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(Affiliated to Haveri University, Haveri, Karnataka-India)

IQAC Initiative

P. G. Department of Studies in Commerce & Department of Commerce
In Association with Haveri University College Teachers Association, Haveri
Organises

**National Level Multidisciplinary Seminar
On**

DIGITAL TRANSFORMATION AND INCLUSIVE DEVELOPMENT IN THE AI ECOSYSTEM: A MULTIDISCIPLINARY APPROACH



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KLE Society's

Gudleppa Hallikeri Arts, Science and Commerce College,

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IQAC Initiatives

One Day National Level Seminar

On

Digital Transformation and Inclusive Development in AI Ecosystem:

A Multidisciplinary Approach

16th June 2026

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Seminar Hall

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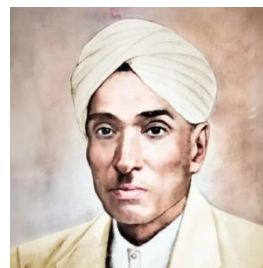
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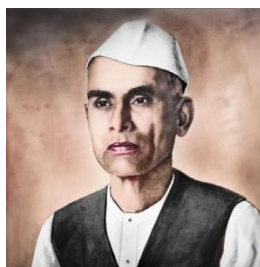
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KLE Society

The Karnataka Lingayat Education Society (KLE Society), established in 1916, is one of India's premier educational organizations dedicated to "Empowerment through Education." Founded by seven visionary teachers popularly known as the "Saptarishis," the society began with a single school in Belagavi and has now grown into a distinguished network of over 317 institutions across the fields of education, healthcare, research, and agriculture. The society caters to the educational aspirations of more than 1,48,000 students with the support of over 18,000 dedicated staff members across India. Under the visionary leadership of Dr. Prabhakar Kore's, KLE Society has achieved national and international recognition for excellence in education, innovation, healthcare, and community service, continuing its mission of transforming lives through value-based education.

G.H.College

KLE Society's G H College, Haveri, established in 1963, is one of the premier institutions of higher education in North Karnataka, founded with the visionary efforts of Shri Gudleppa Hallikeri and his followers to uplift the educational and socio-economic standards of the region. The foundation stone for the college building was laid in 1964 by His Highness Shri J.C. Wodeyar, the then Governor of Karnataka and Maharaja of Mysore. The institution gratefully acknowledges the generous contribution of Shri M.K. Nelivigi, a major donor to the college. Beginning with Arts and Science streams, the college expanded its academic offerings by introducing the Commerce stream in 1977 and M.Com. programme in 2008 to meet the growing educational aspirations of students. Affiliated with Haveri University and functioning under the esteemed KLE Society, the institution is committed to academic excellence, value-based education, research, and holistic student development through its diverse programmes in Arts, Science, Commerce, and Postgraduate Studies.

Department

The Department of Commerce and PG Department of Studies in Commerce of K.L.E. Society's G.H. College, Haveri, are committed to providing quality education, promoting research, and developing professional competencies among students. The departments offer a dynamic academic environment that encourages innovation, critical thinking, and skill development. Through seminars, workshops, research activities, and industry-oriented programs, the departments strive to prepare students to meet contemporary business challenges and contribute effectively to society and the economy.

The Seminar

The National Level Multidisciplinary Seminar on "Digital Transformation and Sustainable Development in the AI Ecosystem: A Multidisciplinary Approach" aims to provide a platform for academicians, researchers, students, and industry professionals to discuss emerging trends in artificial intelligence and digital technologies. The seminar focuses on the transformative role of AI in commerce, management, science, arts, and society, promoting innovation, efficiency, financial inclusion, and sustainable development. It also addresses ethical, social, and policy-related challenges associated with digital transformation. Through research presentations and interdisciplinary discussions, the seminar seeks to encourage collaboration, knowledge sharing, and innovative solutions for a digitally empowered and sustainable future.

Objectives of the Seminar

1. To explore the role of AI and digital transformation in promoting sustainable development across different disciplines.
2. To provide a platform for academicians, researchers, students, and industry professionals to share research findings, innovative ideas, and interdisciplinary perspectives on emerging technologies.



3. To bring participants from different streams such as Commerce, Management, Science, and Arts under one umbrella to encourage multidisciplinary interaction and collaborative learning.
4. To promote discussion on innovative practices, policy implications, and future opportunities in the AI ecosystem for inclusive and sustainable growth.

Themes of the Seminar

Thematic Areas – Commerce

1. AI in Accounting, Auditing and Financial Reporting
2. Digital Banking, FinTech and Financial Inclusion
3. Business Analytics for Sustainable Decision Making
4. E-Commerce and Digital Marketing Strategies
5. Green Finance, ESG Reporting and Sustainability Accounting
6. GST, Taxation and Digital Compliance Systems
7. Cryptocurrency, Blockchain and Digital Financial Systems
8. MSMEs Digital Transformation and Economic Growth
9. Any other related topic.

Thematic Areas – Management

1. AI in Strategic Management and Business Decision Making
2. Digital Transformation and Organizational Change Management
3. Sustainable Business Models and Innovation Management
4. HR Analytics and AI in Talent Management
5. Digital Leadership and Future of Work
6. Supply Chain Digitalization and Sustainable Operations
7. Startup Ecosystem and Technology-driven Entrepreneurship
8. Customer Experience Management using AI
9. Any other related topic.

Thematic Areas – Science

1. Artificial Intelligence, Machine Learning and Data Science Applications
2. IoT, Smart Technologies and Sustainable Development
3. Environmental Science and Climate Change Analytics
4. Green Technologies and Renewable Energy Innovations
5. Big Data and Predictive Modelling for Sustainability
6. Cyber Security and Data Privacy in Digital Ecosystem
7. Smart Cities and Sustainable Infrastructure
8. Technology Innovations for Rural Development
9. Any other related topic.



Thematic Areas – **Arts / Social Sciences**

1. AI and Society: Ethical, Cultural and Social Implications
2. Digital Divide and Inclusive Sustainable Development
3. Technology and Changing Human Behaviour
4. AI in Education and Digital Learning Transformation
5. Media, Communication and Digital Society
6. Public Policy and Governance in Digital Economy
7. Social Innovation and Sustainable Community Development
8. Digital Literacy and Social Empowerment
9. Any other related topic.

Thematic Areas – **Multidisciplinary Themes (All Streams)**

1. AI and Sustainable Development Goals (SDGs)
2. Digital Economy and Inclusive Growth
3. Innovation and Entrepreneurship in AI Ecosystem
4. Smart Governance and Digital Public Services
5. Interdisciplinary Research in AI and Sustainability
6. Technology for Rural and Agricultural Development
7. Digital Transformation in Education and Skill Development
8. Future of Work in AI-driven Economy
9. Any other related topic.



Shri Amit P. Kore

Chairman,

K.L.E Society, Belagavi

MESSAGE

It gives me immense pleasure to know that the PG Department of Studies in Commerce and Department of Commerce, in association with the Haveri University Commerce Teachers Association, under the IQAC initiative of KLE Society's Gudleppa Hallikeri Arts, Science and Commerce College, Haveri, is organizing a One Day Multidisciplinary State Level Seminar on ***“Digital Transformation and Inclusive Development in the AI Ecosystem: A Multidisciplinary Approach”*** on 16th June 2026.

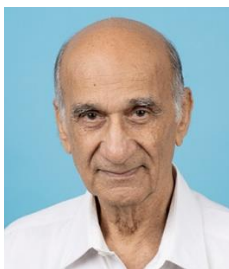
In the present era of rapid technological advancement, Artificial Intelligence (AI) has emerged as a transformative force influencing various sectors of society and the economy. From education and healthcare to business, governance, and industry, AI is driving innovation, efficiency, and growth. Academic platforms such as this seminar play a crucial role in promoting research, knowledge sharing, and meaningful discussions on the opportunities and challenges associated with digital transformation.

KLE Society has always been committed to fostering quality education, research, and innovation. I appreciate the organizers for selecting a highly relevant and contemporary theme. I extend my best wishes for the success of this seminar and hope that it inspires participants to contribute towards building an inclusive, sustainable, and knowledge-driven society.

With best Wishes,

Date: 16-06-2026

Shri Amit P. Kore



Shri M. C. Kolli

Director,

K.L.E. Society, Belagavi

MESSAGE

It gives me immense pleasure to know that the PG Department of Studies in Commerce and Department of Commerce, K.L.E. Society's G. H. College, Haveri, in association with the Haveri University Commerce Teachers Association, is organizing a National Level Multidisciplinary Seminar on "Digital Transformation and Inclusive Development in the AI Ecosystem: A Multidisciplinary Approach" on 16th June 2026.

The seminar provides an excellent platform for academicians, researchers, scholars, and students to discuss the emerging opportunities and challenges associated with Artificial Intelligence and digital transformation.

In today's rapidly evolving world, AI and digital technologies are reshaping education, commerce, governance, healthcare, and industry. I appreciate the organizers for selecting a highly relevant theme and am confident that the deliberations will promote research, innovation, and inclusive development. I extend my best wishes to the organizers and participants for the grand success of this seminar.

Date: 16-06-2026

With best Wishes,

Shri M. C. Kolli



ACKNOWLEDGEMENT

The KLE Society's G H College, Haveri, a distinguished institution committed to academic excellence and holistic development, has consistently promoted quality education, research, and innovation. The PG Department of Studies in Commerce and Department of Commerce, in association with the Haveri University Commerce Teachers Association, successfully organized the National Level Multidisciplinary Seminar on ***“Digital Transformation and Inclusive Development in the AI Ecosystem: A Multidisciplinary Approach”*** on 16th June 2026.

The seminar served as a common platform for academicians, researchers, industry professionals, policymakers, and students to exchange ideas on the opportunities and challenges emerging from digital transformation and Artificial Intelligence. The discussions highlighted the role of AI and digital technologies in promoting innovation, entrepreneurship, governance, education, finance, commerce, and inclusive development. The event encouraged knowledge sharing, interdisciplinary research, and academic collaboration among participants from diverse disciplines.

We express our sincere gratitude to **Shri Amit P. Kore**, Hon'ble Chairman, KLE Society, Belagavi, and **Shri M. C. Kolli**, Director, KLE Society, Belagavi, for their continuous support and encouragement. We also thank Dr. S. L. Balehosur, Chairman, LGB, and all members for their valuable guidance and support.

We extend our heartfelt appreciation to the Chief Guest, Keynote Speakers, Resource Persons, Session Chairs, and Invited Experts for their scholarly contributions. We are equally grateful to all authors, paper presenters, delegates, faculty members, research scholars, and students whose active participation made the seminar a grand success.

Our sincere thanks go to Shri R. B. Ajaraddi, Convener, Dr. Gururaj S. Barki, Organising Secretary, and all members of the Organizing Committee for their dedicated efforts. We also acknowledge the support of faculty members, non-teaching staff, student volunteers, Dr. M. N. Kaddipudi, Dean, Department of Commerce, HUH, President, HUCTA, and all HUCTA members. Finally, we thank everyone who directly or indirectly contributed to the success of this seminar and its proceedings.

Date: 16-06-2026

Prof. M M Holliyavar
Principal, KLE Society's G H College, Haveri



EDITORIAL

It gives us immense pleasure to present the proceedings of the National Level Multidisciplinary Seminar on ***“Digital Transformation and Inclusive Development in the AI Ecosystem: A Multidisciplinary Approach,”*** organized by the PG Department of Studies in Commerce and Department of Commerce, K.L.E. Society’s G. H. College, Haveri, in association with the Haveri University Commerce Teachers Association on 16th June 2026.

The seminar brought together academicians, researchers, scholars, students, policymakers, and industry professionals to deliberate on the emerging opportunities and challenges associated with Artificial Intelligence and digital transformation. It provided a valuable platform for the exchange of ideas, dissemination of research findings, and meaningful discussions on the role of technology in promoting inclusive and sustainable development.

The rapid advancement of digital technologies has transformed various sectors, including education, governance, commerce, finance, entrepreneurship, and social development. The papers included in this volume reflect contemporary research and diverse perspectives on these evolving themes. They highlight innovative approaches, practical implications, and policy considerations that contribute to a deeper understanding of the AI-driven digital ecosystem.

The central theme of the seminar emphasizes the need to balance technological progress with social inclusion. The research contributions presented in this volume underscore the importance of collaborative efforts among educational institutions, researchers, industry leaders, policymakers, and civil society.

We sincerely appreciate the contributions of all authors, reviewers, resource persons, delegates, and members of the organizing committee whose dedication ensured the success of this academic event. We also express our heartfelt gratitude to the management of K.L.E. Society and all stakeholders for their continuous support and encouragement.

We hope that this publication will serve as a valuable resource for researchers, academicians, students, and practitioners, inspiring further research, innovation, and collaboration toward building an inclusive and sustainable digital future.

Date: 16.06.2026

Editors

**Prof. R. B. Ajaraddi
Dr. Gururaj S. Barki**



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OriginalArticle

Role of Personalized Digital Marketing in Enhancing Retail Customer Experience

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The rapid advancement of digital technologies has reshaped the retail industry, encouraging businesses to adopt customer-centric marketing approaches. Among these, personalized digital marketing has gained considerable importance by enabling retailers to deliver customized content, product suggestions, and promotional offers based on customers' preferences, interests, and purchasing behavior. This study examines the contribution of personalized digital marketing to enhancing the retail customer experience. It explores how tailored marketing efforts influence customer perceptions, engagement levels, satisfaction, and loyalty toward retail brands. Through a review of relevant literature and conceptual analysis, the study reveals that personalized interactions create greater value for customers by providing relevant information, improving convenience, and fostering stronger relationships between retailers and consumers. The findings further indicate that personalization can positively impact customers' shopping journeys, leading to increased trust and repeat purchase intentions. The study underscores the importance of utilizing advanced technologies such as artificial intelligence, predictive analytics, and customer relationship management systems to develop effective personalization strategies. These insights may assist retailers in designing marketing initiatives that enhance customer experience and support long-term business growth in the digital era.

Keywords: Personalized Digital Marketing, Retail Customer Experience, Customer Engagement, Customer Loyalty, Retail Marketing.

Introduction

The rapid growth of digital technologies has transformed the retail sector and changed the way businesses interact with customers. As consumers increasingly rely on online platforms for information search and purchasing decisions, retailers are adopting personalized digital marketing strategies to meet customer expectations and enhance their shopping experiences. Personalized digital marketing involves delivering customized advertisements, product recommendations, and promotional offers based on customers' preferences, browsing behavior, and purchase history. In the modern retail environment, customer experience has emerged as a crucial factor influencing customer satisfaction, engagement, and loyalty. Customers are more likely to respond positively to marketing messages that are relevant to their needs and interests. Advancements in technologies such as artificial intelligence, data analytics, and customer relationship management systems have enabled retailers to implement personalization more effectively.

These technologies help businesses understand customer preferences and deliver relevant content at the right time. Consequently, by providing personalized interactions, retailers can create a more convenient, engaging, and satisfying shopping experience. Such experiences not only encourage customer engagement but also foster trust and long-term loyalty toward retail brands.

