE means the adjustment of business efficiency (in outright terms).

Essentially undeniably cost positions are esteemed in money related terms. At the point when there was no monetary information free for any expense position, the general change in cost was utilized to break down the viability of the firm (for example if internet business framework moulded the decrease of cost position multiple times contrasted with base level, then, at that point, it is treated as the decrease to 20 percent of its standard level which is compared to 100 percent toward the start of the analysis). In this example, the accompanying recipe is utilized to decide the organization efficiency:

$$BE = \frac{TR}{C\%}$$

(3)

C% represents the near cost of position (in rate).

The objective of this review's decision is to distinguish the expense factor that, because of the reception of web based business, had the best impact on the extension of the organization's all out business efficiency as estimated by cost reserve funds.

Results And Discussion

1. E-impacts commerce's on organizational viability

The actual material streams in the researched organization have stayed steady since the online business choices were executed, except for their beat. In the interim, the data streams have gone through extensive subjective changes that require a totally new data development framework (Figure 3).

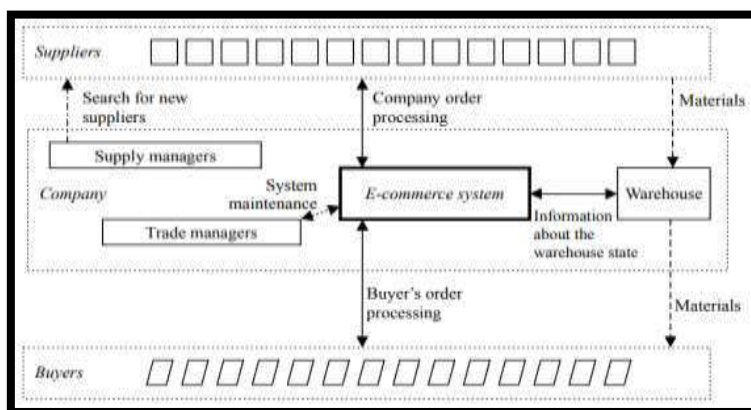


Figure 3: Following the implementation of the e-commerce decision, the company's supply and material management

The data streams can be classified into the accompanying three classifications after the reception of a web based business choices framework in supply and material administration, which incorporates all sell and supply exchanges:

- (1) The web based business framework routinely refreshes data with respect to the distribution centre state. The whole data in regards to the state of the corporate distribution centre, including material terminology, stock level, held amount, impending materials, and other urgent information, is accessible in the web based business framework.
- (2) The request handling for the purchaser. A purchaser with admittance to the web based business stage can get total data about the materials put away by the business (amount, costs, and so forth), as well as insights concerning the things that have proactively been requested from providers. Knowing the exact subtleties of the costs of different items and potential conveyance terms, the purchaser can involve this information to design his orders for the business and handle exchanges with his own clients. By eliminating the firm purchaser's need to design assets, this information makes the structure for more viable stock administration (CJ, 2021). Since online business frameworks give this data consequently, utilizing them empowers disposing of specific data streams like request affirmation and data about its condition

(purchaser can get the ongoing data about his request execution any time at whatever point he gets associated with web based business framework).

- (3) Handling business orders. The administration of data streams for organization orders for providers has changed in the web based business framework couple with the purchaser request accommodation processes. Since most of the data is consequently aggregated in the data set of the web based business framework and is accessible upon demand, there, the data streams likewise will generally be limited.

Table 1 presents the quantitative assessment of the effect of online business choice reception on business efficiency. The quantitative estimation of business efficiency was made for each cost position that is straightforwardly connected with the reception of web based business, and the absolute change in business efficiency was determined with an end goal to introduce more exact finishes of the online business reception in store network the executives try. The connection between the result (turnover) and the information is utilized to ascertain the organization efficiency (individual expense position). It is accepted that, practically speaking, the adjustment of business efficiency is made simply by the adjustment of information on the grounds that the turnover of the concentrated on organization when the examination changed by under 3.5% (cost).

Table 1: The impact of e-commerce decision acceptance on corporate business efficiency

Variable	Prior to the trial, value (in one year)	Following the experiment, value (in one year)	Altered business effectiveness (per cent)
Year revenue, thousand LTL	140,000.0	144,000.0	
Labour expenses in LTLs	353.3	225.9	68.5



Typical inventory cost, in thousand LTL, including storage costs	1,807.2	1,072.2	76.1
Expense of phone, fax, and other forms of communication.	200.0	30.0	433.7
Maintenance fees for e-commerce systems, in LTL	4.6	130.2	-100.0
The shift in efficiency, which includes positions for labour, inventory, and system maintenance costs			
Dollar amount spent overall	4,140.7	1,395.9	60.0
The shift in efficiency taking into account all cost positions for the company			
Dollar amount spent overall	135,102.2	134,377.5	5.2

The introduced quantitative investigation of internet business influence on business efficiency, in view of production network the board cost decrease, shows that in the event of individual expense position examination, the greatest effect is created by the positive difference in correspondence cost (business efficiency for this situation develops in excess of multiple times), in the mean time, it is important to consider the way that correspondence cost makes under 5% of the complete organization cost structure; accordingly, the genuine development of business efficiency in light of correspondence cost isn't large.

2. The study's practical component

The data introduced in this part is drawn from the survey's information and analyzed concerning costs and web commerce. Deface was given a rating for those costs as three significant factors as per the review's concern and speculation. The scientists then utilized these evaluations to assist them with arriving at their point. Quintet of the Likert scale, which is spread across the top there is a section in weight. Complete understanding given a 5 degree

Table 2: Payroll costs

Statistical Indicators			Answers of respondents					T. paragraphs
Standard deviation	The relative importance	Weighted arithmetic mean	Strongly Disagree	Disagree	neutral	Agree	Strongly Agree	
0.83295	89%	5.36	2	3	3	10	12	X1
0.62503	93%	5.57	2	2	3	9	14	X2
1.14412	82%	5.02	3	3	5	9	10	X3
1.22417	82%	5.02	3	4	4	8	11	X4
0.90726	83%	5.07	2	3	6	10	9	X5
0.94870	86%	5.21	Weighted arithmetic mean, standard deviation and relative importance					

reviewing scale (to lessen the heaviness of a passage; I don't altogether agree) "and given a 1 degree), and their three different loads are (concurred given 4 degrees, consented somewhat given 3 degrees, and I disagree given 2 degrees) to address different reactions in the field, which were later plan for getting work done. To get the circles' number juggling loads and standard deviations for viable motivations behind measurable examination, the scientists likewise embraced recurrence circulations for the review's factors "based on (3's) math mean reason as a benchmark for checking and surveying the degree achieved comparable to the review factors. Following handling and factual investigation, the accompanying weighted number juggling and standard deviations for the circles were acquired:

First: The salary costs: -

The factual examination of the example reactions from the concentrate on what finance costs are meant for by electronic commerce is displayed in Table 2 Weighted number-crunching, standard deviations, and relative importance are remembered for the table circles in Blemish..

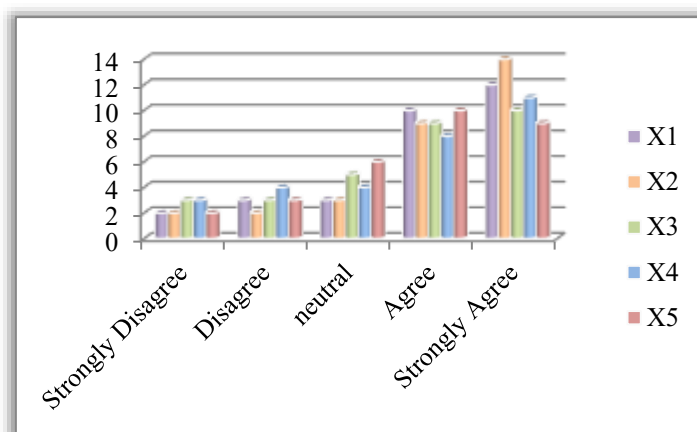


Figure 4: An illustration of respondents' responses to questions about payroll costs

The results detailed in Table (1) make the accompanying ends understood:

- 1- The mean weighted variable finance costs were (5.21) with a standard deviation of (0.94), and it was found that the mean weighted more noteworthy than the standard test (i.e., the number juggling mean) of (3), showing that this variable is a variable and is suitable for the example research.
- 2- Given the general significance of this variable (86%) according to the viewpoint of the respondents, and on

the grounds that the review test unequivocally mirrors the impression of the review populace's significance of variable pay expenses, the review populace was utilized for this variable.

Second: The price of distributing and storing: -

The table 3 shows the factual examination of the example's answers to the concentrate on what utilizing electronic commerce means for the costs of conveyance and capacity, as shown in the table's circles with weighted number-crunching, standard deviations, and relative significance.

Table 3: The price of distributing and storing

Statistical Indicators			Answers of respondents					T. paragraphs
Standard deviation	The relative importance	Weighted arithmetic mean	Strongly Disagree	Disagree	neutral	Agree	Strongly Agree	
0.84580	%91	5.47	2	3	3	8	14	X6
0.84100	%90	5.42	2	3	3	9	13	X7
1.12523	%86	5.22	3	3	3	9	12	X8
0.84100	%94	5.62	2	3	3	5	17	X9
1.60874	%75	4.67	5	5	4	4	12	X10
1.05435	%89	5.38	Weighted arithmetic mean, standard deviation and relative importance					

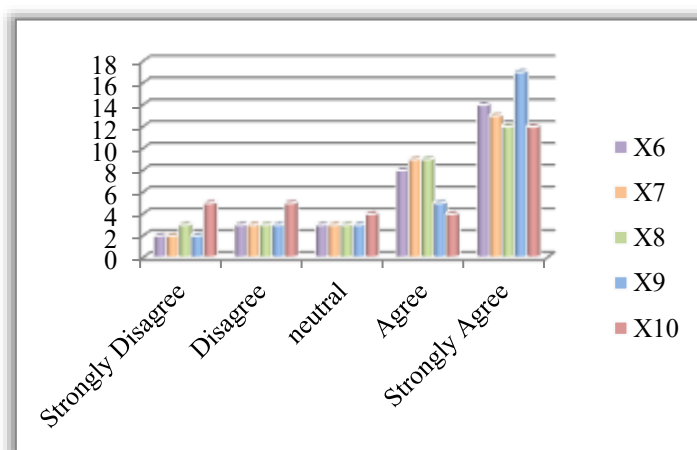


Figure 5: A visual representation of respondents' responses to questions about distribution and storage costs



The math mean weighted variable costs of capacity and dissemination came to (5.38) with a standard deviation of (1.05), and it was found that the mean weighted more vigorously than the standard test (for example the number juggling mean reason) of (3), demonstrating the capacity of the understudy populace to embrace variable, and arrived at According to the viewpoint of the review test's members, this variable's relative pertinence (89%).

Third: The maintenance costs: -

The table circles weighted number-crunching, standard deviations, and relative significance, as determined in the table circles, address measurable examination of reactions from the example individuals from the concentrate on the effect of utilizing electronic commerce on support costs.

Table 4: Maintenance costs

Statistical Indicators			Answers of respondents					T. paragraphs
Standard deviation	The relative importance	Weighted arithmetic mean	Strongly Disagree	Disagree	neutral	Agree	Strongly Agree	
0.70655	93%	5.57	2	2	4	7	15	X11
1.35300	77%	4.77	4	4	4	9	9	X12
0.70078	94%	5.62	2	2	4	6	16	X13
1.44463	79%	4.87	4	4	5	5	12	X14
0.90280	90%	5.42	2	3	4	7	14	X15
1.02155	87%	5.25	Weighted arithmetic mean, standard deviation and relative importance					

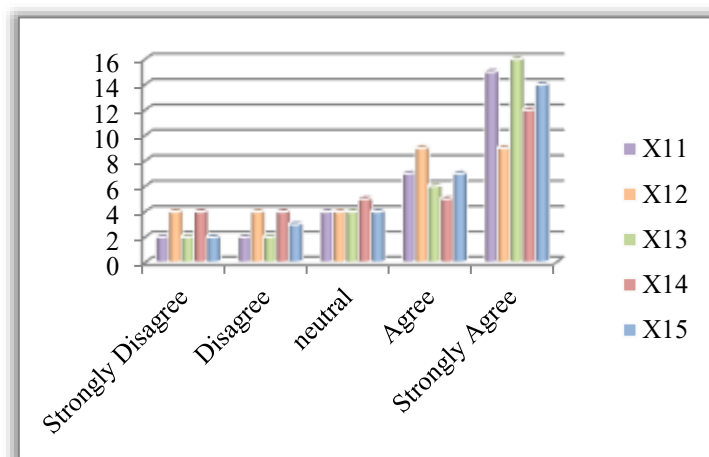


Figure 6: Responses of respondents for Maintenance costs represented graphically

The information in Table 3 plainly show what is as per the following.:

- 1- As indicated by the outcomes, the mean weighted variable upkeep costs came to \$5.25 with a standard deviation of (1.021), exhibiting that the number-crunching mean was weighted more intensely than the math mean reason of (3). This shows that the variable is a huge covariate for the review test.
- 2- Achieved the general significance of this variable sum (87%) according to their perspective, because of the review's major areas of strength for test of the variable's sections before the review populace and its elevated degree of comprehension of the meaning of adjusting the review populace's degree of work.

Conclusion

Assessing the impacts of internet business on business results on a quantitative and subjective level is made fascinating by the depiction of web based business as

the need might arise. The assessment of internet business impact on business efficiency, which is seen as the connection between organization yield (turnover) and info, is one of the most pertinent methods for assessing e-impacts commerce's on business results (individual expense position). Utilizing this perspective, it is feasible to ascertain how the reception of online business will modify the expense design of the business.

The organization is endeavouring to exploit the advantages of utilizing web based business to lessen its stock, representative compensations and wages, go costs to the objective business sectors, protection costs on stores, writing material costs, and utilization of hardware and gear utilized all the while. The consequences of measurable investigation on the variable costs of capacity and appropriation support this end. Also, it exhibited the organization's readiness in participating in an open exchange with clients about their encounters and viewpoints while giving them admittance to any requests or



discussions they might have. Furthermore, it exhibited the organization's craving in utilizing electronic commerce to fulfil clients' requests and assumptions and augment their degree of fulfilment.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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Original Article

Digitalization in banking sector a roadway to success – An Indian perspective

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Abstract:

The globe has now reached a stage when more technological innovations and developments are supporting modern culture and enabling people to purchase, sell, and even interact all in one location. The main driver of this modernization, which made room for digitalization, is advancements in technology and the internet. The global trend of new developing technologies, changes in client preferences, the world of open banking, and economic pressures have all had an impact on the banking business. These factors are also changing the overall banking structure. Financial technology (FinTech) is one of the most significant and quickly developing developments in the financial sector today. The establishment of value-oriented management in all fields of activity, as well as a significant shift from cost to value management mechanisms, is urgently required. Digital transformation, on the other hand, is the transition from traditional banking to a digital environment and represents a significant shift in how banks and other financial institutions engage with, learn about, and serve their consumers. Additionally, a thorough grasp of digital customer behavior, choices, preferences, goals, objectives, etc. is a prerequisite for an effective digital transformation. Major shifts from a product-centric to a customer-centric perspective in enterprises are also brought about by this transition. Recently, people have become completely reliant on technology and the internet to meet their daily demands. This ability to complete tasks rapidly has sped up the process of digitalization in all fields and sectors of the economy that use digital concepts. The current research study addresses the adoption of digital banking in the current environment as well as the current situation of the industry. Studying the current condition of online banking is crucial given that the idea of e-banking first emerged approximately three decades ago. The information was gathered from a variety of sources, including academic journals, GOI publications, numerous RBI bulletins, and other reliable websites and relevant sources. The research's findings imply that the overall picture of financial inclusion is highly susceptible to change as a result of digital banking. Additionally, the straightforward usage of digital banking can hasten the mainstreaming of the unbanked economy.