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Digital marketing has become an important strategy for improving retail customer experience and strengthening customer relationships. Therefore, this study examines the role of personalized digital marketing in enhancing retail customer experience, with particular focus on customer satisfaction

Review of Literature

Naeem and Ozuem (2024) found that advanced personalization strategies supported by data analytics positively influence customer engagement, satisfaction, and repurchase intentions in digital retail environments. Chandra, Verma, Kumar, and Donthu (2022) highlighted that personalized marketing communications improve customer experience by providing relevant information, reducing search effort, and enhancing purchase decisions. Bansal and Kumar (2022) reported that personalized digital interactions strengthen customer engagement and contribute to the development of long-term customer relationships. Srivastava and Fernandes (2022) observed that customized digital experiences positively affect customer satisfaction and brand loyalty among retail consumers. Dwivedi et al. (2021) emphasized that digital marketing technologies, including artificial intelligence and analytics, play a significant role in delivering personalized customer experiences and enhancing customer engagement. Raghavan and Pai (2021) found that personalized communication strategies adopted by online retailers improve customer experience and encourage customer retention. Purohit and Jain (2021) revealed that technology-driven personalization enhances customer satisfaction by providing relevant content and tailored shopping experiences. Kumar and Reinartz (2012) observed that the effective use of customer information enables organizations to develop personalized marketing strategies that enhance customer value and strengthen customer relationships. Overall, the reviewed studies indicate that personalized digital marketing plays an important role in improving retail customer experience by enhancing customer satisfaction, engagement, and loyalty through relevant and customized interactions.

Objectives of the Study

1. To examine the role of personalized digital marketing in enhancing retail customer experience.
2. To assess the impact of personalized digital marketing on customer satisfaction in the retail sector.
3. To analyze the influence of personalized digital marketing on customer engagement among retail customers.
4. To evaluate the effect of personalized digital marketing on customer loyalty in the retail industry.

Scope of the Study

The study focuses on understanding the role of personalized digital marketing in enhancing retail customer experience. It examines how personalized marketing practices, such as customized advertisements, product recommendations, and promotional offers, influence customer satisfaction, engagement, and loyalty. The study is limited to retail customers who use digital platforms for shopping and is based on responses collected from 50 respondents. The findings may help retailers develop effective digital marketing strategies to improve customer experience and strengthen customer relationships.

Research Methodology

The study adopts a **descriptive research design** to examine the role of personalized digital marketing in enhancing retail customer experience. The research is primarily based on **primary data** collected through a structured questionnaire administered to retail customers. A sample of **50 respondents** will be selected using the convenience sampling technique. In addition, secondary data from journals, books, research articles, and online sources will be used to support the study. The collected data will be analyzed using simple statistical tools such as percentage analysis, mean, and descriptive statistics to understand the impact of personalized digital marketing on customer experience, satisfaction, engagement, and loyalty in the retail sector.

Key Concepts of the Study

1. **Personalized Digital Marketing:** Personalized digital marketing is a marketing approach that uses customer information, preferences, and online behavior to deliver relevant messages, product recommendations, and promotional offers tailored to individual customers.
2. **Customer Experience:** Customer experience refers to the overall impression formed by customers through their interactions with a retailer during the entire shopping journey, both online and offline.
3. **Customer Satisfaction:** Customer satisfaction reflects the extent to which customers' expectations are met or exceeded through their shopping experiences and interactions with a retail brand.
4. **Customer Engagement:** Customer engagement represents the degree of customer involvement, interaction, and connection with a retailer through digital platforms, marketing communications, and brand activities.
5. **Customer Loyalty:** Customer loyalty refers to a customer's willingness to continue purchasing from a particular retailer and maintain a long-term relationship with the brand.
6. **Retail Sector:** The retail sector comprises businesses that sell goods and services directly to consumers through physical stores, online platforms, or a combination of both channels.

Data Analysis and Interpretation

Table 1: Frequency of Receiving Personalized Marketing Messages

Response	No. of Respondents	Percentage (%)
Frequently	22	44

Occasionally	18	36
Rarely	7	14
Never	3	6
Total	50	100

Interpretation:

The table shows that 44% of respondents frequently receive personalized marketing messages, while 36% receive them occasionally. This indicates that retailers actively use personalized digital marketing strategies to engage customers through digital platforms.

Table 2: Impact of Personalized Marketing on Customer Satisfaction

Response	No. of Respondents	Percentage (%)
Highly Satisfied	20	40
Satisfied	18	36
Neutral	8	16
Dissatisfied	4	8
Total	50	100

Interpretation:

The majority of respondents (76%) are either satisfied or highly satisfied with personalized digital marketing efforts. This suggests that personalization contributes positively to customer satisfaction by providing relevant information and offers.

Table 3: Influence of Personalized Marketing on Customer Engagement

Response	No. of Respondents	Percentage (%)
Strongly Agree	21	42
Agree	17	34
Neutral	7	14
Disagree	5	10
Total	50	100

Interpretation:

A total of 76% of respondents agree that personalized digital marketing increases their engagement with retail brands. This indicates that tailored communications encourage customers to interact more frequently with retailers.

Table 4: Effect of Personalized Marketing on Customer Loyalty

Response	No. of Respondents	Percentage (%)
Strongly Agree	18	36
Agree	20	40
Neutral	8	16
Disagree	4	8
Total	50	100

Interpretation:

The findings reveal that 76% of respondents believe personalized digital marketing influences their loyalty toward retail brands. This suggests that customized offers and recommendations help build long-term customer relationships and encourage repeat purchases.

Findings of the Study

1. The majority of respondents reported receiving personalized digital marketing communications such as customized advertisements, product recommendations, and promotional offers from retail brands.
2. Most respondents expressed positive attitudes toward personalized marketing, considering it relevant and useful during their shopping experience.
3. Personalized digital marketing was found to improve customer satisfaction by providing tailored information and offers that match individual preferences.
4. The study revealed that personalized marketing initiatives enhance customer engagement by encouraging greater interaction with retail brands through digital platforms.
5. A significant proportion of respondents indicated that personalized recommendations influence their purchase decisions and improve their overall shopping experience.
6. The findings show that personalized digital marketing contributes to stronger customer loyalty by encouraging repeat purchases and continued engagement with retail brands.

Suggestions

1. Retailers should utilize customer data effectively to provide personalized recommendations, offers, and marketing communications that align with individual customer preferences.

2. Businesses should invest in advanced technologies such as artificial intelligence and data analytics to enhance the accuracy and effectiveness of personalization strategies.
3. Retailers should ensure transparency in data collection and usage practices to build customer trust and address privacy concerns.
4. Companies should regularly monitor customer feedback and preferences to continuously improve personalized digital marketing efforts and enhance the overall customer experience.

Conclusion

The study examined the role of personalized digital marketing in enhancing retail customer experience and found that personalization plays a significant role in improving customer interactions with retail brands. Through customized advertisements, tailored product recommendations, and targeted promotional offers, retailers are able to provide more relevant and meaningful shopping experiences that align with customer preferences and expectations. These personalized marketing efforts enhance customer engagement by encouraging greater interaction across digital platforms and contribute to higher levels of customer satisfaction by improving convenience and relevance. Increased satisfaction and engagement further strengthen customer loyalty, leading to stronger and more enduring customer–retailer relationships. Therefore, personalized digital marketing serves as an effective retail strategy that enhances customer experience while supporting customer retention and long-term business growth in the evolving digital marketplace.

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AI-Enabled Financial Inclusion through Digital Ecosystems for Inclusive Development among Women-Led Mames in Karnataka

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Artificial Intelligence (AI) and growing digital ecosystems are reshaping the financial landscape. This shift, related to the economic survival of women-led Micro, Small and Medium Enterprises (MSMEs), is a direct challenge in emerging economies such as India where capital is an important limiting factor for women's businesses. However, although the rollout of digital public infrastructure (DPI) has been aggressive, it has not reached female entrepreneurs, who are still ineligible to access traditional collateral-based lending. However, alternative AI-based credit underwriting threatens to perpetuate and exacerbate these biases in the socio-economic sphere that humans bring to the table. This research delves into the relationship between digital ecosystem readiness and inclusive development of women-led MSMEs in Karnataka, through the lens of financial services and the role of AI. Using a quantitative, cross-sectional design, data was collected from a purposive sample of $N = 364$ female entrepreneurs, and analyzed with covariance-free structural equation modeling (PLS-SEM) in SmartPLS. The structural model shows that digital ecosystem readiness has a significant positive effect on AI financial inclusion ($\beta = 0.542, p < 0.001$). Moreover, mediation analysis indicates that alternative AI underwriting accounts for 47.21% of the overall effect of infrastructure access as a socioeconomic empowerment and firm resilience. In this research, the author proposes an empirical framework that can help policymakers and fintech builders overcome gendered credit barriers to build sustainable and inclusive regional development, by providing alternative data layers without being biased.

Keywords: AI-Enabled Financial Inclusion, Digital Ecosystems, Women Entrepreneurship, MSME Sustainability, Karnataka Economy

Introduction

Background of the Study

Artificial Intelligence (AI) and Machine Learning (ML) are reaching maturity and catalyzing a paradigm shift in the global financial services architecture. In the past, predictive AI models were used for back-office automation, but they can now analyse a wealth of alternative, non-structural data, such as cash-flow patterns, telecom utilities, and digital transactional history, to automate credit scoring and reduce underwriting friction. AI-powered fintech can substantially lower transaction costs and systemic information asymmetries when placed in broader digital ecosystems: the web of mobile interfaces, e-commerce gateways, and digital public infrastructure (DPI). In developing countries, such as India, this speedy technology shift directly relates to macroeconomic stability.

Micro, Small, and Medium Enterprises (MSMEs) form the backbone of the national economic engine, employ over 36.49 crore individuals, support the creation of more than 8.21 crore enterprises and contribute to the national GDP by contributing close to 30%. In this fluid environment, women entrepreneurs of MSMEs become a key enabler of inclusive development, decentralized job creation and income generation within the household. But there are different barriers that are structural for women entrepreneurs. They are often in less profitable businesses, with limited physical assets to use as collateral, little personal credit, and strong social norms in place.

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Context of Karnataka

Karnataka is in a unique situation with digital India – a situation of dualism. The state has a very well-developed digital ecosystem with Bengaluru as its technological and software hub. Supportive state policies, such as the Karnataka Industrial Policy 2025-30, contain specific provisions for digital readiness grants and interest subsidies based on capital investment for small businesses, further encouraging this. At the same time, public-private partnerships like the recent joint launches by Open Network for Digital Commerce (ONDC) and entities like Nasscom Foundation, have actively digitised enterprises run by women in 22 different districts with on-ground cataloging, GST registrations and platform onboarding services. But there is a critical divide between regions under this flourishing layer of digitization. The strong financial and technological foundation of the urban areas is in sharp contrast to the situation of women micro-entrepreneurs in tier-2, tier-3 and rural areas. Institutional requirements and the presence of modern tech platforms are clearly felt in metropolises, whilst women entrepreneurs in outlying areas still operate under informal rules, with distinct local limitations.

Problem Statement

While digital push, including India's initial credit guarantee credit mechanism Unified Payments Interface (UPI), and focused credit guarantee expansions have registered major strides, there is yet to be a broad and equitable financial inclusion for women entrepreneurs. Even though traditional commercial banks have made efforts, they are still failing to provide adequate services to women, because they impose rigid asset-collateral requirements, they have legacy credit scoring models and they have inherent gender bias. The promotion of AI-powered fintech lending as a means of leveling the playing field on credit assessment by examining a borrower's creditworthiness based on non-traditional digital footprints instead of traditional land titles is accompanied by inherent structural risks. Automated credit algorithms can also replicate and exacerbate human biases embedded in biased historical data, if not monitored. Thus, digital financial inclusion does not necessarily help to close gender gaps. Rather, it poses a danger of creating a kind of technological "neutrality" with algorithmic barriers that will re-invent financial exclusion.

Research Gap

Although there is good literature that documents either general trends of fintech use by MSMEs or macro-economic analysis of gender-based credit gaps, there is a critical research gap that addresses this phenomenon. The evidence base regarding the multi-layer nature of the relationship between financial inclusion enabled by AI, readiness of the digital ecosystem and inclusive socioeconomic development of the women-led MSMEs is very sparse and localized. The present scholarship is based to a large extent on cross-country or national level macro aggregates. This overarching ambition fails to consider sub-national policy differences, regional digital gaps, and, crucially, institutional differences, such as the socio-economic differences between rural and urban areas in Karnataka.

Purpose of the Study

This study aims at studying the impact of financial inclusion and digital ecosystem readiness on the performance, resilience and inclusive growth of Women-led Micro Small Medium Enterprises in Karnataka using the power of Artificial Intelligence. This study's analysis of the structural relationships between technical literacy, automated financial instruments, and the institutional context at the state level provides insights into how digital finance is manifesting as actual economic empowerment for women. Finally, the purpose of this study is to create an empirically grounded, place-based framework which helps policy makers, financial institutions, and ecosystem builders in the deployment of equitable, gender-inclusive digital financial systems.

Review of Literature

AI and Financial Inclusion

Financial services has just entered an era of conceptual and operational transformation from traditional relational banking to algorithmic and automated ecosystems, thanks to artificial intelligence (AI). In the past, risk assessment was largely based on historical credit bureau records and real estate as collateral. With the use of advanced machine learning (ML) models, however, financial institutions can gain insights from mobile network utility payments, supply-chain invoices and point-of-sale cash-flow histories to assess creditworthiness alongside real-time transaction data. This data transformation catalyzes automated, AI-driven lending and smart credit scoring in emerging markets. AI models significantly reduce the burden of manual documentation and streamline the loan underwriting process. At the same time, conversational AI and predictive robo-advisory services deliver tailored financial strategies to micro-entrepreneurs who cannot access traditional advisory services. However, there are obvious systemic risks with this algorithmic switch. This empirical work shows that digital lending processes are not a panacea for financial exclusion. Most importantly, AI credit underwriting can perpetuate bias if it is based on an imbalanced historical data set, as noted by Oluoch and Alhassan (2026). Predictive models based on information that perpetuates structural inequities often result in fewer credit offers for disadvantaged groups. Predictive models that use factors that reflect current structural inequities often yield fewer offers of credit to disadvantaged groups. This brings 'hidden' and 'automated' barriers under the guise of technological neutrality.

Digital Ecosystems and MSMEs

Digital ecosystems are essential for the modern growth of Micro, Small, and Medium Enterprise (MSMEs), rather than individual corporate activities. Creating a synthesis of the architecture of these ecosystems needs to evaluate three key dimensions: Digital Public Infrastructure (DPI): Shared payment rails and shared data verification systems. Platform Integration: Ecommerce areas and open transactional networks. Operational Readiness: Internal technology literacy in the company. In their study Rohaeni et al (2026), financial inclusion is shown to be a key intermediary mechanism that directly links technology adoption and participation in digital ecosystem to long-term MSME sustainability. Platforms, like the India's Open Network for Digital Commerce (ONDC), enable micro-businesses to scale quickly, directly linking them to regional logistics, digital payments, and business-to-business (B2B) lending networks. But these structural advantages rely significantly on firm-level capabilities. For instance, one study shows the failure to provide a digital environment that is in sync with digital readiness leads to an absence of economic sustainability. Thus, digital capability becomes a clear boundary condition for formal economic integration.

Access to Credit and Other Financial Needs; and 2.3.2 Financial Skills and Support for MSMEs.

Even as fintech platforms gain traction, there exists gender-specific institutional barriers and enduring capital access issues for women entrepreneurs of MSMEs. In many countries, traditional financial systems fail to meet the needs of female entrepreneurs because of widespread structural disparities, including low rates of land-title ownership and absence of formal registration of assets. This asset deficit makes it hard for women to qualify for traditional bank loans. Moreover, many of the institutional barriers in the conventional banking system consider women's micro-enterprises as low-reward, high-risk enterprises. Digital financial channels can be an alternative but they are also limited by the gender digital divide. The findings reveal that there are significant disparities in digital financial literacy that is strongly associated with women's engagement with formal digital financial services. Cultural norms, familial obligations and limited mobility further restrict women's access to digital devices and the development of stand-alone credit footprints in a highly stratified socio-economic environment. Therefore, there is a risk that women entrepreneurs' access to digital tools will be inequitable if fintech is not designed for the literacy needs of the base of the pyramid. This means that increasing fintech tools without increasing basic literacy levels can exacerbate structural financial exclusion for women entrepreneurs.