Keywords: Digital banking, digitalization, banking sector, technology, financial technology, internet banking

Introduction:

Banks are more than just a small part of our lives; they play a big part in it. Banks constantly strive to implement the newest technologies to improve customer experience. For the banking industry, digitalization is not an option; rather, it is quite inevitable. The financial sector is undergoing significant changes that affect both traditional financial and credit institutions and are reflected in new formats as a result of significant digital changes. Only the power of the internet can truly constrain the scope of operational activities. The personalization of banking services, which boosts the speed at which they are received, as well as the expansion of the network of channels for their delivery, are the major trend areas that served as the foundation for the development of the newest banking technologies and services offered in digital format. It should be noted that having a secure way to provide and receive banking services in a digital format is likely necessary in light of the growing cyber threats.

Digitalization of the banking sector for each individual bank has become a necessary evil as a means of overcoming antiquated methods and ineffectively managed customer relationships. The actions taken up until now, mainly in the FinTech sector, have been a combination of testing new digital offerings and imitating other market leaders. Technology has given rise to a new paradigm in banking called digital banking, but real transformation will necessitate extensive,

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deep changes as well as getting rid of outdated practices like urging customers to visit various branches and offering them complicated, impenetrable products. Deep cleaning of established procedures and workable technologies within the banking industry will also be necessary. We are currently in a digital wonderland where the milkman is undoubtedly willing to accept wallet payments without a hitch, a man is busy purchasing a geometry set worth Rs. 100 using a credit card, and a vegetable vendor uses QR code scanning. Thus, the idea of Internet banking has brought about a revolution in banking and finance. When using internet banking, a customer interacts directly with the bank's website; as a result, high-quality online services are crucial on the part of the bank. As the term "Internet Banking" is used to describe banking operations carried out through a secure Internet application, these operations include features like bill payment, money transfers, account statement viewing, and loan and mortgage repayment. Customers are drawn to internet banking because of its 24/7 accessibility and simplicity of use. Due to their dissatisfaction with conventional procedures and practices, some customers have been known to switch to internet banking. Some people find the complete lack of human interaction appealing. Customers sometimes use online banking services for security reasons. Customers' confidence in banks' ability to keep transactions safe and secure is the main reason for this. The Internet Explorer user interface is used for the majority of online transactions. More than ten years have passed since the introduction of the Internet Explorer. The bank's centralized database is web-enabled and is available through the internet banking system.

Digitalization in the banking sector and its evolution:

"Digital banking" refers to the digitalization of conventional banking procedures to facilitate banking transactions more easily. Digitalized banking, in contrast to traditional banking, attempts to create flexible computerized goods and services to satisfy the needs of their digitalized clientele. Digital banking has revolutionized the banking industry and changed how money is transferred between accounts. It has also benefited customers by making it easier for them to view account information, pay bills online, and move funds more quickly between accounts. The end-user now leads a systematic financial life and embraces hassle-free online banking as a result of this. In order to improve customer service, bookkeeping, and MIS reporting, the Indian banking industry saw the need for computerization in the late 1980s. India had numerous financial reforms in the late 1980s, which caused the banking industry to feel the need to improve customer service and computerize knowledge recording and accounting. In 1988, the Federal Reserve Bank of India established a committee under the direction of Dr. C. Rangarajan to examine computerization in the banking industry. After the Liberalization, Privatization, and Globalization (LPG) strategy was adopted, both the digitalization process and the change in the Indian economy accelerated. The process of computerization accelerated alongside economic change in India when private and foreign banks first entered the market in 1991–1992, with the goal of digitalizing the economy and improving the services provided to customers by general public sector banks. E-banking and internet banking were first used in India between 1996 and 1998. The Information Technology Act, 2000 was subsequently passed by the Indian

government to give electronic transactions and other forms of electronic commerce legal status.

The Indian banking sector has gone increasingly digital since the advent of ATMs. With technologies like Telebanking, Electronic Compensation Service, Electronic Funds Transfer, MICR, RTGS (Real-Time Gross Settlement), Point of Sale Terminal, and others, the banking sector frequently experiences new developments. E-banking has helped in a number of ways to generate income while also significantly reducing costs. The RBI and National Payment Corporation of India took numerous steps to improve the payment and settlement systems in banks, including the United Payments Interface (UPI) and Bharat Interface for Money. These programs and platforms have made it so that customers can conduct transactions whenever and wherever they want without having to hold or carry cash with them.

Re-orientation of the Indian banking structure: technology

The amount of resources needed to support the growth process will increase as the economy expands. The loan to GDP ratio is expected to increase as the economy expands, and the Indian banking sector must keep up. To finance the economic growth envisioned in the 12th Five Year Plan, the banking sector must experience a dramatic expansion, from an anticipated Rs 115 trillion in 2012 to an estimated Rs 288 trillion by 2020. Therefore, it is necessary to reorient the banking structure so that it can maintain systemic stability and safety while also becoming more dynamic and adaptable. The banking structure can be greatly expanded in terms of size and capacity. As a result, the Reserve Bank issued a set of suggestions for the licensing of new banks in the private sector in February 2013. At the conclusion of the licensing procedure, "in-principle" approval was granted to two candidates who intended to launch new banks in the private sector within 18 months. The Reserve Bank announced its decision to "in-principle" approve the two applicants, adding that going forward, it will use the knowledge it gained from this licensing effort to modify the rules. appropriately and start issuing licenses more frequently on a "tap" basis. The Reserve Bank would also work toward a policy of having a number of "differentiated" bank license categories, allowing a larger pool of participants in banking, increasing banking penetration, and fostering greater market competition. The Reserve Bank has therefore begun drafting the necessary regulations for issuing licenses to small banks and payment banks. With time, the reoriented financial organization might eventually have four tiers. Three or four significant, internationally active Indian universal banks, as well as Indian branches of foreign banks, may be included in the first tier. Many mid-sized financial institutions, including specialized financial institutions like Payment Banks with significant economic clout, are likely to be included in the second tier. The third tier may include old private sector banks, regional rural banks, and multistate cooperative urban banks. The fourth tier may contain a large number of regional cooperative banks and privately owned local banks.

Competition in digital banking:

In their "Blue Ocean Strategy," W. Chan Kim and A. Renee Mauborgne demonstrated that businesses can prosper by building Blue Oceans of uncontested market space rather than by battling rivals. By generating new demand and eliminating the competition, these tactical



choices add value for the business, its clients, and its staff. The "Blue Ocean Strategy" seeks to combine innovation with utility, pricing, and cost propositions in contrast to the Red Ocean Strategy, the traditional company strategy of out-competing the competitors. Similar to how the financial sector has been transformed, there are now many new, untapped markets. The rise in bank competition is a symptom of this evolution. In 1991, just before reforms began, public sector banks (PSBs) made about 90% of all banking assets; today, that number is closer to 72%, a decline of roughly 1% every year. In a move that is further anticipated to increase competition in the domestic banking industry, the Reserve Bank released the framework for new universal banks and differentiated banks, such as small banks and payment banks, in November 2013. This was done alongside the framework for new universal banks and differentiated banks, such as payment banks, which is in the works. Additionally, banks are becoming more at risk from non-bank rivals like NBFCs, MFIs, and tech companies. Peer-to-peer (P2P) lending, direct consumer lending, and social investment are examples of technologies that could lead to an increase in non-bank related finance activities in the future. Banks will need to take advantage of unexplored business prospects due to rising competition. Utilizing resources at the base of the pyramid would also be necessary in this situation. Both small clients and large commercial possibilities are crucial to their company's expansion. Banks would have to figure out how to best employ innovation and technology to reduce the cost of intermediation while preserving their bottom lines.

Current status of India in the digital space

Banks today work hard to provide their customers with efficient, accurate, and high-quality banking services. All Indian banks currently prioritize digitalization. The Indian government actively promotes online shopping. With the introduction of the United Payments Interface (UPI) and the Bharat Interface for Money, the National Payments Corporation of India (NPCI) has made two significant moves toward innovation in the Indian payment systems industry (BHIM). With the help of the UPI smartphone interface, users can instantly transfer money between accounts at supported virtual addresses from various institutions. According to the RBI Report for 2016–17, there are 2,22,475 automated teller machines (ATMs) and 25,29,141 point of sale devices. (POS). Indian banks have widely embraced a variety of electronic payment systems, including NEFT (National Electronic Fund Transfer), ECS (Electronic Clearing Service), RTGS (Real Time Gross Settlement), Cheque Truncation System, Mobile Banking Industry, Debit cards, Credit Cards, and Prepaid Cards. These are all significant turning points in the digital transformation of the banking sector. The way that banking is done has changed significantly as a result of online banking. National Electronic Funds Transfer (NEFT) is the most widely used electronic payment method in India for transferring funds between bank branches (NEFT). There are currently 23 settlements, and groups of two run every half-hour. The primary use cases for Real-Time Gross Settlement are high-value transactions that can support "real-time" settlement (RTGS). Two lakh rupees is the lowest amount that can be transferred using RTGS. There is no upper limit. Immediate Payment Service (IMPS), a 24/7 instant electronic payments transfer service, is offered by the National Payments Corporation of India

(NPCI). Prepaid payment instruments (PPIs) are being used more frequently for both remittances and the acquisition of goods and services. PPI Cards, which include gift cards, overseas trip cards, corporate cards, and mobile wallets, are used to exchange money. From Rs. 105 billion and Rs. 82 billion in 2014–15 to Rs. 277 billion and Rs. 532 billion in 2016–17, respectively, the amount of money exchanged through PPI Cards has increased dramatically.

Review of Literature:

Jarunee Wonglimpiyarat (2006) in their research article, the authors expressed the opinion that Thai banking's technological knowledge and prowess are relevant to digital issues. The results show that the use of technology from the mass automation regime is carried over to the smart automation regime, showing that the banking industry's technological transformation is evolutionary rather than revolutionary.

Vadlamani Ravi (2007) According to their research, the use of sophisticated information and communication technologies in conjunction with computer science is referred to as "banking technology" and enables banks to provide better services to their customers in a secure, dependable, and affordable manner as well as maintain a competitive advantage over other banks.

Costas Lapavistas and Paulo L. Dos Santos (2008) in their research article, the authors concluded that technological innovation has helped to bring about recent changes in the manner and nature of banking, but that its effects have been mixed. First, while trading in money has grown more affordable, investment costs have gone up and a wider range of services have been required. Banks' cost-effectiveness has not increased.

Bhattacharya, H (2015) the majority of the research article on "analyses contrast among online and digital banking" Although these two terms are available, web-based banking can be described more briefly as it focuses mostly on money transfers, bill payments, and basic online account management. Virtual banking, internet banking, and e-banking are other terms that are equal to web-based banking. In a similar vein, online banking is focused on digitizing the "core" features of banking. However, digitizing every program and action used by financial institutions and their clients is a component of digital banking.

George, A. and Kumar, G (2016) the authors of the study came to the conclusion that mobile phones will likely take the lead in India's digital development since the country's youth prefer to use smartphones to access banking services rather than waiting in long queues. A mobile view of 90% or more will likely promote financial inclusion. The current and expected connectivity for each and every smart phone in the country provides a disruptive and convenient channel, allowing banking and payment services can reach a wider audience.

Khandelwal, A.K. (2017) they found that banks play a significant role in our daily lives. Every single day, an infinite number of people engage in a single financial transaction. So as to improve the customer experience, banks continuously work to implement cutting-edge technology. Digitization is unquestionably not a decision for the banking sector given that every industry, including business, is becoming more digital.

Antony Rahul Golden S (2017) an overview of digitalization in the Indian banking sector is attempted to



be studied in the research piece named "An overview of digitalization in Indian banking sector." Banks play a significant role in our lives in addition to being a part of them. As a result, banks constantly strive to adopt cutting-edge technology in order to enhance the client experience. The survey's findings indicated that the implementation of this digitalization is posing both opportunities and challenges for the Indian banking sector. The survey also discovered that because we live in a digital age, it is impossible to resist the development of digital banking services and products.

Hema Divya and Suma Vally (2018) focus on the analysis of the degree of consumer adoption of digital payment systems in the article titled "A Study on Digital Payments in India with Perspective of Consumer's Adoption." In Hyderabad, 183 respondents provided the primary data. The Chi-Square technique was used to analyze the data gathered through the questionnaire. The study discovered that the adoption of technology for digital payments has enhanced the banking industry's performance and made it possible to realize the goal of a cashless society.

Dr. Rajeshwari M.Shettar (2019) the present paper focused on the advantages of digital banking in their article titled "Digital Banking an Indian perspective," specifically how we can easily offer customers a higher interest rate on their deposits if the service fee in the bank is low as a result of digital banking. Maintaining low operating costs will boost the bank's profit and lower carrying costs. Additionally, this will aid in resolving the crisis. The use of digital banking will lower the bank's operating expenses.

Role of digitalization in banking sector:

Information technology has been used by banks to streamline customer service while taking into account customer conveniences. The Indian government has made significant investments in the industry and has quickly expanded banking facilities. After the digitalization, we also discovered results that were satisfactory. Customers can now use banking services from home. Our banking experience has been streamlined by ATMs, Internet banking, mobile banking, mobile wallets, tab banking, etc. Customers' time and money have been saved by this. The nation is moving toward a cashless system after going digital. Common people have a variety of doubts about whether online transactions will be convenient or cause them more trouble. Will it have benefits or drawbacks? However, in today's world where the nation is battling the issue of lockdown in such a situation, digital transactions are a huge help and financial transactions can be easily carried out at home. By examining the loyalty benefits that can increase your savings, we can say that the government offers rebate programs, cash back offers, and reward points. India has a sizable population, so the government has created a variety of options for various groups. To use digital platforms like BHIM UPI and E-Wallets and promote digital payments, a smart phone is required. We have a banking correspondent model that will cover rural areas to connect elderly and uneducated people. A committee to handle security-related concerns in digital payments has already been established by the government. According to the report, the RBI has set a goal for digital transaction growth of 4-fold by 2021. The growth of digital transactions is largely attributable to RTGS (82.2%), and there has been a 59.3% increase outside of internet transactions. By 2021, it is anticipated that UPI and other

payment systems will have grown at a 100% average annual growth rate. The application of artificial intelligence has also given the field of financial technology a new direction. Debit card volume and value have increased by 19.5% and 16.3%, respectively, in 2018–19. A recent report from the Reserve Bank of India states that between 2018 and 2019, the volume of digital transactions increased dramatically by 19.5% and 58.8%. Up until March 2019, there were 217.40 crore deposit accounts. Retail electronic payments, which include credit transfers (NEFT, Fast Payments, UPI, IMPS) and direct debits (ECS, NACH), have experienced rapid growth within the digital payment sector, with CAGRs of 65% and 42% in terms of volume and wave, respectively. Debit and credit card payments in India have seen a CAGR of 44% and 40%, respectively, in terms of volume and value.