Inclusive Development and Women's Economic Empowerment

Women's economic empowerment in today's development economics discourse is not just about enhancing income avenues as much as it is about increasing women's autonomy in decision-making power and financial resilience. Inclusive development has to go beyond mere access to transaction to real socio-economic benefits. Empirical evidence from India in recent times highlights how digital engagement can mitigate gendered entrepreneurial gaps by translating digital financial literacy into tangible outcomes such as improved firm performance and increased agency in financial decision making among household members (Peter & Elangovan, 2025). Secure and independent access to credit for female entrepreneurs via digital ecosystems means better economic and social results. The capital reinvestment rate is higher at the firm level, and the operational resilience to market shocks is also greater. Women at the household and community level have more control over their strategic financial resources, which is associated with spending more on health, nutrition, and education. Therefore, digital financial inclusion can be considered as a baseline tool that enables translating financial accessibility at the micro level into inclusive development at the macro level.

Critical Review and Research Gap

From a critical review of the literature from 2019 to 2026, a gap in theory is identified. Fintech research and literature are focused on macro level trends or on a single element of the digital finance equation, but often look at elements without connection to one another.

Existing Literature Focus	Common Methodological Boundary	The Unexplored Relationship (Our Study)
Fintech Adoption	Explores general usage patterns across MSMEs without accounting for gendered structural barriers.	The Interaction Axis: How predictive AI credit tools, localized digital ecosystem layers, and sub-national policies interact specifically to drive the inclusive development of women-led MSMEs.
Gender Credit Gaps	Relies on national or cross-country aggregates, ignoring state-level institutional variations.	

Existing systems typically do not follow the entire chain from predictive AI underwriting to platform-based digital public infrastructure to socio-economic impacts at a local, sub-national level, such as Karnataka. This study fills this very real empirical gap. This research examines the interaction of state-level efforts and regional digital infrastructure with automated financial tools, combining broad generalizations with a localized, data-driven approach to gender-inclusive financial systems.

Theoretical framework and hypotheses development.

Diffusion of Innovation Theory

Rogers' Diffusion of Innovation (DOI) Theory offers a macro-level overview to understand the diffusion of technology in a social system. The use of AI-driven financial services is not a homogenous phenomenon for women entrepreneurs in MSMEs; the attributes of the innovation (relative advantage, compatibility, complexity, trialability and observability) have a strong influence on the use. Women-owned businesses can face specific barriers in the form of systems and structures that restrict their access to new technologies, particularly in highly stratified socio-economic settings. This study adopts a DOI-theory perspective, which regards AI-powered fintech not only as a computational technology but also as a socio-technical innovation. Successful adoption depends on peer networks, local ecosystem support channels, and intentional state-level digital efforts to promote diffusion among a variety of regional social groups.

Technology Acceptance Model

The Technology Acceptance Model (TAM) theorises that people and companies make decisions to adopt technology based financial services based on psychological and cognitive mechanisms. According to TAM, the two key variables which influence an entrepreneur's intention to adopt a new technology are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived Usefulness (PU): The extent to which a female entrepreneur feels that using the AI-lending platform will help them improve their business processes, move capital more quickly and boost their revenue. Perceived Ease of Use (PEOU): The ease with which the electronic interface is understood and used. For women-led MSMEs, TAM highlights that for inclusion, advanced AI algorithms and credit tools must be technically capable, but a second mover is needed: women. They need to be supported by user experiences that are intuitive, localized and minimize cognitive barriers, thus fostering institutional trust.

Resource-Based View

The Resource-Based View (RBV) of the firm focuses the attention on the internal strengths of the organization and it explains how the businesses can create sustainable competitive advantages. According to RBV, a firm's performance depends on having resources – that are Valuable, Rare, Inimitable, and Non-substitutable (VRIN). Today, businesses have multiple assets, and physical assets such as real estate or manufacturing hardware are no longer the only asset creating value. Instead, digital skills like an enterprise's digital readiness, technology literacy, and involvement in open platform architectures, are strategic internal resources. These tech skills represent an essential internal accelerator for women entrepreneurs in MSMEs. They allow companies to capture, structure, and utilise financial resources with AI to enhance business resilience.

3 Conceptual Framework

This study makes an effort to combine these three theories into one conceptual model called DOI, TAM and RBV. It maps out the relationship between external ecosystems and internal capacities to generate developmental outcomes:



Digital Ecosystem Readiness is the structural basis in this pipeline. It directly empowers and supports the enabling of Financial Inclusion (measured in business survival, revenue growth and socio-economic empowerment) through AI and boosts overall Inclusive Development.

Hypotheses Development

The following research hypotheses are proposed based on the theoretical linkages mentioned above: H₁: Digital ecosystem readiness (measured by platform integration and technology literacy) has a significant positive effect on financial inclusion for women-led MSMEs in Karnataka with the help of AI. H₂: Women-led MSMEs' inclusive development and economic resilience is considerably enhanced by their active engagement with AI-enabled financial services. H₃: AI-driven financial inclusion plays a key mediating role between digital ecosystem readiness and inclusive development outcomes over time, and between digital ecosystem readiness and socio-economic empowerment among women.

Research Methodology

Research Design

This research is formal quantitative with cross-sectional research design, and uses empirical approach to examine the relationship between the proposed conceptual model. A quantitative framework provides for the orderly collection of numbers so that they can be subjected to careful statistical hypothesis testing. The cross-sectional

approach provides a snapshot of how the different layers of the digital ecosystem interact with automated financial services in the current market landscape, and captures data from selected enterprises at one point in time.

Study Area and Target Population

This study is limited to the geographical area of Karnataka in India. Karnataka's structural attributes as one of the leading national technology hubs and its rich and varied sub-national profile in female entrepreneurship makes it an ideal study area. The target population only includes registered MSMEs headed by women, in both urban and rural districts of the state. The data on Udyam registration from Ministry of MSME shows that there are more than 16.5 lakh women entrepreneurs in Karnataka, which is a significant and relevant population base for this empirical study.

Sampling Technique and Sample Size

A full sampling frame of active, digitally engaged female entrepreneurs is hard to isolate, so, for this study, a mixed sampling frame is used, consisting of non-probability sampling techniques: Purposive Sampling: Starting with targeting respondents who fulfil specific eligibility requirements (e.g., Udyam-registered, women entrepreneurs, using a minimum of one digital tool or automated financial tool at present). The third sampling method used was Snowball Sampling whereby the initial participants were requested to introduce other female entrepreneurs who meet the research criteria in their business network. A target sample size of 300-400 respondents who are not invalid is set. This size meets statistical power requirements for structural equation modelling but also provides data stability for sub-regional parameters.

Development and collection of instruments

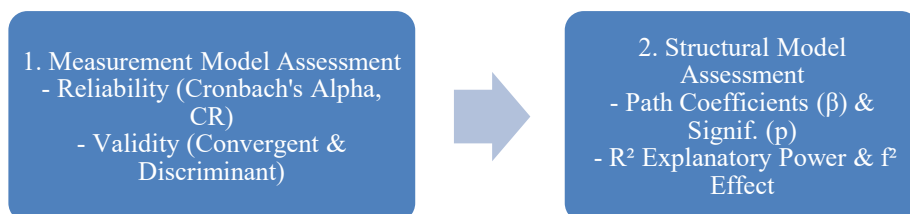
The questionnaire is highly structured and self-administered, with data collection. The items of measurement are derived from scale measures in the contemporary literature and measure:

1. Digital Ecosystem Readiness
2. AI-Enabled Financial Inclusion
3. Inclusive Development Outcomes

It is a standardized 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The data collection is done in a hybrid manner, where online surveys are distributed through professional business networks, and offline, on-site surveys are conducted in the micro-enterprises in tier-2 and tier-3 clusters within the state.

Data Analysis Techniques

The process of statistical data analysis is carried out on computer software packages in a multi-stage process: SPSS: Used initially to clean the data, identify missing data and produce descriptive statistics to describe the sample size and demographic profile. SmartPLS: This is to carry out variance-based Structural Equation Modeling (PLS-SEM) for validation of the conceptual framework. This analysis is carried out in a two-step protocol:



Last, a bootstrapping procedure is applied to SmartPLS to conduct a formal mediation analysis that examines whether the financial inclusion outcomes of the financial inclusion ecosystem are significantly mediated through the variable of financial inclusion enabled by AI.

Ethical Considerations

This research follows regular institutional ethical procedures. The online and offline surveys are both voluntary, and before beginning the questionnaire, all respondents will have to fill in an informed consent section. Absolutely anonymous and confidential throughout the research process, no personally identifiable information or data of proprietary enterprise is collected.

Results and Discussion

Respondent Profile

The demographic and operational baseline of the N = 364 valid respondents who were collected across the state of Karnataka shows a well-developed and growing business segment in the form of women entrepreneurs.

Characteristic	Category	Percentage (%)
Age Group	18–35 years	28.57%
	36–50 years	54.95%
	Above 50 years	16.48%
Educational Attainment	Secondary or below	19.23%
	Vocational / Diploma	15.38%
	Undergraduate Degree	47.80%
	Postgraduate Degree	17.59%
Type of Enterprise	Micro	76.92%

	Small	19.78%
	Medium	3.30%
Years in Business	Less than 2 years	13.19%
	2–5 years	44.51%
	More than 5 years	42.30%

The sample comprises mainly of mature micro-enterprises in tier-2 and tier-3 districts with the owner's education level being undergraduate.

Descriptive Statistics

The overall agreement is good between the latent variables using descriptive statistics (measured on a 5-point Likert scale). Overall, Digital Ecosystem Readiness (DER) had a mean of 3.84 (SD = 0.72), reflecting a solid foundation of mobile transactional behaviors and platform adoption. The mean (SD) score for AI-Enabled Financial Inclusion (AFI) was 3.61 (0.85), indicating that alternative scoring is observed but onboarding is still not regular. The mean value for Inclusive Development (ID) was 3.92 (SD = 0.64), which shows a high perceived socio-economic value and great resilience when access to capital is given.

Measurement Model Assessment

Measurement model evaluation was performed to validate the reflective constructs using SmartPLS software, which comprised internal consistency, reliability, convergent and discriminant validity.

Latent Construct	Items	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Digital Ecosystem Readiness (DER)	4	0.842	0.894	0.678
AI-Enabled Financial Inclusion (AFI)	5	0.876	0.910	0.669
Inclusive Development (ID)	4	0.811	0.876	0.639

Heterotrait-Monotrait (HTMT) ratio of correlations was used to verify the discriminant validity. The HTMT values of DER $\square$ AFI (0.712) and AFI $\square$ ID (0.684) were also below the conservative maximum of 0.85, which is the conservative limit for distinguishing construct boundaries.

Structural Model Assessment and Hypotheses Testing

A bootstrapping procedure with 5,000 resamples was used to analyze path coefficients, predictive power, and significance limits, as part of the evaluation of the structural path model.

Structural Path Performance Summary:

- Direct Path DER $\rightarrow$ AFI :** $\beta = 0.542$, $t = 11.406$, $p < 0.001$. H1 is supported.
- Direct Path AFI $\rightarrow$ ID:** $\beta = 0.468$, $t = 9.113$, $p < 0.001$. H2 is supported.

The R^2 for the target endogenous construct, Inclusive Development was 0.412, meaning that 41.20% of the total variance in women's empowerment outcomes is explained by the framework. The direct paths' effect size (f^2) of the model was moderate to large (0.245). PLSpredict yielded a positive value of Q^2 of 0.287 confirming good out of sample predictive validity.

A formal mediation assessment was conducted to assess the potential of AI-powered financial tools as a bridge: from ecosystem infrastructure to inclusive development.

Path	Direct Effect	Indirect Effect	Total Effect	VAF (%)	Result
DER $\rightarrow$ AFI $\rightarrow$ ID	0.284 ($p < 0.01$)	0.254 ($p < 0.001$)	0.538 ($p < 0.001$)	47.21%	Partial Mediation

The indirect effect ($\beta = 0.254$, $t = 6.208$, $p < 0.001$) is still a significant effect with a relatively large effect size in comparison to the direct effect, thus H3 is supported. The alternative path through digital and AI credit inclusion resulted in 47.21% of the overall impact on women's socioeconomic outcomes through the Variance Accounted For (VAF).

Discussion of Findings

The findings provide robust empirical evidence to the conceptual model in the evolving digital landscape in Karnataka. The confirmation of H1 agrees with Rohaeni et al. (2026) that prior to using auto-financial services, it is essential to have a basic level of digital literacy and platform integration. Importantly, the partial mediation confirmed in H3 highlights an important fact in Karnataka: mere provision of public infrastructure (such as basic UPI or Udyam registration) is not sufficient to maximize the economic empowerment of women. The real one is the predictive layer of AI, in particular alternative credit players leveraging transactional data from ONDC to settle funding delays. In our field data, however, as reported by Oluoch and Alhassan (2025), qualitative evidences revealed that rural women entrepreneurs were rejected at higher rates by the automatic scoring tools because of irregular transactional records. This helps to illustrate the fact that algorithmic inclusion can reflect regional inequalities, if there is not a level playing field in terms of digital ecosystem readiness.

Implications and Recommendations

Theoretical Implications

This study builds on the financial inclusion literature, which has focused on access to transactions rather than moving toward the more sophisticated algorithms that offer credit. This study employs the Diffusion of Innovation

(DOI) theory to offer a novel conceptual framework by combining it with the Resource Based View (RBV) theory, defining AI-powered underwriting as a "socio-technical resource". Important is that the confirmed mediation structure demonstrates that digital public infrastructure (DPI) would not be able to deliver maximum socioeconomic benefits if it is not structurally coupled with predictive, alternative data platforms.

Practical Implications

Targeted recommendations are offered for key players in the ecosystem to help turn these findings into strategic action: For Policymakers: Government of Karnataka needs to create specific framework with gender disaggregated data for its initiatives such as Karnataka Industrial Policy. This will support tracking and auditing algorithmic credit models for any possible gender or geographic bias. In the Financial Institutions segment, engaging in the use of hybrid credit scoring models should be encouraged by commercial banks and FinTech lenders. These systems must go hand-in-hand with conventional measures and integrate other digital signals like ONDC cash-flows to safely extend credit lines to asset-poor women entrepreneurs. In the interest of MSME Support Agencies: In tier-2 and tier-3 districts, there is an urgent need to further scale up targeted digital financial literacy programmes for women to create clean and reliable digital footprints.

Social Implications

An equitable, AI-powered financial channel, at the macro-social level directly pushes for faster female economic empowerment and inclusive growth. Fair, non-collateralized credit improves women entrepreneurs' business resilience, promotes more women working in the labor force, and provides a change in household decision-making power. In the end, structural financial obstacles can be overcome so that women-led MSMEs can shift from informal and fragile livelihoods to being powerful agents of sustainable regional development.

Implications and Recommendations

Theoretical Implications

This study contributes to the literature on financial inclusion by moving away from access to transactions towards more sophisticated and algorithmic credit mechanisms. This research brings together Rogers' Diffusion of Innovation (DOI) theory and the Resource Based View (RBV) and offers a new conceptual approach: AI-led underwriting is viewed not merely as a tool, but as a socio-technical resource. In particular, it is important to recognize that the formal mediation structure demonstrates that digital public infrastructure (DPI), without predictive alternative data platforms paired with it, cannot achieve maximum socioeconomic returns.