New trends of digitalization for banking services:

The world is transitioning to the digital era right now. In this age of digitization, banks are not far behind. Through the adoption of new technology, they are also actively devitalizing themselves. As a result, competition within banks is also growing. Banks work to provide their services to customers who may be present anywhere at any time. Banks are implementing a new method of service delivery. They are spending money on video and text chat services. This is due to the higher customer satisfaction and improved business outcomes provided by chat services. Banks are promoting automation by using the issues that arise from algorithms, and all communication with them will be automated. As of the end of November 2019, there were over 64.2 crore and 1.9 core wireless and wire line broadband subscribers, respectively, across the nation, indicating that internet usage is on the rise in India. Banks and financial institutions have begun to consider using blockchain technology to offer modern customers better services. due to the fact that Santander Bank outperformed rivals by releasing One Pay FX on the blockchain. Swim is the first international money transfer service that One Pay FX merchants are promoting. One Pay FX offers a safe, quick, and easy way to transfer money between accounts using blockchain-based technology. Numerous opportunities are being presented by blockchain technology to enhance customer services. Online transactions have grown in India since the demonetization on November 8, 2016. Additionally, mobile banking has been used for the majority of online transactions. This demonstrates that the country's cashless trend is growing. Today, everyone from small business owners to major corporate executives conducts business online using services like Paytm, BharatPay, Google Play, etc.

Conclusion:

In order to enhance customer service, banks have recently given information technology priority. Training has been heavily invested in, and the outcomes are promising. Customers have completed banking-related tasks through various digital channels, saving them time and money even in the challenging lockdown situation. During the lockdown, interest in digital banking has increased. Nevertheless, the banking industry faces some difficulties, including a lack of networking infrastructure, poverty, economic laggardship, and a sizable population. It is a huge success that now 70% of the PM Jandhan Yojana is being carried out correctly. In order for digital banking and financial literacy to be successful and financial inclusion to



be achieved, banks must work together. In order to expand digital banking in rural areas and ensure the success of Digital India, it is essential that broadband connectivity in the nation be increased. Through digital banking, we can increase the number of customers as well as provide them with the best services possible, allowing us to both meet the objectives of financial inclusion and have a keen understanding of its profitability. Its objectives are to reduce corruption, make the economy cashless, and make all services easily accessible to the general public. Cash and paper-based banking is starting to give way to cashless and paperless banking as a result of banking's digitization. There is still a long way to go, though, so it will take facing problems, coming up with solutions, and seizing opportunities. Nassim Nicholas Taleb's quotation, "Banking is a very treacherous business because you don't realize it's risky until it's too late," further illustrates this point. It is comparable to calm waters that produce powerful storms.

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Original Article

Digitalization and Sustainability: AI Tools in Education with Reference to Augmented Reality Technology Programme

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Abstract

The rapid advancement of digital technologies has transformed the educational landscape, emphasizing the need for sustainable and inclusive learning systems. Artificial Intelligence (AI) and Augmented Reality (AR) have emerged as powerful tools that enhance teaching-learning processes by enabling interactive, personalized, and immersive experiences. This paper explores the role of digitalization in promoting sustainability in education, with a particular focus on AI tools and Augmented Reality technology programmes. It examines how AR contributes to student achievement, engagement, and long-term retention, especially in subjects like Geography. The study adopts a conceptual and analytical approach supported by existing literature and proposes a framework integrating AI and AR for sustainable education. The findings indicate that AR-based learning significantly improves academic performance, motivation, and conceptual understanding while aligning with Sustainable Development Goals (SDGs). The paper concludes by highlighting challenges and suggesting strategies for effective implementation in educational systems.

Keywords: Digitalization, Sustainability, Artificial Intelligence, Augmented Reality, Student Achievement, Geography Education

Introduction

The 21st century has witnessed a paradigm shift in education due to the integration of digital technologies. Digitalization in education refers to the adoption of technological tools such as Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), and data analytics to improve teaching and learning outcomes. Simultaneously, sustainability in education emphasizes the development of systems that ensure long-term learning, equity, and environmental responsibility.

Traditional teaching methods often fail to engage learners or address diverse learning needs. In contrast, AI and AR technologies provide dynamic and interactive learning environments that foster deeper understanding. Augmented Reality, in particular, allows students to visualize complex concepts in real-world contexts, making learning more meaningful and experiential.

This research paper focuses on the integration of AI tools and AR technology programmes in education and their contribution to sustainability and student achievement, especially in Geography education at the secondary level.

Objectives of the Study

The main objectives of this research paper are:

1. To examine the concept of digitalization and sustainability in education.
2. To analyze the role of AI tools in enhancing learning outcomes.
3. To explore the effectiveness of Augmented Reality technology programmes in education.
4. To study the impact of AR on student achievement in Geography.
5. To identify challenges and provide recommendations for sustainable implementation.

Conceptual Framework

Digitalization, AI, AR, and sustainability are interconnected components of modern education systems.

- **Digitalization** enables the integration of advanced technologies.

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- **Artificial Intelligence** facilitates personalized and adaptive learning.
- **Augmented Reality** enhances experiential and visual learning.
- **Sustainability** ensures long-term effectiveness, inclusivity, and environmental consciousness.

The integration of AI and AR creates a **smart learning ecosystem** that supports cognitive development, engagement, and sustainability.

Digitalization and Sustainability in Education

Digitalization has revolutionized education by making it more accessible, flexible, and efficient. It supports sustainability in the following ways:

1 Environmental Sustainability

- Reduction in paper usage through digital content
- Virtual labs and simulations reduce physical resource consumption

2 Social Sustainability

- Inclusive education for diverse learners
- Equal access to quality education through digital platforms

3 Economic Sustainability

- Cost-effective learning solutions
- Scalable educational systems

Thus, digitalization aligns with global educational goals and promotes sustainable development.

Role of AI Tools in Education

Artificial Intelligence has significantly enhanced the teaching-learning process.

1 Types of AI Tools

- Intelligent Tutoring Systems
- Chatbots and Virtual Assistants
- Adaptive Learning Platforms
- Learning Analytics Systems

2 Benefits of AI in Education

- Personalized learning experiences
- Immediate feedback and assessment
- Predictive analysis of student performance
- Improved efficiency and productivity

AI helps in identifying learning gaps and customizing instruction, thereby improving student achievement and supporting sustainable learning systems.

Augmented Reality in Education

Augmented Reality (AR) is a technology that overlays digital information onto the real-world environment.

1 Features of AR

- Interactive 3D models
- Real-time visualization
- Experiential learning

2 Importance in Education

AR enhances understanding by:

- Making abstract concepts concrete
- Increasing student engagement
- Supporting active learning

For example, in Geography, AR can be used to visualize landforms, solar systems, and climatic processes, making learning more interactive and meaningful.

AR Technology Programme in Geography Education

The implementation of an AR technology programme in Geography involves structured planning and execution.

1 Programme Components

- Selection of topics (e.g., landforms, solar system)
- Development of AR-based content
- Integration into lesson plans
- Student interaction and assessment

2 Teaching-Learning Process

- Introduction using AR visualization
- Exploration through interactive models
- Explanation with guided instruction
- Evaluation through tests and activities

This structured approach enhances student participation and improves learning outcomes.

Impact on Student Achievement

Numerous studies have highlighted the positive impact of AR on student achievement.

1 Academic Performance

- Improved test scores
- Better conceptual understanding

2 Engagement and Motivation

- Increased interest in learning
- Active participation

3 Retention and Understanding

- Long-term memory retention
- Enhanced visualization of concepts

In Geography education, AR helps students understand spatial relationships and environmental processes more effectively than traditional methods.

Integration of AI and AR for Sustainable Education

The combination of AI and AR creates a powerful educational framework.

1 Benefits of Integration

- Personalized immersive learning
- Real-time feedback and adaptation
- Enhanced student engagement

2 Sustainable Learning Ecosystem

- Technology-driven education
- Inclusive and equitable learning
- Long-term knowledge retention

This integration supports the development of 21st-century skills such as critical thinking, creativity, and problem-solving.

Challenges in Implementation

Despite its advantages, the integration of AI and AR faces several challenges:

- Lack of infrastructure and resources
- High cost of devices and software
- Need for teacher training
- Technical issues and maintenance



- Digital divide among students

Addressing these challenges is essential for effective and sustainable implementation.

Recommendations

To ensure successful integration of AI and AR in education, the following measures are suggested:

1. Provide adequate infrastructure and technological support.
2. Conduct teacher training and professional development programmes.
3. Develop curriculum-integrated AR content.
4. Promote government and institutional support for digital education.
5. Ensure accessibility and inclusivity for all learners.

Conclusion

Digitalization, supported by AI and Augmented Reality technologies, has the potential to transform education into a sustainable and learner-centered system. AR technology programmes, particularly in subjects like Geography, significantly enhance student achievement, engagement, and retention. The integration of AI and AR creates intelligent learning environments that align with global sustainability goals. Although challenges exist, strategic implementation and policy support can ensure the successful adoption of these technologies. This study highlights the importance of embracing digital innovation to build a sustainable future in education.

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I would like to express my sincere gratitude to everyone who contributed to the successful completion of this project titled "**Digitalization and Sustainability: AI Tools in Education with Reference to Augmented Reality Technology Programme.**"

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Original Article

A Study on Customer Awareness and Usage of AI-Driven Personal Financial Apps and Its Impact on Financial Behavior in India.

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Abstract:

The rapid integration of the Artificial Intelligence (AI) in the Indian FinTech industry has transformed consumer financial management. The research paper is an empirical study into the nature of customer awareness, usage, and the consequential effect of AI-based personal financial applications on the financial behavior of Indian retail customers. A descriptive research design was used to gather primary data using a structured questionnaire among a population of 350 smartphone users living in Bengaluru and a sample of 350 was chosen using convenience sampling. The conceptual model tested independent variables of customer awareness, perceived ease of use, trust and tenure of usage versus the dependent variable of improved financial behavior, which is budgeting discipline and investment consistency. Descriptive statistics, Pearson correlation, and multiple regression analysis were used to analyze the data. The results show that the perceived ease of use has a very significant positive association with the enhanced financial discipline ($r = 0.955$). In addition, the multiple regression model has shown that positive financial behavioral changes can be explained by the tested variables which show that 94.2 percent of the variance are explained by the tested variables. The awareness of AI algorithms among the users was high, and automated investment features were very effective, albeit with minor privacy concerns. The paper comes to a conclusion that AI-based financial technologies are not unjust technological marvels but are significant catalysts of financial literacy improvement, increased wealth, and daily money management in the community of Indian consumers.

Keywords: Artificial Intelligence, Personal Finance, Financial Behavior, FinTech, Robo-Advisory

Introduction

The personal finance environment in India is changing radically due to the blistering incorporation of the Artificial Intelligence (AI) system into the banking and financial system (Deepthi et al., 2022). The upcoming wave of banking and FinTech innovation based on AI has become the next frontier of providing a highly personalized customer experience in the context of the new markets (Sheth et al., 2022; Ghosh et al., 2025). These new financial products are more customized based on advanced behavioral data (Agarwal and Modanwal, 2025) and can redefine the traditional wealth management by automating the complicated advisory services through the use of AI-based robo-advisors (Pangavhane et al., 2023). The development of such AI-based applications is, in turn, actively influencing the saving and investment patterns of consumers, especially young investors (Patel, 2022) and the increasing middle-class (Arora et al., 2025). This technological development is not only radically transforming daily consumer financial behavior (Meng et al., 2025) but also having a crucial role in closing the divide towards greater financial inclusion and financial well-being nationwide (Sharma and Priya, 2025). With the increasing proliferation of AI-based personal financial management apps (Saini et al., 2025), they provide unmatched and easily available wealth creation and financial monitoring tools. Nonetheless, even with all these good perspectives, there are major factors of challenge concerning customer adoption and general user perceptions (Lavanya and Srivani, 2024; Kaur et al., 2024). One of the key factors that define consumer financial decision-making is the risk perception of the user and the trust they are ready to put on algorithmic scoring and advisory systems (Kodete, 2021; Dubey et al., 2026).

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Moreover, customer attitudes are a pivotal mediating force that leads to the actual usage of these AI-enabled services, which is noticeable across all the demographics, including urban centers and rural India (Tyagi and Bhatt, 2025). Hence, it is important to empirically assess the current level of awareness among customers, understand the various usage patterns and ascertain the impact of such AI-powered apps on the financial behaviour of Indian customers.

Review Of Literature

Author and Year	Objective	Methodology	Key Findings	Summary
Patel, T. K. (2022)	To examine AI's role in shaping youth saving and investment habits.	Empirical study on young consumer behavior.	AI apps significantly improve saving and investment discipline among youth.	Emphasizes AI's positive influence on young consumers' financial habits.
Sharma, V., & Priya, B. (2025)	To analyze AI-FinTech's impact on financial inclusion and well-being.	Descriptive analysis of FinTech adoption metrics.	AI-powered tools bridge gaps, improving overall financial inclusion and well-being.	Highlights AI FinTech as a catalyst for inclusive financial growth.
Kodete, C. S. (2021)	To assess how AI trust scoring affects financial decision-making.	Impact study within India's digital ecosystem.	Trust scoring models directly influence and guide consumer financial choices.	Establishes the crucial role of AI trust in financial decisions.
Sheth, J. N., et al. (2022)	To explore AI's role in personalizing emerging market banking services.	Qualitative review of emerging market banking.	AI creates highly personalized experiences, defining the next banking frontier.	Underscores AI as essential for personalized banking in emerging markets.
Agarwal, S., & Modanwal, P. (2025)	To study how AI assistants use behavioral insights for customization.	Analytical study of behavioral finance data.	Behavioral insights allow AI to offer highly tailored financial advice.	Focuses on behavioral data driving customized personal finance assistance.
Kaur, R., et al. (2024)	To evaluate customer perceptions of AI-driven sustainable banking initiatives.	Primary survey of Indian banking customers.	Positive customer perception accelerates the adoption of sustainable AI banking.	Links positive user perception to successful AI sustainability adoption.
Arora, S., et al. (2025)	To understand robo-advisors' role in middle-class financial management.	Empirical study focusing on middle-class investors.	Trust bridges the technology gap, making robo-advisors popular for wealth creation.	Highlights robo-advisors building trust in middle-class financial planning.
Deepthi. B, et al. (2022)	To assess the operational dynamics of AI in Indian banking.	Comprehensive review of Indian banking sector dynamics.	AI dynamically transforms traditional operations into efficient digital workflows.	Provides an overview of AI's transformative dynamics in Indian banking.
Tyagi, P., & Bhatt, S. (2025)	To identify adoption drivers of AI financial services in rural India.	Quantitative study using mediation analysis.	Customer attitude strongly mediates AI technology adoption in rural areas.	Highlights attitude as a key driver for rural AI finance adoption.
Lavanya, B., & Srivani, D. (2024)	To identify user-perspective prospects and challenges of AI finance apps.	User-centric exploratory study.	While promising, data privacy remains a major challenge for user adoption.	Balances the benefits of AI apps against user adoption challenges.
Saini, M. S., et al. (2025)	To examine the functionality of AI personal finance management apps.	Descriptive analysis of app features.	AI applications streamline personal financial management and budgeting tasks.	Overviews the functional benefits of AI finance management tools.



Pangavhane, P., et al. (2023)	To evaluate financial transformation via automated AI finance advisors.	Conceptual analysis of financial automation.	Automation through AI advisors drastically improves personal financial efficiency.	Focuses on automation as the core transformer in personal finance.
Meng, K., et al. (2025)	To review literature on AI's effect on consumer financial behavior.	Systematic literature review approach.	AI significantly alters consumer spending and saving behaviors across demographics.	Provides a comprehensive review mapping AI to financial behavior changes.
Ghosh, R. K., et al. (2025)	To study personalized services driven by NLP and AI in FinTech.	Technical review of NLP/AI FinTech innovations.	NLP combined with AI creates highly responsive and personalized financial services.	Highlights NLP and AI as technical drivers for FinTech personalization.
Dubey, M., et al. (2026)	To analyze how risk perception affects AI-driven financial decision-making.	Risk assessment study in FinTech context.	Lowering perceived risk is essential for enhancing AI financial decision-making.	Connects user risk perception directly to AI financial adoption success.