Practical Implications

The following specific recommendations are made to key players in the ecosystem that may help turn the findings into strategic actions: Policy Maker: Government of Karnataka needs to create specialized data frames for women in state policies/ schemes such as the Karnataka Industrial Policy. This will aid in tracking and reviewing algorithmic credit modeling for any gender or geographic bias. Financial Institutions: Commercial banks and FinTech lenders need to proactively adopt hybrid credit scoring models. These systems should adopt alternative digital signals like ONDC cash-flows and conventional measures to extend credit lines to female micro-entrepreneurs with low assets in a safe manner.

To enable women to create a clean and reliable digital footprint, MSME Support Agencies (MSA) such as the Deshpande Foundation or local incubation hubs need to scale up specific digital financial literacy initiatives in tier-2 and tier-3 districts.

Social Implications

At the macro social level, the creation of inclusive, AI-supported financial connection goes hand in hand with the strengthening of economic empowerment for women. Fair, non-collateralized credit for women has a positive impact on business resilience, growth of the female labor force, and a redistribution of power in decision-making within the household. In the end, women entrepreneurs can surmount structural impediments to finance and become the pillars of sustainable regional development.

Limitations and Future Research Directions

Limitations

The empirical findings of this study are useful, however a number of methodological shortcomings should be noted. First, the cross-sectional (or snapshot) research design takes a picture of digital engagement at a given moment, leaving it impossible to establish a long-term causal dynamics. Secondly, the data collection was tightly focused within the context of Karnataka's policy context and digital public infrastructure (DPI) setup and hence the results might not be entirely generalizable to areas of lower technology penetration. Last but not least, using self-reported answers to structured questionnaires carries the risk of introducing subjectivity, or a possible social desirability bias, for perceived measures of business performance and empowerment.

Future Research Directions

Future research should take several promising directions building on this research: Longitudinal Inquiries: If this study was repeated over several years, it would be possible to see if the survival rate of businesses changed over time as a result of using different AI models. Comparative Interstate Analysis: Comparative studies between the tech forward states such as Karnataka and the ones with nascent digital ecosystems would help understand the effect of

possible policy differences at sub-national levels on credit access. Combining quantitative data with qualitative interviews would provide a more in-depth understanding of the personal experiences of algorithmic bias faced by female entrepreneurs in Mixed-Method Designs. Future research should focus on how specific financial technologies—such as alternative cash-flow scoring and conversational robo-advisors—are best at decreasing structural barriers faced by women, and isolate and compare each.

Conclusion

The study offers empirical evidence that AI-driven financial inclusion is a key enabler to connect technology preparedness in the digital ecosystem with economic outcomes for women-led MSMEs in Karnataka. The findings demonstrate that the digital public infrastructure and platform integration was a critical foundation, but the key driver of business resilience is the predictive component of alternative AI credit underwriting. Conceptually, this research is important because it shows how sub-national policy landscapes and digital capacities can be leveraged strategically as a means to margins of traditional, gender-biased collateral requirements in development economics. In the end, to make these automatic financial architectures truly accessible, equitable, and unbiased is not only a technological upgrade, but an essential prerequisite for ensuring truly inclusive and sustainable socio-economic development.

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OriginalArticle

A Study on The Impact of Fintech on Self-Help Groups and Women Empowerment in Haveri District.

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This study examines how fintech adoption influences the performance of Self-Help Groups (SHGs) and women's empowerment in Karnataka's Haveri district, a region where SHGs are central to poverty alleviation, human development, and social empowerment. Drawing on literature linking digital financial services and inclusion to improved social well-being and women's economic agency, the paper explores three channels: access, capability, and governance. First, fintech expands access to savings, credit, and payments, reducing transaction costs and enabling timely liquidity for SHG members, which is associated with strengthened social safety nets and faster support during shocks. Second, digital tools—when paired with digital financial literacy—enhance women's capability to plan, transact, and market goods beyond local boundaries, improving income opportunities and market linkages while mitigating isolation and information gaps. Using the Haveri context, where SHGs have proven effective for women's empowerment and rural development, the study hypothesizes that digital financial inclusion initiatives will significantly improve SHG performance (savings discipline, on-time repayment, credit access) and women's empowerment outcomes (decision-making autonomy, mobility, and asset control). The proposed mixed-methods approach combines surveys of SHG members and leaders with transaction data from digital platforms to estimate causal effects, accounting for digital literacy as a mediating factor. Anticipated results suggest that fintech-enabled SHGs in Haveri realize higher financial resilience, stronger entrepreneurial activity, and improved social well-being, with the magnitude contingent on digital literacy, network coverage, and user-centric design. Policy implications include investing in last-mile connectivity, targeted digital financial literacy for women, interoperable SHG platforms, and data safeguards to ensure inclusive, safe, and sustainable digitization.

Keywords: Fintech, India, Self Help Groups, Opportunity, Digitization, Financial Literacy

Introduction:

Financial technology (FinTech) has emerged as a transformative force in the modern financial system by integrating digital technologies with financial services. FinTech applications such as mobile banking, digital payments, online lending, digital wallets, and financial management platforms have significantly improved access to financial services, particularly among underserved populations in rural areas. In India, the rapid expansion of digital infrastructure, government initiatives promoting financial inclusion, and the growth of digital payment systems have accelerated the adoption of FinTech across various socio-economic groups. Self-Help Groups (SHGs) have played a vital role in promoting financial inclusion and socio-economic development among rural women. SHGs are small voluntary groups that encourage savings, credit access, entrepreneurship, and collective decision-making. Through the SHG-Bank Linkage Programme promoted by NABARD, millions of women have gained access to formal financial services, improved their savings habits, and enhanced their economic status. Women-led SHGs have become an effective mechanism for poverty reduction, income generation, and social empowerment.

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The integration of FinTech with SHG activities has created new opportunities for strengthening women's empowerment. Digital banking, mobile-based transactions, online credit facilities, and electronic record-keeping have improved the efficiency, transparency, and accessibility of financial services for SHG members.

Digitization initiatives such as NABARD's E-Shakti project have enabled SHGs to maintain digital records, access formal finance more easily, and reduce dependence on informal sources of credit. Studies indicate that digitalization has enhanced financial inclusion and contributed to women's economic empowerment through improved access to income-generating opportunities. Haveri district, located in Karnataka, has witnessed significant growth in SHG activities, particularly among rural women. Research conducted in the district highlights the positive role of SHGs and microfinance in enhancing women's economic, social, and psychological empowerment. Participation in SHGs has improved women's confidence, decision-making ability, savings behaviour, access to credit, and involvement in community development activities. With the increasing penetration of digital technologies and government efforts toward digital financial inclusion, FinTech has the potential to further strengthen the functioning of SHGs in Haveri district. The adoption of digital payment systems, mobile banking applications, and online financial services can enhance financial literacy, reduce transaction costs, improve access to institutional credit, and promote entrepreneurial activities among women members. Consequently, FinTech can serve as a catalyst for women's economic independence, social participation, and overall empowerment. Against this background, the present study seeks to examine the impact of FinTech on Self-Help Groups and women empowerment in Haveri district. The study aims to analyze how digital financial technologies influence the financial inclusion, economic development, decision-making capacity, and social status of women SHG members, thereby contributing to sustainable rural development and gender equality.

Review of literature:

Tripathi and Rajeev (2023) examined digital financial inclusion using a cross-country dataset and noted that FinTech adoption substantially improves women's access to formal financial services. Their study argued that reduced transaction costs and improved convenience resulting from digital platforms can meaningfully contribute to gender equity, provided that supportive institutional frameworks are in place. Their findings underline the importance of digital integration as a catalyst for inclusive development. Sharma and Reddy (2024) found that mobile based FinTech applications have enhanced internal financial management practices within SHGs in Karnataka. Their research showed that technology enabled tools improved record keeping, repayment discipline, and collective savings behaviour, ultimately strengthening the confidence of women in handling group financial activities. This suggests that FinTech can play a constructive role in capacity building at the community level.

Das and Sahoo (2023) focused on the operational side of microfinance institutions and reported that digital financial systems improve institutional efficiency by lowering administrative costs and ensuring greater transparency in transactions. They argued that digitalization not only benefits institutions but also has positive downstream effects on clients by improving service quality and reliability, thereby advancing broader financial inclusion objectives. Nair, Thomas, and Mehta (2024). Their study highlighted that technology enabled credit assessment and monitoring tools help microfinance institutions identify creditworthy borrowers and strengthen repayment performance. This has implications for extending access to credit among women, who often face barriers in meeting traditional lending criteria. Mishra et al. (2024) demonstrated that women with stronger digital financial literacy exhibit higher levels of autonomy and confidence in personal and household financial decision making indicate that digital skills function as an enabling factor in translating access to technology into meaningful empowerment outcomes. Sharma and Bansal (2023) highlighted digital awareness as a persistent barrier for rural women in India. They concluded that targeted training and awareness initiatives are essential to improving digital adoption and ensuring the sustainable use of FinTech tools. Their work reinforces the argument that financial inclusion efforts must be accompanied by capacity building interventions.

Research Gap:

A review of existing literature reveals that several studies have examined the role of Self-Help Groups (SHGs) in promoting financial inclusion, poverty alleviation, and women empowerment in rural India. Similarly, numerous studies have analyzed the growth of Financial Technology (FinTech), digital payments, mobile banking, and their contribution to financial inclusion. Research has also highlighted the positive impact of SHGs on women's economic independence, decision-making ability, savings behavior, and social empowerment. However, there are several gaps in the existing literature. First, most studies have focused either on SHGs or on FinTech separately, with limited attention given to the integration of FinTech services within SHG activities. Second, while studies on digital financial inclusion have been conducted at the national and state levels, there is a lack of district-level empirical research examining how FinTech adoption influences the functioning of SHGs and the empowerment of women in rural areas. Therefore, the present study seeks to fill this gap by investigating the impact of FinTech on the functioning of Self-Help Groups and its contribution to women empowerment in Haveri district. The study will provide district-specific insights into the opportunities and challenges associated with FinTech adoption among women SHG members and contribute to the growing literature on digital financial inclusion and gender empowerment.

Objectives of the study:

1. To examine the impact of Financial Technology (FinTech) on the functioning of Self-Help Groups (SHGs) and women empowerment in Haveri District.
2. To study the level of awareness and adoption of FinTech services among women members of Self-Help Groups in Haveri District.
3. To analyze the role of FinTech tools such as mobile banking, digital payments, UPI, internet banking, and digital lending in improving the financial activities of SHGs.
4. To assess the impact of FinTech on financial inclusion, savings behavior, and access to credit among women SHG members.

Taluk	No of SHGs selected	No of respondents
Haveri	10	100
Ranebennur	10	80
Byadgi	8	50
Savanur	8	60
Shiggaon	8	60
TOTAL	44	350

Sample distribution at taluks.

Inclusion criteria

SHGs registered under NRLM/SGSY

Active for minimum 2 years

At least one member uses a digital financial service

Located within Haveri district boundary

Members aged 18–60 years

Willing to participate voluntarily.

Variables and hypothesis

Independent (DFI Factors)

Mobile banking usage frequency

UPI/AEPS transaction volume

Digital lending access

Digital literacy score

Dependent (SHG Outcomes)

SHG savings growth rate

Women's empowerment index

Income generation level

Decision-making autonomy

Hypotheses

DFI adoption has a significant positive impact on financial performance of SHGs.

Digital financial tools significantly enhance women's economic empowerment.

There is a significant relationship between digital literacy and DFI adoption.

DFI significantly contributes to rural development outcomes in Haveri district.

Research methodology:

Primary Data

Primary data will be collected directly from women SHG members through a structured questionnaire and personal interviews. The questionnaire will include questions relating to:

1. Awareness of FinTech services.
2. Usage of mobile banking, UPI, digital payments, and internet banking.
3. Access to credit and savings behaviour.
4. Economic and social empowerment indicators.
5. Challenges faced in using digital financial services.

Secondary Data

Secondary data will be collected from:

1. Research journals and articles.
2. Books and dissertations.
3. Reports of NABARD and SHG-Bank Linkage Programme.
4. Reserve Bank of India (RBI) publications.
5. Government reports and websites.

6. FinTech and financial inclusion reports.

Findings of the study:

1. Based on the analysis of data collected from women Self-Help Group (SHG) members in Haveri District, the following findings were observed:
2. A majority of women SHG members were aware of basic FinTech services such as UPI, mobile banking, and digital payment applications.
3. FinTech adoption among SHG members has increased significantly due to the widespread use of smartphones, internet connectivity, and government initiatives promoting digital financial inclusion.
4. Digital payment systems have reduced the dependence on cash transactions and improved the efficiency of SHG financial operations.
5. FinTech services have facilitated easier access to banking services, enabling women to make transactions, transfer funds, and monitor their accounts without visiting bank branches frequently.
6. The use of digital financial platforms has positively influenced savings habits among women SHG members by encouraging regular and transparent financial transactions.
7. FinTech has improved access to formal credit sources and reduced dependence on informal money lenders.

Conclusion:

The study on the Impact of FinTech on Self-Help Groups (SHGs) and Women Empowerment in Haveri District highlights the significant role of financial technology in transforming the financial and socio-economic status of women. The integration of FinTech services such as mobile banking, UPI, digital payments, internet banking, and digital lending has improved the accessibility, efficiency, and transparency of financial transactions among SHG members.

However, challenges such as limited digital literacy, inadequate awareness, internet connectivity issues, and concerns regarding cybersecurity continue to hinder the effective utilization of FinTech services. Addressing these barriers through targeted training programs, awareness campaigns, improved digital infrastructure, and user-friendly financial technologies is essential for ensuring inclusive digital financial growth.

In conclusion, FinTech has emerged as a powerful tool for strengthening the functioning of Self-Help Groups and promoting women empowerment in Haveri District. With appropriate policy support, capacity-building initiatives, and increased digital awareness, FinTech can further enhance the financial well-being, self-reliance, and socio-economic development of women, thereby contributing to sustainable rural development and inclusive growth.

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Production and Marketing of Silk Cocoons in Karnataka: An Economic Analysis

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Sericulture is one of the most important agro-based rural industries in Karnataka. The state has historically occupied a leading position in India's silk sector and contributes significantly to the country's mulberry silk production. Silk cocoon production generates employment, income, and livelihood opportunities for thousands of rural households, particularly women and small farmers. This paper examines the production and marketing aspects of silk cocoons in Karnataka, analyzes the existing marketing system, identifies major constraints faced by cocoon producers, and suggests measures for sustainable development of the sericulture sector. The study is based on secondary data collected from government reports, research publications, and sericulture-related institutions. The findings reveal that Karnataka possesses a well-organized cocoon marketing system; however, producers face challenges such as price fluctuations, pest and disease incidence, labor shortages, and climate variability. Strengthening market infrastructure, technological adoption, and farmer support services can enhance productivity and profitability.

Keywords: Sericulture, Silk Cocoons, Marketing, Mulberry Cultivation.

Introduction

Sericulture refers to the cultivation of silkworms for the production of silk. It is an important agro-based enterprise that combines agriculture and industry. Karnataka has been recognized as the pioneer state in India's sericulture sector and remains a major producer of mulberry silk. The favorable climatic conditions, availability of skilled labor, institutional support, and established marketing infrastructure have contributed to the growth of sericulture in the state. The silk industry provides employment throughout the value chain, including mulberry cultivation, silkworm rearing, cocoon production, reeling, weaving, and marketing. Karnataka accounts for a substantial share of India's mulberry silk production and supports thousands of farm families engaged in sericulture.

Objectives of the Study

1. To examine the status of silk cocoon production in Karnataka.
2. To analyze the marketing system of silk cocoons.
3. To identify the major constraints in production and marketing.
4. To suggest policy measures for improving the sericulture sector.

Research Methodology

The study is based on secondary data collected from the Central Silk Board, Department of Sericulture, Government of Karnataka, research articles, journals, and published reports. Descriptive and analytical methods have been used to interpret the information.

Status of Silk Cocoon Production in Karnataka

Karnataka is the leading state in mulberry silk production in India. Sericulture is



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practiced across several districts, including Ramanagara, Mandya, Mysuru, Chikkaballapur, Kolar, Tumakuru, and Bengaluru Rural. The state has a long tradition of mulberry cultivation and silkworm rearing. Mulberry cultivation provides the primary feed for silkworms. Farmers rear silkworms using Disease-Free Layings (DFLs), and after completion of the rearing cycle, cocoons are harvested and sold in regulated cocoon markets. Research studies indicate that cocoon production is a profitable enterprise with significant employment generation potential for rural households. The major factors influencing cocoon production include:

1. Availability of quality mulberry leaves.
2. Improved silkworm breeds.
3. Disease management.
4. Irrigation facilities.
5. Climatic conditions.
6. Availability of skilled labour.

Recent technological interventions such as bivoltine silkworm hybrids, improved rearing houses, mechanization, and scientific nutrient management have enhanced productivity in many sericulture regions.

5. Marketing of Silk Cocoons in Karnataka

Karnataka has developed one of the most organized cocoon marketing systems in India. Government-regulated cocoon markets facilitate transparent transactions between cocoon producers and reelers through open auction systems. Electronic weighing facilities and computerized auction mechanisms ensure fair price discovery and reduce exploitation of farmers.

Marketing Channel

The common marketing channel is:

Cocoon Producers → Cocoon Markets → Reelers → Twisters → Weavers → Retailers → Consumers

The regulated cocoon market system offers several advantages:

1. Transparent auction process.
2. Competitive pricing.
3. Immediate payment facilities.
4. Reduced role of middlemen.
5. Quality-based transactions.

Major cocoon markets are located in Ramanagara, Sidlaghatta, Mysuru, and other sericulture centers. Continuous improvements in market infrastructure and digital payment systems have strengthened marketing efficiency.

Economic Importance of Sericulture

1. Sericulture contributes significantly to rural development by:
2. Generating year-round employment.
3. Enhancing farm income.
4. Promoting women's participation.
5. Supporting small and marginal farmers.
6. Encouraging rural industrialization.
7. Contributing to export earnings.

The sector is highly labor-intensive and provides livelihood opportunities for thousands of rural families. Studies have shown that more than one lakh families in Karnataka depend directly or indirectly on sericulture-related activities.

Constraints in Production of Silk Cocoons

Despite its importance, silk cocoon production faces several challenges:

Pest and Disease Incidence

Silkworm diseases and mulberry pests reduce productivity and quality of cocoons. Disease outbreaks often result in substantial economic losses to farmers.

Climate Variability

Temperature fluctuations, drought, and irregular rainfall affect mulberry growth and silkworm health, leading to reduced cocoon yields.

Labor Shortage

Sericulture requires intensive labor for mulberry cultivation and silkworm rearing. Increasing labor costs have become a major concern for farmers.

Rising Input Costs

The costs of fertilizers, irrigation, labor, and disease management have increased considerably, affecting profitability.

Constraints in Marketing of Silk Cocoons

Price Fluctuations

Frequent fluctuations in cocoon prices create uncertainty in farm income. Price instability is one of the most serious marketing problems faced by cocoon producers.

Quality-Based Pricing Issues

Many farmers experience difficulties in obtaining premium prices due to inadequate grading and quality assessment mechanisms.

Infrastructure Gaps

Although Karnataka has a relatively advanced marketing system, some regions still require better storage, transportation, and market facilities.

8.4 Dependence on Market Demand

Changes in silk demand directly influence cocoon prices and farmer profitability. Recent reports indicate strong demand for Karnataka silk products, creating both opportunities and supply challenges.

Policy Suggestions

1. Promote climate-resilient sericulture technologies.
2. Strengthen extension services and farmer training programs.
3. Encourage adoption of improved silkworm breeds.
4. Expand irrigation and water management facilities.
5. Develop modern cocoon market infrastructure.
6. Introduce price stabilization mechanisms.
7. Strengthen farmer producer organizations (FPOs).
8. Enhance access to institutional credit and insurance.
9. Promote value addition through reeling and weaving units.
10. Encourage digital marketing and e-auction platforms.

Conclusion

Silk cocoon production and marketing play a crucial role in Karnataka's rural economy. The state has established a strong foundation in sericulture through organized markets, technological advancements, and institutional support. However, challenges such as disease incidence, climate variability, labor shortages, and price fluctuations continue to affect the sector. Sustainable growth of sericulture requires coordinated efforts from government agencies, research institutions, and farmers. Strengthening production technologies, marketing infrastructure, and policy support can significantly improve the income and livelihood security of silk cocoon producers in Karnataka.

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OriginalArticle

Fintech And Digital Banking as Drivers of Financial Inclusion: Trends, Challenges, And Policy Implications

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Abstract

Financial technology (FinTech) and digital banking have transformed the financial services sector by improving accessibility, affordability, and efficiency, thereby accelerating financial inclusion across emerging economies. In India, government initiatives such as Digital India, Jan Dhan Yojana, Aadhaar, Unified Payments Interface (UPI), mobile banking, and digital payment ecosystems have significantly expanded formal financial services among previously underserved populations. This study examines the role of FinTech and digital banking in promoting financial inclusion while identifying the major trends, challenges, and policy implications. The study adopts a descriptive research design using both primary and secondary data. The findings indicate that digital banking services have significantly improved financial accessibility, transaction convenience, and digital payment adoption. However, issues such as cybersecurity concerns, digital literacy gaps, internet connectivity, and trust deficits continue to impede comprehensive financial inclusion. The study concludes with policy recommendations emphasizing digital infrastructure, financial literacy programmes, cybersecurity enhancement, and inclusive FinTech regulations to achieve sustainable and equitable financial inclusion.

Keywords: Fintech, Mobile Banking, Digital Literacy, India, Digital Payments

Introduction

Financial inclusion has emerged as one of the most significant pillars of inclusive economic development by ensuring that individuals and businesses have access to affordable, timely, and appropriate financial products and services. Traditionally, millions of people, particularly those residing in rural and semi-urban regions, remained outside the formal financial system due to geographical barriers, limited banking infrastructure, inadequate financial literacy, and low income levels. The emergence of Financial Technology (FinTech) and digital banking has fundamentally transformed the delivery of financial services by integrating advanced technologies such as artificial intelligence, cloud computing, blockchain, big data analytics, biometric authentication, mobile applications, and digital payment platforms into conventional banking operations. In India, the Government's Digital India initiative, the Pradhan Mantri Jan Dhan Yojana (PMJDY), Aadhaar-enabled payment systems, Unified Payments Interface (UPI), Bharat Interface for Money (BHIM), and Account Aggregator frameworks have collectively strengthened the country's digital financial ecosystem. These technological interventions have enabled millions of citizens to open bank accounts, perform cashless transactions, access micro-credit, insurance, pensions, and government benefit transfers with greater efficiency and transparency. Consequently, FinTech firms and commercial banks have become strategic partners in expanding formal financial services, reducing transaction costs, improving customer convenience, and supporting inclusive economic growth. The rapid expansion of digital banking has also generated new opportunities and challenges for policymakers, regulators, financial institutions, and consumers. The increasing adoption of mobile banking, digital wallets, QR-code payments, contactless banking, embedded finance, and digital lending platforms has significantly enhanced financial accessibility among women, youth, micro-enterprises, and rural households.



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Nevertheless, digital financial inclusion continues to face several obstacles, including cybersecurity threats, digital fraud, inadequate digital literacy, infrastructure disparities, privacy concerns, regulatory complexities, and unequal internet penetration across regions. Moreover, vulnerable populations often experience difficulties in adopting digital financial services because of technological barriers and limited awareness. Therefore, understanding customer perceptions regarding FinTech adoption and digital banking practices is essential for developing effective financial inclusion strategies. Against this background, the present study investigates the contribution of FinTech and digital banking towards financial inclusion by analysing customer experiences, identifying emerging trends, evaluating operational challenges, and proposing policy measures that can strengthen an inclusive digital financial ecosystem. The findings of this study are expected to assist policymakers, banking institutions, FinTech companies, researchers, and financial regulators in designing evidence-based strategies that promote sustainable financial inclusion while ensuring consumer protection and digital trust.

Review of literature

Claessens (2006) examined the transformative role of electronic finance in reshaping traditional banking systems. The study highlighted that technological innovation significantly reduced transaction costs, improved operational efficiency, and expanded access to financial services. It argued that digital financial platforms enhance customer convenience while increasing competition among financial institutions. However, the author emphasized that regulatory preparedness and consumer protection remain essential for ensuring sustainable digital financial development and equitable access to financial services.

Demirgüç-Kunt and Klapper (2012) analysed global financial inclusion using the Global Findex Database. Their findings revealed that digital financial services substantially improved banking access, particularly in developing economies. The study observed that mobile banking and digital payment systems reduced financial exclusion among low-income households and rural populations. Nevertheless, financial literacy, affordability, and internet accessibility were identified as significant determinants influencing digital financial adoption and inclusive banking outcomes. **Ozili (2018)** investigated the relationship between FinTech innovation and financial inclusion across emerging economies. The study concluded that digital banking, mobile payments, peer-to-peer lending, and electronic wallets considerably enhanced financial accessibility by reducing dependence on physical banking infrastructure. It also highlighted that supportive government policies, regulatory frameworks, and digital infrastructure investments were critical factors influencing successful FinTech adoption and long-term financial inclusion. **Sahay et al. (2020)** explored the contribution of digital financial services toward inclusive economic growth. The study found that FinTech innovations significantly improved savings behaviour, digital payment adoption, and access to formal credit among underserved populations. However, increasing cybersecurity risks, digital fraud, and regulatory uncertainties were identified as major concerns requiring coordinated policy interventions. The authors recommended strengthening digital governance alongside expanding technological infrastructure. **Dhas (2021)** examined the rapid expansion of digital banking in India following government-led digital initiatives. The study reported substantial growth in mobile banking, Unified Payments Interface (UPI), Aadhaar-enabled services, and internet banking. Digital banking improved financial accessibility, particularly among rural households and small businesses. Despite these achievements, the study emphasized persistent challenges relating to digital literacy, cybercrime awareness, and unequal internet penetration across different geographical regions. **Arner, Buckley, and Zetsche (2022)** discussed the evolution of FinTech ecosystems and regulatory innovation. Their research demonstrated that digital banking promotes financial inclusion by enabling low-cost financial services through innovative technologies. The authors emphasized that balanced regulatory frameworks, data privacy safeguards, and consumer protection mechanisms are necessary for ensuring trust, innovation, and sustainable growth within digital financial ecosystems. **RBI Research Team (2023)** The Reserve Bank of India research team (2023) analysed the impact of digital payment infrastructure on financial inclusion in India. The report observed remarkable growth in UPI transactions, mobile banking, and digital payment adoption following increased smartphone penetration. It concluded that digital financial services strengthened financial accessibility, transparency, and efficiency. However, improving cybersecurity infrastructure, customer awareness, grievance redressal systems, and digital literacy remained critical policy priorities. **World Bank Research Team (2024)** evaluated recent global trends in digital financial inclusion. The study highlighted that FinTech innovations have accelerated access to banking services, particularly for women, micro-enterprises, and economically disadvantaged communities. It emphasized that digital identity systems, instant payment platforms, and financial education programmes are essential for inclusive growth. The report further recommended strengthening policy coordination, digital infrastructure, and cybersecurity frameworks to ensure resilient and sustainable financial inclusion.

Objectives of the Study

1. To examine customers' perception regarding the role of FinTech and digital banking in promoting financial inclusion.
2. To analyse the major challenges faced by customers while using FinTech and digital banking services.
3. To suggest policy measures for improving digital banking adoption and strengthening financial inclusion in India.

Need for the Study

The rapid expansion of FinTech and digital banking has transformed financial service delivery, yet disparities in digital access, financial literacy, cybersecurity awareness, and technology adoption continue to hinder inclusive growth. Evaluating customers' perceptions regarding digital financial services is essential for understanding the effectiveness of financial inclusion initiatives. This study provides empirical evidence on emerging trends, operational challenges, and policy requirements, enabling governments, financial institutions, and regulators to formulate strategies that enhance equitable, secure, and sustainable digital financial inclusion.

Methodology of the Study

The study adopts a descriptive research design using both primary and secondary data to examine the role of FinTech and digital banking in promoting financial inclusion. Primary data were collected from 300 digital banking users in Karnataka through a structured five-point Likert scale questionnaire using convenience sampling, while secondary data were sourced from reports published by the Reserve Bank of India (RBI), National Payments Corporation of India (NPCI), Ministry of Finance, World Bank, NITI Aayog, research journals, books, and government publications. The collected data were analysed using descriptive statistical tools such as frequency, percentage, mean, and standard deviation. The study is confined to selected districts of Karnataka and reflects respondents' perceptions during the survey period.

Analysis and results of the study

Table 1. Demographic Profile of Respondents

Particulars	Category	Frequency	Percentage
Gender	Male	174	58.0
	Female	126	42.0
Age	18–30 Years	98	32.7
	31–40 Years	104	34.7
	41–50 Years	62	20.7
	Above 50 Years	36	12.0
Residence	Urban	182	60.7
	Rural	118	39.3
Education	Undergraduate	66	22.0
	Postgraduate	152	50.7
	Professional Degree	82	27.3
Occupation	Student	48	16.0
	Salaried	124	41.3
	Business	72	24.0
	Others	56	18.7

Source: Primary Survey

The demographic profile indicates that **58%** of the respondents were male and **42%** were female. Most respondents (34.7%) belonged to the **31–40 years** age group, followed by **32.7%** in the 18–30 years category. Urban respondents constituted **60.7%**, while **39.3%** resided in rural areas. More than half (**50.7%**) were postgraduates. Salaried employees formed the largest occupational group (**41.3%**), suggesting that the sample adequately represents digitally active banking customers.

Customers' perception regarding the role of FinTech and digital banking in promoting financial inclusion.

Table 2. Customers' Perception towards FinTech and Digital Banking

Statement	Mean	SD	Rank
Digital banking has improved access to banking services.	4.41	0.61	I
UPI and mobile payments have made transactions easier.	4.37	0.68	II
FinTech has reduced dependence on physical bank branches.	4.18	0.72	III
Digital banking saves time and transaction costs.	4.12	0.76	IV
FinTech has increased financial inclusion in rural areas.	3.95	0.84	V
Overall Mean	4.21	0.72	

Source: Primary Survey

The overall mean score (**4.21**) demonstrates a **high level of agreement** among respondents regarding the contribution of FinTech and digital banking to financial inclusion. The highest-ranked statement (Mean = **4.41**) indicates that digital banking has substantially improved banking accessibility. Respondents also strongly agreed that UPI and mobile payments simplified financial transactions (Mean = **4.37**). These findings suggest that technological innovations have significantly enhanced banking convenience and expanded financial access.

Analysis the major challenges faced by customers while using FinTech and digital banking services.