Research Gap

The current literature is rich in the adoption of AI FinTech, trust issues and overall behaviour shift, and there is a crucial need for empirical support. There is a lack of research measuring directly the extent of customer awareness of complex AI-powered features, in terms of real-world financial discipline, such as budgeting and investment, particularly among mobile-driven, urban Indian consumers who are part of a rapidly evolving digital financial ecosystem.

Research Design

1 Statement of The Problem

Increasing use of Artificial Intelligence (AI) in Indian fintech has transformed the personal finance. While the mobile phone usage is high, it is unclear how well the users understand and use the financial apps with artificial intelligence (AI) functions like robo-advisor and automatic budgeting. The aim of this research is to bridge the gap between the technology availability and user perception. We must find out whether these new technologies are helping financial behaviour, like saving, investing, and spending discipline or they are leading to over dependency and poor financial decisions.

2 Objectives

- To assess the current level of customer awareness regarding AI-driven features within personal financial applications.
- To find out the major usage trends and adoption levels of these AI financial tools among various population groups.
- To assess the immediate effects of the personal financial apps that run on AI on the financial habits of the users, particularly, in terms of saving and investment discipline.

3 Research Methodology

This study design describes the scientific structure applied to collect and process information on the use of AI financial apps. It outlines the research design, data sources, sampling plan and analytical instrument that is required to objectively

answer the main objectives of the study and to test the underlying behavioral hypotheses.

The kind of research design that is mainly used in this study is Descriptive research design. It perfectly fits the purpose of this title because it tries to present a true picture of the features, consciousness and usage behavior of consumers using AI financial applications. It assists in accurately measuring the effect of these tools on the existing financial behaviors.

4 Sources Of Data

Primary data: The researcher will gather primary data personally in the proposed sample (active users of digital financial apps), which consists of the target sample units. This qualitative data is collected directly to this study by use of structured questionnaires to obtain real user awareness and behavior change.

Secondary data: The secondary data will be obtained through published sources that were gathered by other researchers and institutions on different, but related objectives. This will encompass academic journals, financial journals, reports of the fintech industry, articles, and official websites, which will offer a solid theoretical basis of the ongoing research.

5 Sampling Plan

Sampling unit: The unit of sampling will include individual smartphone users in Bengaluru, who use digital personal financial apps actively.

Sample size: The number of responses that will be used in this study is precisely 350 in order to have a statistical reliability.

Sampling method: Convenience Sampling method will be used, whereby the respondents will have to be conveniently sampled basing on their easy accessibility and their readiness to become active financial app users.

6 Tools for Data Collection

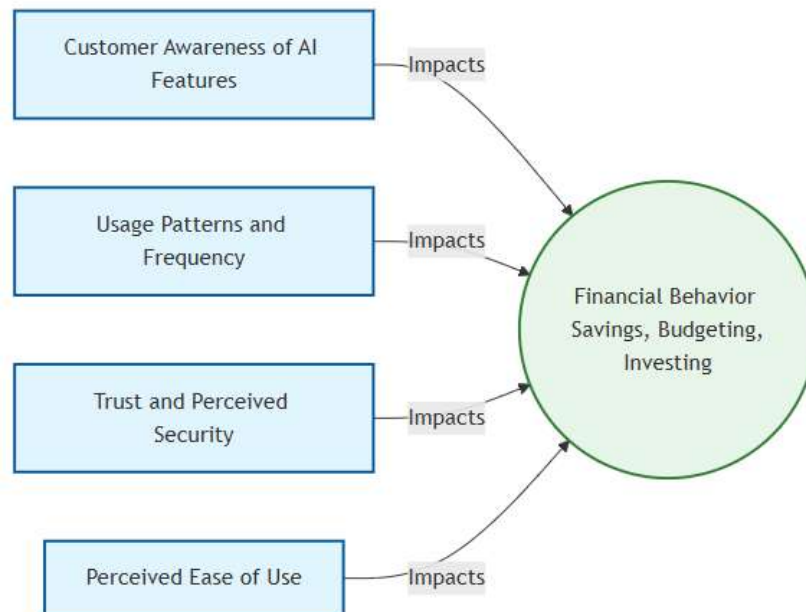
Survey: The primary data collection method will be a survey with a questionnaire with 5-point Likert scale response options to understand the opinions, level of awareness and change in financial behaviours.



Observation: Limited direct observation will be conducted to capture the overall trends in the visual interaction between users and the interfaces of AI applications and reactions to automated financial prompts in the initial study stages.

Focus groups: It is possible to use small focus groups to obtain the initial qualitative data, exchange personal experiences with robo-advisors, and narrow down the survey questionnaire, then generalize it to the sample.

Conceptual Framework



Results

H0 (Null Hypothesis): No significant effect of the use of AI-based personal financial applications on the financial behavior (saving, budgeting, and investment discipline) of Indian consumers exists.

H1 (Alternative Hypothesis): There is a significant positive impact of the usage of AI-driven personal financial apps on the financial behavior (such as saving, budgeting, and investment discipline) of consumers in India.

Independent Variables (IVs): The variables that are the one that change or predict the changes in the behavior of the user.

7 Plan Of Analysis

The primary data collected will be carefully tabulated, categorized and compiled in a desirable manner. It will be then analyzed and deduced through certain analytical methods which include Regression analysis, Correlation and Descriptive statistics using the help of MS Excel spreadsheets and SPSS software in order to be able to conclude with the precise effects on the financial behavior.

- Awareness of AI Features among customers.
- Pattern of Use and frequency.
- Trust and Perceived Security.
- Perceived ease of use.

Dependent Variable (DV): This is the main outcome that is being measured and influenced by the independent variables.

- Financial Behavior

1 Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
age group	350	1	4	2.02	.915
monthly income	350	1	4	2.36	.988
current occupational status	350	1	4	2.17	.801
most frequently used AI-driven personal financial apps	350	1	5	2.40	1.209
Tenure of using AI features (like automated insights or robo-advisory) using in financial applications	350	1	4	2.34	.999



purpose of using AI-driven financial apps	350	1	4	2.07	1.038
first awaring of the AI-driven features in personal financial apps	350	1	4	2.03	1.054
I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.	350	1	5	3.55	1.071
I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps	350	1	5	3.82	1.011
Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps.	350	1	5	2.59	1.141
I trust the AI-generated recommendations for my personal investments more than traditional, human financial advisors.	350	1	5	3.18	1.134
Using AI-driven financial apps has significantly improved my monthly budgeting and daily expense tracking discipline.	350	1	5	3.71	1.051
The predictive spending alerts and notifications from my financial apps have successfully prevented me from making unnecessary expenditures.	350	1	5	3.54	1.124
Automated investment features (e.g., auto-investing spare change or scheduled SIPs driven by AI) have helped me invest more consistently.	350	1	5	3.83	1.015
Overall, my financial health and savings rate have noticeably improved since I started using AI-driven personal financial apps.	350	1	5	3.67	1.080
Valid N (listwise)	350				

Interpretation

According to the descriptive statistics of 350 respondents, the data indicate very encouraging tendencies in terms of adoption and effects of AI-driven financial apps. In terms of demographics, the means of age (2.02) and income (2.36) and occupational status (2.17) are an indication of a sample consisting of young, earning professionals with moderate experience using these apps (Tenure means = 2.34).