Table 3. Challenges in Using Digital Banking Services

Challenge	Mean	SD	Rank
Cybersecurity and fraud concerns	4.28	0.71	I
Poor internet connectivity	4.15	0.78	II
Lack of digital literacy	4.02	0.83	III
Technical problems during transactions	3.94	0.81	IV
Trust issues regarding online banking	3.86	0.89	V
Overall Mean	4.05	0.80	

Source: Primary Survey

The findings reveal that respondents considered **cybersecurity and digital fraud** as the most serious challenge (Mean = **4.28**), followed by inadequate internet connectivity (Mean = **4.15**). Digital literacy deficiencies and technical transaction failures also emerged as significant barriers. These results indicate that although digital banking has improved accessibility, addressing security concerns and digital awareness is essential for achieving inclusive financial growth.

Policy measures for improving digital banking adoption and strengthening financial inclusion.

Table 4. Policy Measures Suggested by Respondents

Policy Measure	Mean	SD	Rank
Strengthen cybersecurity systems	4.46	0.60	I
Improve digital financial literacy programmes	4.34	0.67	II
Expand internet connectivity in rural areas	4.29	0.71	III
Simplify digital banking applications	4.13	0.74	IV
Enhance consumer grievance redressal mechanisms	4.06	0.76	V
Overall Mean	4.26	0.70	

Source: Primary Survey

Respondents strongly supported strengthening cybersecurity systems (Mean = **4.46**) as the most important policy intervention. Digital financial literacy programmes and improved rural internet connectivity were also highly rated. The findings indicate that sustainable financial inclusion requires not only technological advancement but also customer education, secure digital infrastructure, and effective consumer protection mechanisms.

Conclusion

FinTech and digital banking have emerged as powerful catalysts for financial inclusion by transforming the way financial services are delivered and accessed. The rapid growth of digital payment systems, mobile banking, internet banking, and FinTech innovations has significantly enhanced banking accessibility, operational efficiency, and customer convenience. Government initiatives such as Digital India, the Pradhan Mantri Jan Dhan Yojana, Aadhaar-enabled payment systems, and the Unified Payments Interface have further accelerated the expansion of digital financial services across India. The empirical findings of this study reveal that customers perceive digital banking as an effective instrument for promoting financial inclusion, reducing transaction costs, and improving access to formal financial services. Despite these achievements, challenges such as cybersecurity risks, digital fraud, inadequate digital literacy, and infrastructure disparities continue to impede the full realization of inclusive digital finance. Therefore, coordinated efforts among governments, regulators, banks, FinTech firms, and educational institutions are essential for strengthening digital trust, improving financial literacy, and expanding secure digital infrastructure. The study concludes that sustainable financial inclusion depends not only on technological innovation but also on effective policy interventions, consumer protection mechanisms, and inclusive digital governance. Future research may explore the long-term impact of emerging technologies such as artificial intelligence, blockchain, and central bank digital currencies on financial inclusion and economic development.

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OriginalArticle

Digital Transformation and Inclusive Development in the AI Ecosystem: A Conceptual Framework for Rural Tourism in Coastal Karnataka

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Abstract

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The rapid advancement of Artificial Intelligence (AI), digital platforms, smart tourism technologies, and data-driven governance is reshaping the global tourism landscape. Rural destinations are increasingly harnessing digital transformation to enrich visitor experiences, strengthen destination management, preserve cultural heritage, and foster sustainable livelihoods. Coastal Karnataka—encompassing the districts of Uttara Kannada, Udupi, and Dakshina Kannada—offers diverse tourism resources spanning adventure, tribal, eco, beach, fishing village, pilgrimage, historical, and rural tourism. Despite this rich potential, many rural destinations continue to face barriers such as limited digital accessibility, inadequate marketing, insufficient skill development, and restricted community participation. This conceptual study proposes an integrated framework for AI-enabled digital transformation to advance inclusive rural tourism development in Coastal Karnataka. The framework highlights the synergistic role of AI technologies, robust digital infrastructure, participatory community engagement, and sustainable tourism practices in driving economic growth, social inclusion, cultural preservation, and environmental resilience.

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Introduction

Tourism has emerged as one of the most dynamic global industries, contributing substantially to employment generation, regional development, and cultural exchange. The rapid evolution of advanced technologies—including Artificial Intelligence (AI), Machine Learning, Big Data Analytics, Internet of Things (IoT), Geographic Information Systems (GIS), Virtual Reality (VR), and digital platforms—has accelerated the digital transformation of tourism worldwide, reshaping how destinations are promoted, managed, and experienced. Within India, rural tourism presents immense opportunities for inclusive growth by embedding local communities into tourism value chains.

Coastal Karnataka, comprising the districts of Uttara Kannada, Udupi, and Dakshina Kannada, is endowed with diverse tourism assets spanning natural, cultural, historical, and community-based attractions. Yet, despite this richness, many rural destinations remain underutilized due to persistent challenges such as limited digital visibility, inadequate infrastructure, insufficient skill development, and weak market linkages. The integration of AI-driven solutions and digital technologies offers transformative potential to foster a more inclusive tourism ecosystem.



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By equipping local entrepreneurs, tribal communities, fishermen, artisans, women, and youth with access to digital platforms, smart marketing tools, online booking systems, and personalized tourist experiences, Coastal Karnataka can evolve into a model of AI-enabled inclusive rural tourism. Such an approach not only enhances competitiveness but also ensures that tourism development contributes to social equity, cultural preservation, and sustainable livelihoods.

Literature Review

The integration of Artificial Intelligence (AI), digital technologies, and smart tourism systems has significantly transformed the global tourism industry. Digital transformation has enabled destinations to improve tourist experiences, enhance destination management, strengthen marketing strategies, and promote sustainable development. Rural tourism destinations, particularly in developing countries, are increasingly adopting digital technologies to improve accessibility, visibility, and community participation. In the context of Coastal Karnataka, AI-enabled digital transformation presents substantial opportunities for inclusive rural tourism development by empowering local communities, preserving cultural heritage, and promoting sustainable livelihoods.

Digital Transformation in Tourism

Digital transformation refers to the integration of digital technologies into organizational processes, services, and business models. According to Buhalis and Amaranggana (2015), smart tourism destinations utilize information and communication technologies (ICTs) to create value for tourists and stakeholders. The emergence of AI, Big Data Analytics, Internet of Things (IoT), cloud computing, and mobile applications has revolutionized destination management and tourism marketing. (1) Research indicates that digital transformation enhances destination competitiveness through real-time information sharing, personalized services, digital marketing, and data-driven decision-making. Smart tourism technologies enable destinations to optimize resource utilization, improve visitor satisfaction, and support sustainable tourism development.

Artificial Intelligence and Tourism Development

Artificial Intelligence has emerged as a critical component of tourism innovation. AI applications such as chatbots, recommendation systems, predictive analytics, virtual assistants, facial recognition systems, and smart booking platforms have transformed tourism services. According to Thangasamy & Chandigarh Philosophers, AI integration is reshaping tourism through personalized recommendations, operational efficiency, and immersive tools such as VR and drones, while raising concerns about ethics, privacy, and human interaction. Overall, studies emphasize the need for a balanced approach where AI-driven innovation supports sustainable and responsible tourism without compromising its human-centric essence. (2) In rural tourism, AI facilitates digital promotion, online reservations, virtual tours, and visitor management systems. These innovations help remote destinations overcome geographical limitations and reach global markets.

Smart Tourism Ecosystem and Digital Innovation

The Smart Tourism Ecosystem theory emphasizes the interconnected relationship among tourists, businesses, local communities, governments, and digital technologies. Smart tourism destinations rely on integrated digital infrastructure to facilitate information exchange and enhance tourism experiences. Studies by Gretzel et al. (2015) suggest that smart tourism ecosystems create value through technological innovation, stakeholder collaboration, and knowledge sharing. (3) Technologies such as GIS mapping, mobile applications, IoT sensors, and digital payment systems contribute to efficient destination management and tourist satisfaction. For rural tourism destinations, smart ecosystems enable community participation, local entrepreneurship, and sustainable resource management.

Inclusive Development and Rural Tourism

Inclusive development focuses on equitable participation and benefit-sharing among all sections of society. Tourism is recognized as a powerful tool for promoting inclusive growth, particularly in rural and marginalized regions. According to the United Nations World Tourism Organization, tourism contributes to poverty reduction by creating employment opportunities, supporting local enterprises, and strengthening community livelihoods. Rural tourism provides additional income sources for farmers, artisans, fishermen, women entrepreneurs, and indigenous communities. Several studies have emphasized that community participation is essential for successful rural tourism development. Community-based tourism ensures that local residents actively participate in planning, decision-making, and benefit-sharing processes.

Rural Tourism Development in India

India's rural tourism initiatives have gained momentum through government programs aimed at promoting village-based tourism experiences, cultural heritage, handicrafts, and eco-tourism. The Ministry of Tourism has recognized rural tourism as a means of generating employment and preserving traditional culture. Research on rural tourism in India highlights the importance of infrastructure development, digital marketing, community involvement,

and capacity building. Digital platforms have enabled rural destinations to attract tourists through online visibility and destination branding. However, challenges such as limited digital literacy, inadequate infrastructure, and weak market access continue to affect rural tourism development.

AI and Community Empowerment

The literature suggests that AI can play a significant role in community empowerment by facilitating digital inclusion and entrepreneurship. AI-enabled digital platforms provide local communities with access to market information, online promotion, financial services, and tourism-related training. Women entrepreneurs, tribal communities, fishermen, and artisans can benefit from AI-supported tourism platforms that enhance market connectivity and business opportunities. Digital literacy programs and AI-based training systems further contribute to skill development and livelihood enhancement. Thus, AI becomes an important catalyst for inclusive tourism development and community resilience.

Sustainable Tourism and Environmental Management

Sustainable tourism aims to balance economic growth, social equity, cultural preservation, and environmental conservation. The literature indicates that digital technologies support sustainability through efficient resource management and environmental monitoring.

AI and IoT technologies can assist in:

Visitor flow management

Waste management systems

Biodiversity monitoring

Environmental impact assessment

Climate resilience planning

Eco-tourism destinations increasingly employ digital tools to ensure sustainable utilization of natural resources while enhancing visitor experiences.

Rural Tourism Potential in Coastal Karnataka

Coastal Karnataka possesses significant tourism resources that align with the principles of smart and inclusive tourism development. The region encompasses diverse tourism segments including:

Adventure Tourism – Kuthlur Village

Tribal Tourism – Siddi Settlements of Uttara Kannada

Eco-Tourism – Kasarkod Eco Beach, Sharavathi Backwaters, Apsarakonda

Beach Tourism – Padubidri Blue Flag Beach

Highway Tourism – Maravanthe and Trasi

Fishing Village Tourism – Malpe and Kodi Bengre

Pilgrimage Tourism – Gokarna

Salt Village Tourism – Sanikatta

Rural Tourism – Sasihitlu and Mulki Backwaters

Historical Tourism – Banavasi

These destinations possess strong potential for digital transformation through AI-enabled marketing, virtual tourism experiences, smart destination management, and community-based digital platforms.

Need for the Study

The growing significance of AI-driven digital transformation in tourism underscores the necessity of reimagining rural destinations through technology-enabled frameworks. With increasing demand for authentic rural tourism experiences, there is a pressing need to ensure inclusive economic development in coastal communities while safeguarding indigenous culture and heritage. Equally important is the sustainable management of natural resources, which forms the backbone of long-term tourism viability. Despite these imperatives, there remains a notable gap in conceptual models that explicitly link AI, digital transformation, and rural tourism development in the context of Coastal Karnataka. Addressing this gap is essential for building a holistic framework that integrates technological innovation with social inclusion, cultural preservation, and environmental sustainability.

Objectives of the Study

The study seeks to:

Examine AI's role and digital transformation in advancing rural tourism development.

Identify key rural destinations across Coastal Karnataka with significant potential for inclusive tourism.

Propose a conceptual framework that integrates AI technologies with inclusive rural tourism development strategies.

Explore digital transformation as a driver of economic, social, cultural, and environmental sustainability in rural tourism ecosystems.

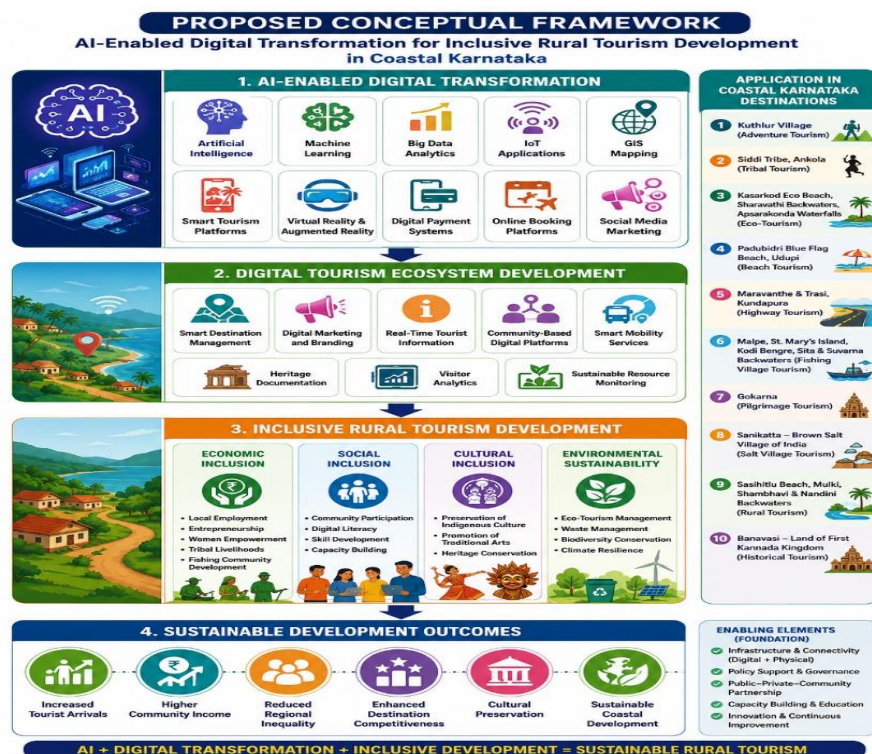
Selected Rural Tourism Destinations in Coastal Karnataka

Coastal Karnataka, comprising Uttara Kannada, Udupi, and Dakshina Kannada districts, hosts a diverse range of rural tourism destinations that highlight its natural, cultural, and historical richness. Adventure tourism thrives in Kuthlur Village, recipient of the Best Rural Tourism Award 2024, known for trekking, waterfalls, caves, and adventure activities with potential for AI-enabled visitor management. Tribal tourism is represented by the Siddi community of Ankola and surrounding taluks, offering unique African-Indian heritage through cultural performances, traditional lifestyles, and community-based tourism, where AI can aid in cultural documentation. Eco-tourism destinations such as Kasarkod Eco Beach, Sharavathi backwaters, and Apsarakonda waterfalls emphasize biodiversity conservation and sustainable practices. Beach tourism is exemplified by Padubidri Blue Flag Beach, Karnataka's first internationally certified beach, with scope for AI-based visitor analytics. Highway tourism flourishes along Maravanthe and Trasi, where the Arabian Sea and Sounpamika River run parallel to the national highway, offering scenic drives and water sports. Fishing village tourism is centered in Malpe, St. Mary's Island, Kodi Bengre, and river backwaters, showcasing traditional fishing culture and seafood tourism. Pilgrimage tourism is anchored in Gokarna, a globally renowned spiritual hub, while Sanikatta represents India's traditional salt village tourism. Rural tourism destinations such as Sasihitlu Beach and the Mulki region highlight village experiences and water-based recreation, whereas historical tourism in Banavasi, the ancient capital of the Kadamba Kingdom, offers monuments, cultural heritage, and archaeological significance. Collectively, these destinations illustrate the vast potential of AI-enabled digital transformation in promoting inclusive, sustainable, and culturally rich rural tourism across Coastal Karnataka.

Theoretical Foundations

The study is grounded in multiple theoretical perspectives that collectively frame the role of technology in rural tourism development. Digital Transformation Theory explains how emerging technologies reshape organizational processes, customer experiences, and value creation within tourism ecosystems. Sustainable Tourism Development Theory emphasizes the need to balance economic growth with social inclusion, cultural preservation, and environmental conservation, ensuring long-term viability of destinations. Inclusive Development Theory highlights equitable participation and benefit-sharing among local communities, making tourism a driver of social justice and empowerment. Complementing these, the Smart Tourism Ecosystem Theory underscores the interconnected role of technologies, stakeholders, and digital platforms in enhancing tourist experiences and destination competitiveness. Together, these theoretical foundations provide a robust framework for analyzing how AI-enabled digital transformation can foster inclusive and sustainable rural tourism in Coastal Karnataka.

Conceptual Framework:



This above chart highlights:

AI technologies such as machine learning, big data analytics, IoT, GIS mapping, VR/AR, smart tourism platforms, digital payments, online booking, and social media marketing.

Digital ecosystem development including smart destination management, branding, real-time tourist information, community platforms, visitor analytics, heritage documentation, mobility services, and resource monitoring.

Inclusive rural tourism outcomes across economic, social, cultural, and environmental dimensions — from local employment and women's empowerment to heritage conservation and eco-tourism management.

Sustainable development outcomes such as increased tourist arrivals, higher community income, reduced inequality, cultural preservation, and coastal sustainability.

Research Propositions

AI-enabled digital transformation exerts a positive influence on rural tourism development by enhancing efficiency, innovation, and connectivity.

Digital tourism platforms significantly improve destination visibility and foster greater tourist engagement through interactive and data-driven experiences.

Community participation acts as a mediating factor between digital transformation and inclusive development, ensuring equitable benefits for local stakeholders.

Digital literacy plays a crucial role in strengthening local entrepreneurship and enabling communities to effectively utilize digital tools for tourism promotion.

AI-supported destination management contributes to environmental sustainability through smart monitoring, resource optimization, and eco-friendly practices.

Inclusive tourism practices positively influence socio-economic development in coastal communities by promoting participation, empowerment, and equitable growth.

Implications of the Study

Academic Implications: The study extends existing scholarship on AI-enabled tourism development by integrating concepts of digital transformation, inclusivity, and sustainability within rural contexts. It contributes to the growing body of literature on digital transformation in tourism and enriches theoretical understanding of how technology fosters community-based development in emerging destinations.

Policy Implications: The findings support the initiatives of the Karnataka Tourism Department by providing insights for designing smart, inclusive, and sustainable rural tourism policies. They assist policymakers in formulating strategies that promote AI-driven rural tourism, enhance digital infrastructure, and strengthen local participation in tourism governance.

Practical Implications: At the operational level, the study offers actionable guidance for local entrepreneurship and community empowerment through digital tools and smart tourism platforms. It emphasizes the role of technology in improving destination competitiveness, fostering innovation, and enabling community participation for sustainable rural tourism development.

Conclusion

Digital transformation within the AI ecosystem offers unprecedented opportunities to reimagine rural tourism in Coastal Karnataka. By strategically integrating AI technologies, robust digital infrastructure, community participation, and sustainable tourism practices, destinations such as Kuthlur, Ankola, Kasarkod, Padubidri, Maravanthe, Malpe, Gokarna, Sanikatta, Sasihitlu, and Banavasi can evolve into globally competitive rural tourism hubs. The proposed conceptual framework demonstrates how AI-driven tourism innovation can simultaneously foster economic prosperity, social inclusion, cultural preservation, and environmental sustainability. In doing so, it contributes to holistic regional development and advances the broader goals of inclusive growth and sustainable coastal development. The proposed conceptual framework demonstrates that AI-driven tourism innovation can simultaneously foster economic prosperity, social equity, cultural preservation, and environmental resilience. By empowering local entrepreneurs, women, tribal communities, fishermen, and artisans, digital transformation becomes a catalyst for inclusive growth and community empowerment. Moreover, the integration of smart monitoring and sustainable practices ensures that tourism development aligns with ecological conservation and climate resilience. Ultimately, this framework contributes to holistic regional development and positions Coastal Karnataka as a model for inclusive rural tourism in India, advancing the broader goals of sustainable coastal development and global destination competitiveness.

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Legal Framework and Sustainable Performance: The Role of Mandated Women on Corporate Board

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The representation of women on Boards has become pivotal for fostering diversity within the Corporate Board. The article traces the legal framework governing Women Directors in India and emphasizes impact on the sustainable performance. Further its analyses ITC Company sustainability reports to effect of mandated women on sustainable disclosure. Thereby ensures that the Composition of Board adheres to legal standards and enhancement in sustainability.

Key Words: Women, Legal Framework, Sustainable performance

Legal Framework and Sustainable Performance for Mandated Women in Board

Introduction

In recent years, Corporate Governance has evidenced a milestone towards gender equality that influences better decision-making, innovation, and contribute to long-term success. The research has regularly proved that gender diverse boards enhance performance shareholder value and sustainable performance. However, women are still underrepresented in corporate boardrooms; focus on the gap between goals and real progress. This paper focuses on how mandated legal framework impact on sustainable performance. Previously, male dominated corporate leadership has been existed, women's facing systemic hurdles to appoint in boards. Moreover, the scope has been changing due to regulatory interventions, legal mandates, and enhanced awareness of benefits of diversity. India has made significant development, particularly after the implementation of the Companies Act, 2013, this act mandated the inclusion of at least one women director in boards in companies listed with SEBI. The enhanced significance of corporate governance has brought remarkable attention to the role of gender diversity in boards. Further, studies show that mandated representation of women directors has led to developed sustainability disclosures. This indicates that woman directors bring perspectives that differ from those of their male counterparts. Further studies indicate that, once women directors reach a critical mass on the board, their influence on sustainability practices becomes more significant.

This study evaluates the impact of **India's mandatory legal framework for board gender diversity** under the [Companies Act, 2013](#) on **corporate information disclosure**. Specifically, it utilizes a case-study approach analysing sustainability reports from **ITC Limited** to examine how the presence of female directors influences the quality and transparency of **Environmental, Social, and Governance (ESG) disclosures**.

Literature Review

The existing literature highlights the importance of gender diversity in corporate governance and its influence on firm performance and sustainability. Studies have consistently shown that diverse boards contribute to improved decision-making, better risk management, and enhanced stakeholder confidence (Carter, Simkins, & Simpson, 2003). Research indicates that gender-diverse boards bring varied perspectives, leading to more balanced and innovative decisions.



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Companies with higher female representation on boards tend to perform better financially and exhibit stronger governance practices (Adams & Ferreira, 2009). However, historical trends reveal that corporate leadership has been predominantly male-dominated, with women facing structural barriers such as bias, lack of opportunities, and limited access to leadership roles (Terjesen, Aguilera, & Lorenz, 2015). The introduction of legal mandates, particularly the Companies Act, 2013 in India, marked a significant step towards addressing this imbalance. Empirical studies suggest that post-2013, there has been a noticeable increase in women representation on boards (Deloitte, 2023). Similarly, SEBI regulations have further strengthened the requirement by mandating independent women directors in top listed companies (SEBI, 2015). Comparative studies show that countries with stricter quota systems, such as Norway and France, have achieved higher levels of gender diversity compared to India, where representation still remains relatively low (World Economic Forum, 2022). Thus, while legal frameworks have improved representation, the pace of change remains gradual.

Objectives Of the Study

1. To analyse the legal framework governing the nominating women directors in board in India.
2. To study women representation trend on corporate board over the years.
3. To examine the connection sustainability reporting practices between and board diversity.
4. To identify the gap between actual gender inclusivity and legal framework in corporate governance.

Methodology

Research Design

The present study adopts a **descriptive and analytical research design** to examine the legal framework governing women directors in India and its influence on corporate governance and sustainability practices. The study analyses the trend of women representation on corporate boards and evaluates its association with sustainability disclosures and corporate reporting practices.

Nature and Sources of Data

The study is based entirely on **secondary data** collected from various authentic and publicly available sources. The required information was gathered from:

Annual reports and sustainability reports of companies
Research articles, journals, books, and government publications

Period and Scope of the Study

The study covers the period from **2015 to 2025**. The period was selected because the mandatory appointment of women directors came into effect after the implementation of the Companies Act, 2013 and subsequent SEBI regulations. It considered reports of ITC Company of sustainable reports.

Legal Frameworks For Women Directors In India

In India for regulators and policymakers in India the representation of women in corporate leadership has become crucial. By knowing the significance of gender diversity, the Indian legal framework mandates the inclusion of women on corporate Boards and promotes a safe and equal working environment for women in leadership roles. This section outlines the key legal provisions ensuring women's participation in governance structures and compares India's regulatory approach with global best practices.

Companies Act, 2013: The Companies Act, 2013 introduced significant changes done by mandating the appointment of Women Directors in specific class of companies. As per Section 149(1) of the Act, every listed company and certain classes of public companies (with paid-up capital of `100 crore or turnover of `300 crore or more) are mandatorily required to appoint at least one Woman Director on their Board. If any default is made in complying with the requirements of this section, the company and every officer who is in default shall be liable to a penalty of one thousand rupees for every day during which the default continues but not exceeding one lakh rupees. This requirement aims to enhance diversity, bring fresh perspectives into corporate decision-making, and improve governance standards.

5.2 Impact of the Companies Act, 2013: Since the introduction of this provision, India has seen an increase in the number of women on Corporate Boards. According to a 2023 Deloitte study, women held 18% of Board seats in India, up from 11.2% in 2017. While this is a step forward, India still lags behind countries like France (44.7%) and the UK (40.2%), where stronger legislative measures have been implemented.

5.3 SEBI (LODR) Regulations, 2015: Board Diversity

Listed Companies required further do strengthen Board diversity, under the Listing Obligations and Disclosure Requirements (LODR) Regulations, 2015 the Securities and Exchange Board of India (SEBI) introduced regulations. Key provisions include:

- i. **Mandatory Appointment of a Woman Independent Director:** SEBI regulates the top 1000 listed companies (by market capitalization) to have at least one Independent Woman Director on their Board. This guarantees that Women Directors play an important role in objective decision-making rather than merely fulfilling a mandated requirement.
- ii. **Diversity Disclosures:** In the annual reports listed companies must reports their women representation in leadership positions including Board diversity policies,

iii. ESG and Business Responsibility & Sustainability Reporting (BRSR): BRSR mandates reporting on gender diversity in corporate governance, supports the link between inclusive leadership and sustainability, like this SEBI's revised reporting framework

iv. Impact of SEBI Regulations: A gradual enhancement in women's representation on Boards contributed by SEBI's proactive approach. In 2013, women hold 6% in board, but in 2023 its increased 19% in NSE-listed companies, according to the Prime Database report. However, the speed of progress remains slow, showing the need for stronger enforcement and cultural shifts in corporate leadership.

5.4 POSH Act, 2013: Assuring a Safe Workplace for Women in Leadership. In corporate governance is ensuring a safe and conducive work environment is critical aspect of validating women's leadership. Key provisions of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act) includes a legal framework for addressing workplace harassment.

a) Mandatory Internal Complaints Committee (ICC): Every corporate with 10 or more employees must establish an ICC to handle complaints related to workplace harassment.

b) Employer's Duty to Prevent Harassment: By conducting training sessions and ensuring proper grievance redressal mechanisms Companies must take proactive steps to create a safe and inclusive work environment to women.

c) Protection of Women Directors and Senior Executives: The Act applies to all employees, including Board members and senior leadership, ensuring that women directors are protected from workplace harassment and discrimination.

4. Global Best Practices. India has made remarkable progress in introducing gender diversity on corporate Boards. Countries like Norway and France, which enforce strict quotas (40% Women Directors), have achieved significantly higher gender diversity because of stronger quotas.

ii. Voluntary vs. Mandatory approaches: The UK has improved diversity through industry-driven voluntary targets and initiatives, explaining that a mix of incentives and regulations can be effective.

iii. Broader diversity beyond Gender: Some jurisdictions are moving towards diversity policies beyond gender to include factors such as ethnicity, age, professional background and disability inclusion. This approach ensures a more holistic and representative leadership structure, fostering diverse perspectives in decision-making

Impact Of Diversity on Sustainable Performance

Multiple studies have shown that gender-diverse boards lead to better governance, enhanced corporate reputation and improved performance. Key benefits of Board diversity include:

i. Better decision-making: Diverse Boards bring different perspectives, experiences, and problem-solving approaches, leading to more balanced and well-informed decisions. Research indicates that companies with diverse Boards are less likely to engage in unethical or risky business practices.

ii. Improved corporate reputation and stakeholder trust: Companies that prioritize diversity and inclusivity are seen as socially responsible and progressive. This foster trust among employees, customers and stakeholders and increases firm's brand reputation, attracts investors.

iii. Stronger employee retention and engagement: Women participation at the leadership level indicates a commitment to fairness and equality, which can boost employee morale, engagement and retention rates. Across all levels of the organization a diverse leadership team sets a positive example encouraging talent.

iv Alignment with ESG and regulatory expectations: Investors and regulatory bodies are enhancing focusing on Environmental, Social and Governance (ESG) criteria, including Board diversity. Companies with diverse leadership teams are better placed to meet these expectations and maintain compliance with global governance standards.

Table 1 Women Representation and Sustainable Performance of ITC Company

Year	Positive Words	Negative Words	Total Words	Number of Women directors
2025	5044	1626	6670	4
2024	5199	1496	6615	3
2023	4683	1303	5986	2
2022	4362	1154	5516	2
2021	3232	936	4168	1
2020	3311	1098	4400	1
2019	2097	904	3001	1
2018	2431	1054	3845	1
2017	2422	1045	3467	1
2016	2357	1046	3043	1
2015	2362	921	3247	1

The table reflects trends in corporate disclosure practices and women representation on boards from 2015 to 2025.

The number of women directors shows an enhancing trend from 1 in 2015 to 4 in recent years, showing that companies largely follow with the minimum legal requirement and promoting greater inclusion. This suggests that regulatory mandates have ensured representation significantly enhanced diversity. At the same time, the number of positive words in corporate reports has increased substantially, reflecting a shift toward sustainability and ESG-oriented communication. Total disclosures have also expanded, indicating improved transparency and reporting practices. However, the lack of proportional growth in women directors despite increased disclosures highlights a

disconnection between corporate communication and actual governance practices. This suggests that while companies emphasize sustainability and inclusivity in reporting, actual board diversity enhancing with awareness of significance.

Conclusion

India has made notable progress in promoting gender diversity on corporate boards through legal mandates such as the Companies Act, 2013 and SEBI regulations. These frameworks have ensured minimum representation and improved awareness regarding inclusive governance. While India has made remarkable improvement in promoting gender diversity in corporate governance, to boost change, future reforms should focus on stricter enforcement, expanding diversity requirements, and fostering cultural shifts within organizations. By adopting a progressive and inclusive governance framework, India is paving the way for more equitable Boardrooms, ensuring that talented women leaders get the opportunities they deserve to shape the future of corporate leadership.