In the case of the behavioral measures analyzed on a 1-5 Likert scale, the highest level of agreement is found between the effectiveness of automated investment functions (Mean = 3.83, SD = 1.015) and the ease of use of these AI tools (Mean = 3.82, SD = 1.011). This underscores the fact that the interfaces are very intuitive to users and practical in

creating wealth on a regular basis. The apps are also effective to promote financial discipline day-to-day as the mean scores of improved monthly budgeting (3.71), overall financial health (3.67), and the avoidance of unnecessary spending (3.54) are high. Moreover, users are well aware of AI algorithms (Mean = 3.55) and have a moderate level of trust in AI compared to traditional human advisors (Mean = 3.18). Interestingly, relatively low hesitation caused by privacy concerns and data security concerns (Mean = 2.59) implies that security concerns are not significant adoption obstacles. The standard deviations, which remain consistent (ranging between 1.0 and 1.1 in most of the variables), indicate a consistent agreement among the participants on these positive results.



2 Correlation

Correlations						
		Tenure of using AI features (like automated insights or robo-advisory) using in financial applications	I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.	Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps.	I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps	Using AI-driven financial apps has significantly improved my monthly budgeting and daily expense tracking discipline.
Tenure of using AI features (like automated insights or robo-advisory) using in financial applications	Pearson Correlation	1	-.041	-.033	-.014	-.031
	Sig. (2-tailed)		.442	.538	.788	.566
	N	350	350	350	350	350
I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.	Pearson Correlation	-.041	1	.904**	.911**	.940**
	Sig. (2-tailed)	.442		.000	.000	.000
	N	350	350	350	350	350
Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps.	Pearson Correlation	-.033	.904**	1	.849**	.873**
	Sig. (2-tailed)	.538	.000		.000	.000
	N	350	350	350	350	350
I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps	Pearson Correlation	-.014	.911**	.849**	1	.955**
	Sig. (2-tailed)	.788	.000	.000		.000
	N	350	350	350	350	350
Using AI-driven financial apps has significantly improved my monthly budgeting and daily expense tracking discipline.	Pearson Correlation	-.031	.940**	.873**	.955**	1
	Sig. (2-tailed)	.566	.000	.000	.000	
	N	350	350	350	350	350
**. Correlation is significant at the 0.01 level (2-tailed).						

Interpretation

The Pearson correlation matrix indicates that there are strong, very significant positive relationships ($p < .001$) between key user perceptions and improved financial behavior (budgeting discipline). In particular, a better budgeting is highly associated with perceived ease of navigation ($r = .955$), awareness of AI algorithms ($r = .940$), and perceptions of data security ($r = .873$). This suggests that appealing user-friendliness and concise perception are essential in motivating favorable financial practices.



Conversely, there is a weak non-significant negative correlation between the tenure of app usage ($r = -.031$, $p = .566$), meaning that just simple duration of usage does not necessarily translate to increased financial discipline.

3 Regression Analysis

Variables Entered/Removed ^a			
Model	Variables Entered	Variables Removed	Method
1	I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps, Tenure of using AI features (like automated insights or robo-advisory) using in financial applications, Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps., I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.b	.	Enter
a. Dependent Variable: Using AI-driven financial apps has significantly improved my monthly budgeting and daily expense tracking discipline.			
b. All requested variables entered.			

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970a	.942	.941	.255
a. Predictors: (Constant), I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps, Tenure of using AI features (like automated insights or robo-advisory) using in financial applications, Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps., I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.				

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	362.969	4	90.742	1393.858	.000b
	Residual	22.460	345	.065		
	Total	385.429	349			
a. Dependent Variable: Using AI-driven financial apps has significantly improved my monthly budgeting and daily expense tracking discipline.						
b. Predictors: (Constant), I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps, Tenure of using AI features (like automated insights or robo-advisory) using in financial applications, Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps., I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.						



Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.030	.068		.433	.666
	Tenure of using AI features (like automated insights or robo-advisory) using in financial applications	-.006	.014	-.005	-.419	.676
	I am fully aware of how artificial intelligence and algorithms are used to provide personalized financial advice within the apps I use.	.369	.039	.376	9.547	.000
	Privacy and data security concerns make me hesitant to fully link my bank accounts to utilize all the AI features available in these apps.	.043	.028	.047	1.523	.129
	I find it easy to navigate and utilize the AI-driven features (such as robo-advisors or automated savings rules) in my financial apps	.595	.033	.572	17.976	.000
a. Dependent Variable: Using AI-driven financial apps has significantly improved my monthly budgeting and daily expense tracking discipline.						

Interpretation

The multiple regression shows that the overall model ($F = 1393.858$, $p < .001$) is highly significant, and effectively explains the variance of 94.2% of the improved financial behavior. Evaluation of the independent predictors, perceived ease of use ($p < .001$, $\beta = .572$) and customer awareness ($p < .001$, $\beta = .376$) can be considered as robust and significant positive predictors of budgeting discipline. Tenure of app use ($p = .676$) and privacy issues ($p = .129$) do not however play any significant role in the dependent variable. Since the overall model proves that the AI financial apps features have a considerable and positive effect on the user financial behavior, the alternative hypothesis (H_1) is accepted and the null hypothesis (H_0) is rejected.

Discussions

- A large percentage of the 350 respondents are the youth and young adult group with 142 people in the range of 26–35 years.
- Salaried professionals, the exact number of them is 188 people, and 124 users have a monthly income between 25,001 and 50,000 & 25,001–50,000.
- The automated investment options such as scheduled SIPs using artificial intelligence are well received by users who have a maximum score of satisfaction with a mean of 3.83.

- The navigation and use of these AI-based financial tools is exceptionally easy to the respondents and hence the high mean score of 3.82.
- The use of AI has already been effective in enhancing day-to-day cost monitoring and monthly budgeting discipline with a decent average score of 3.71 out of 5.
- The general financial wellness and regular rates of savings have been significantly enhanced among the consumers since the onset of their use of AI-based personal applications, with an average score of 3.67.
- A huge proportion of users have full knowledge of the way artificial intelligence and algorithms can give personalized financial guidance, with a mean score of 3.55.
- Privacy and data security issues are relatively low among the active users, with the lowest mean score of 2.59 in the descriptive statistical analysis.
- The regression analysis will show that the tested independent variables account for the exact 94.2 percent of the variance in the improved financial behavior.
- The overall multiple regression model has a very high value with a resultant F-value of 1393.858, which validates the claim that the use of AI apps has a positive effect on financial habits of Indian consumers.



- Perceived ease of use was also the highest positive predictor of greater financial behavior with a highly significant beta of 0.572.
- Customer awareness is also a strong determinant in enhancing daily budgeting discipline and its unstandardized beta coefficient is significant and exhibits a beta of 0.369 in the model.
- There is a very high positive correlation of 0.955 between the ease of navigation in the application and the fact that the budgeting discipline has been very much improved monthly.
- The customer awareness of AI algorithms has a positive correlation of 0.940 with the enhanced financial behavior and discipline in tracking daily expenditure among the users, which is massive in nature.
- The tenure or duration of artificial intelligence use features yield a non-significant negative relationship of -0.031 with improvement of overall budgeting and financial discipline.

Conclusion

The introduction of Artificial Intelligence in financial apps is a revolutionary leap in how Indian consumers manage their finances. This study provides compelling evidence that such AI-based financial tools are not "toys", but they are very effective for changing customers' financial behaviours. As the empirical findings demonstrate, the majority of young working professionals in India are well-informed and heavy users of such apps in automatic budgeting and investment.

Crucially, the research has shown a strong, statistically significant link between the perceived ease of use, customer awareness and increased financial discipline. People who consider these apps easy to use and have an understanding of the algorithms at work report a greater savings rate and daily expenditure monitoring. This is also supported by regression analysis that rejects the null hypothesis and demonstrates that AI features such as robo-advisory and predictive alert have a positive impact on saving for investment.

While there are concerns of privacy and data security, they are by no means as significant as the utility of such applications. In conclusion, AI-powered personal financial apps promote financial wellbeing. From building user awareness and transparency of algorithms, Fintech players can also leverage AI to make wealth management a reality for all and build a robust financial ecosystem in the Indian market.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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