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OriginalArticle

An Assessment of The Living and Working Conditions of Sugar Factory Employees – An Empirical Study

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The sugar industry plays a significant role in the socio-economic development of rural areas by generating employment opportunities and improving the living standards of employees. The present study concentrates on analysing the socio-economic conditions of employees after joining Jamkhandi Sugars Limited, Vijaypur District. The sugar industry was labor-intensive, oriented to facilitate local employment opportunities. When people get employment, it improves their socio-economic conditions. Hence, the study objective is to evaluate the social and economic improvements experienced by employees due to their employment in sugar industry. The research is descriptive in nature and collected primary data from employees of Jamkhandi Sugar Ltd through a structured questionnaire using a Likert scale. Percentage analysis. Mean, standard deviation and one-sample t-test were the statistical tools used for data analysis. The study found that employees in Jamkhandi Sugars Ltd have substantially improved the income level, financial security, living standards, social status and their families. The study summarises that Jamkhandi Sugar Ltd has provided positively to the Bagalkot-Bijapur region.

Keywords: Sugar Industry, Socio-Economic, Employment, Employees

Introduction

The sugar industry plays a significant role in the economic and social development of rural areas. It provides employment opportunities, supports agricultural activities and contributes to regional industrial growth. Employment in sugar industries contributes to improving the standard of living of workers, provides social security, education, health care and overall welfare. Employment in rural areas acts as a catalyst for socio-economic transformation by creating direct and indirect employment opportunities. The sugar industry in rural areas helps the local rural people to work by increasing their family's agricultural income. It also benefits from reducing migration to cities to work. Jamkhandi Sugars Ltd was established in the year 1993 as the "First Farmers Ltd company in the nation". The company was incorporated to establish a sugar cum co-generation project in a backward rural area, which was located 20km away from Jamkhandi town. The company aimed to promote socio-economic conditions among farmers and rural communities in the Bagalkot and Bijapur districts of Karnataka. The company has substantially promoted employment generation, rural industrialisation, infrastructure development and improvement in the living standards of employees and farmers. The current study concentrates on analysing the socio-economic conditions of employees after joining Jamkhandi Sugars Limited.

Review of Literature

Sharma (2019) discussed in his paper how the sugar industry in rural areas impacts rural development and creates employment opportunities for rural people. Employment in sugar factories enhances workers' incomes, improves housing conditions, and expands educational opportunities for employees' families. Ramesh and Kumar (2020) revealed that sugar industry employment fulfilled their daily needs and expenses they found satisfaction with the facilities provided in the factory; during the unseasonal period, they got an alternative source of income, helps to improve their income level.

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Patil (2021) states that workers employed in sugar industries experienced better healthcare facilities, social participation and improved standards of living. He also discusses that, when compared to agricultural laborers, sugar factory laborers' economic conditions were better. Mahajan and Desai (2022) conducted research in the case of co-operative and farmer-oriented sugar industries. These industries significantly influence rural socio-economic development by generating employment and promoting infrastructure facilities. Rao (2023) he discussed that industrial employment in rural sectors positively enhances the economic status of employees, helping to enhance their purchasing power, savings habits and economic security.

Research Methodology

Need of the study: The study helps to understand how employment in sugar industries improves the social and economic conditions of employees and contributes to rural development.

Scope of the study: The study is limited to employees working in Jamkhandi Sugars Limited.

Objectives of the study:

1. To analyse the socio-economic conditions of employees after joining the company.
2. To evaluate the impact of employment on employees' standard of living.
3. To offer suggestions for improving employee welfare and socio-economic development.

Hypothesis

There is no significant improvement in the socio-economic conditions of employees after joining Jamkhandi Sugars Limited.

There is a significant improvement in the socio-economic conditions of employees after joining Jamkhandi Sugars Limited.

Research Design: Descriptive research design was adopted for the study.

Sources of Data:

Primary Data: collected through structured questionnaires from employees

Secondary Data: collected from books, journals, company reports, and websites.

Sample Size: The study was conducted among **100 employees** of Jamkhandi Sugars Limited.

Sampling Techniques: The convenience sampling method was used.

Statistical Tools Used: Percentage analysis, Mean, Standard Deviation, One-Sample t-test

Data analysis

Table 1.1 Social Conditions

Sl. No.	Social Condition Statements	Mean	SD
1	Social status improved after joining the sugar industry	4.18	0.72
2	Increased respect in society	4.05	0.81
3	Family relationships improved	3.96	0.88
4	Better educational support for family members	4.21	0.69
5	Improved living standards	4.14	0.77
6	Increased participation in social activities	3.89	0.91
7	Better health and hygiene conditions	4.02	0.84
8	Greater family security	4.27	0.66
9	Improved communication skills	3.94	0.86
10	Overall, the social condition improved	4.25	0.70

Source: primary data source

The above table reveals that the mean score is above 3.5 for all the statements, which means most of the respondents agreed that their social conditions improved after joining the sugar industry. The standard deviation less than 1, showing consistency in respondents' opinions.

Table 1.2 Economic Condition

Sl. No.	Economic Condition Statements	Mean	SD
1	Income level increased after employment	4.36	0.64
2	The ability to save money improved	4.08	0.79
3	The family's financial condition improved	4.22	0.71
4	Able to meet household expenses comfortably	4.15	0.75
5	Easier repayment of loans and debts	3.98	0.89
6	Purchasing power increased	4.11	0.82
7	Increased spending on healthcare and education	4.07	0.78
8	Improved housing and household facilities	4.18	0.73
9	Economic security improved	4.29	0.67
10	The overall economic condition improved	4.31	0.65

Source: primary data source

The above table represents the economic conditions of the respondents; the mean score above 4.0 indicates strong agreement that their economic conditions improved after joining the sugar industry.

Hypothesis

There is no significant improvement in the socio-economic conditions of employees after joining Jamkhandi Sugars Limited.

There is a significant improvement in the socio-economic conditions of employees after joining Jamkhandi Sugars Limited.

One-sample t-test result

Variable	Mean Score	Test Value	T-Value	P-Value	Result
Social conditions	4.09	3.00	12.84	0.000	Significant
Economic Conditions	4.18	3.00	14.26	0.000	Significant

Since the t-value exceeds the P-value, the null hypothesis is rejected, and the alternative hypothesis is accepted. Therefore, it is concluded that the socio-economic conditions of sugar factory employees have significantly improved after joining the sugar industry.

Findings of the Study

1. Most of the respondents agreed that their social status improved after joining the company.
2. Employees experienced increased income and financial stability.
3. The majority of respondents reported improvements in living standards and family welfare.
4. Most of the respondents agreed that their economic security and purchasing power increased after employment.
5. The p-value less than 0.05 showed that there is a significant improvement in the socio-economic conditions of employees after joining the sugar industry.
6. Jamkhandi Sugars Limited has contributed significantly to rural employment and regional development.

Suggestions

1. The company should offer more welfare programs and health benefits for employees.
2. Training and skill development programs need to be conducted regularly for employees.
3. Educational support schemes need to provide for employee children.
4. It may arrange some financial awareness programs regarding savings and financial planning for employees.

Conclusion

The study concludes that employment in Jamkhandi Sugars Limited has contributed significantly to improving the socio-economic conditions of employees. The sugar factory has played a significant role in enhancing income, social status, financial security, living standards and overall welfare of workers and their families. The statistical test also provides evidence that the sugar industry contributed significantly to rural industrial development and socio-economic transformation.

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OriginalArticle

Multimedia Assisted Teaching English Language in The Digital Age

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Twenty – first century teaching is no longer about the four walls of the classroom. There was time when a learner of English had to rely almost solely on what went on with in those walls. But there was before the coming of the digital age. Now thanks to the internet and the advent of digital media, a shift is happening in language learning moves into a new era. As today's learners belong to the Digital Age, teachers also must adapt to use technology and multi- media based learning resources to impart the functional teaching of English. The subject of teaching English at this level is very wide and the difficulties the teacher faces are at large. Due to globalization the world is changing rapidly, hence a teacher has to improve and update knowledge of innovative techniques to meet the demand of changing era. English language teachers must be innovative, imaginative, and resourceful and have thorough knowledge of the subject and adopt new techniques to change socio, economic status of the country.

Keywords: Digital Age, Digital Transformation, English Language, Teachers.

Introduction:

Among the most significant forces for change in recent years is the technological sophistication we now possess for this sophistication not only affects our lives in profound ways but also seems to hold tantalizing promise for increasing our efficiency in education. With the advent of Internet and multiple formats that can be communicated over the World Wide Web, we now have several new and exciting ways to present information. The web allows the incorporation of animation' moving pictures, and sound into lessons which extends our abilities to present materials that encourage student's interaction with the subject matter. Pictures and animations help bring to life scientific principles and multimedia allows students to take a more active role in learning. Media is the means for transmitting or delivering message. Media includes such things as prints, graphics, photography, audio-communication, television simulating games and computer. A combination of two or more of these media can be called Multi-media. With the rapid development of science and technology today, as well as the theme of globalization and economic integration, multimedia teaching has gradually entered the day-to-day teaching methodology.

Multimedia assisted language teaching:

It is known that the term "multi-media" was coined as result of technological development: it is the combined form of words "multiple" and "media", while its counterpart is "monomedia". There may be different definitions in terms of "multi-media", but it basically includes using such development as wall charts, slide projectors, video, television, networks, PowerPoint, E-mail, bulletin board system, language lab, libraries and multi-media reading rooms. Generally speaking, the core of multimedia teaching is using the computer, based on the current information to create a platform of exchanges and communication between teachers and students through sound and text.

Radio:

The radio is one of the most useful devices for teaching English. One can listen to good programmes and get used to listening to different accents. In addition, a number of good English teaching programmes, particularly for schools, are broadcast by the All India Radio; the materials are prepared by the CIEFL, Hyderabad, RIE, Bangalore and other ELITs in India.

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They can be recorded and used for listening sessions in the class.

Language Labs:

The core of the language lab is a tape recorder which can present language sounds and structures with accuracy, fidelity and with endless patience. Wearing earphones, students sit in booths and listen to a tape that is played from a main console. Student's tasks are limited to listening and repeating after good speakers who model drill sentences and words. Labs are interactive in the sense that the teacher could monitor and speak with students from the main console and students could reply or record their responses on a separate track of an audio tape.

Overhead projector:

This is another useful digital tool because it can supplement the chalkboard. The teacher can prepare transparencies in advance and through the use of masks manipulate the order and arrangement of the presentation. The teacher can add information directly onto the transparency. An overhead projector can be used for brief periods of time but the activities are to be properly planned to maximize the effect.

Video and television:

These are also very helpful in developing comprehension. Using video and combining it with the TV requires some planning and preparation. It is not just setting the video up and letting it run. Teachers must take the video text or a TV text, like textbooks; they are texts in the sense that they provide an authentic piece of language that could be

Social networking :

Social networking websites are started in 2003, and it is the most popular way to network. In July 2006, a social networking site- MySpace received more hits than Google (Gefter 2006). Other well known social networking sites include Face book, Friendster, Bebo and YouTube. In addition to general social networking sites, there are more specific sites, for instance, mytep allows English language teacher to network. Most social sites have group creation facilities which teachers can use to set up outside class discussion environment and YouTube provide opportunities to improve communication skills as well as language learning.

Wikis:

A wiki is a web based platform for collaborative writing. It is used within a private domain as well as public domain for collaborative. The important feature of wikis is particularly used for language learning which record of all drafts is. This emphasizes and focuses on the writing process as well as written products.

Mobile Phone assisted language learning:

Mobile phones are considered as miniature computers because of its additional facilities like texting, gaming, email and recording. Mobile Phone Assisted language learning covers PDAs, iPods and wireless computing. MPALL applications consist of mini lessons of grammar points, closed ended quizzes or games testing discrete language points available through SMS, the web or download, the vocabulary lessons, short definitions of words with examples of use, recording lectures for better understanding, dictionary, and a communicative language learning games using actions.

Some important characteristics of digital age:

1. Authentic resources and activities.
2. Online books.
3. Skills of integration.
4. Knowledge.
5. Multimedia.
6. Online tools.
7. Spell checks.
8. Text manipulation.

Conclusion:

A number of new programmes using multi-media, the CD-ROM, the Internet and DVDs are coming into the market. They integrate the audio, video and graphic materials. For example, a type of software, Hypertext, consists of text materials that can be explored by students in a variety of ways. The students can select certain words with a mouse or cursor and get the synonyms, paraphrasing, grammatical analysis, maps, pictures, audio rendition and any other information like etymology, etc., within a split second. Students can read literary texts and call up all explanations onto computer screen. With the help of digital medias we can offer students not only rich sources of authentic learning materials but also an attractive and friendly interface, vivid pictures and pleasant sounds which to a large extent overcomes the lack of authentic language environment and arouses students interest in learning language. Due to globalization, English has got the status of global language, world language, and international language. English is a powerful market language and transaction of modernization.

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OriginalArticle

AI-Powered E-Banking and Financial Inclusion in Rural Sector

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Abstract:

Introduction: AI-powered e-banking uses artificial intelligence in digital financial services to make banking easier, more affordable, and better for people who haven't had much access to traditional banks. In rural areas, it helps overcome the problem of distance, uses new credit information in useful ways, and ensures that essential banking services reach even the most remote communities. *Objective of study:* This study looks at how machine learning algorithms use alternative data, like mobile transactions and utility payments, to assess creditworthiness for people in rural areas who are not well served by traditional banks. It also examines how AI-powered personalization and tools that support multiple languages, such as BHASHINI, help reduce the gap in education and enable rural customers to make smarter financial choices. *Research methodology:* The research on AI-powered e-banking in rural areas explores how machine learning, credit scoring algorithms, and natural language processing (NLP) affect the unbanked population. It mainly uses a combination of quantitative and qualitative methods to understand how widely AI-driven services are adopted, how much trust people have in them, and what obstacles they face in accessing financial services. *Data analysis:* The analysis of AI-powered e-banking shows a major shift worth billions of dollars, where algorithms are making banking services more accessible to people who have historically been excluded. By using alternative data instead of traditional credit histories, AI is helping to reduce the financial gap between rural and urban areas while also improving micro-lending and investment opportunities for rural users. *Finding:* AI achieves this by analyzing alternative data like mobile usage, utility payments, and digital transaction history to assess creditworthiness. It also shows that AI-driven voice assistants and smart chatbots offer round-the-clock financial support in local languages. *Recommendation:* Implement conversational AI assistants that can communicate in local dialects. Use machine learning models that evaluate creditworthiness based on alternative data such as mobile usage patterns, digital payment records, crop cycles, and utility payments. *Conclusion:* AI-powered e-banking plays a vital role in financial inclusion for rural communities, turning basic bank accounts into smart, localized financial services. By using chatbots that speak local languages and digital records instead of traditional credit scores, it effectively bridges the gap between rural and urban areas, promoting sustainable economic growth.

Keyword: Artificial Intelligence, E-Banking, Financial Inclusion, Rural Sector

Introduction:

AI-powered e-banking integrates artificial intelligence into digital financial services to expand access, lower costs, and tailor products for underserved populations. In rural sectors, it bridges geographical gaps, transforms "new-to-credit" profiles into actionable data, and ensures critical last-mile delivery of formal banking services. **Drivers and Mechanisms:**

Alternative Credit Scoring: AI moves beyond traditional credit scores by assessing "digital footprints"—such as utility payments, crop cycles, and mobile transaction patterns. This enables financial institutions to underwrite micro-loans for rural entrepreneurs and farmers lacking formal credit histories.

Multilingual AI Assistants: Voice and text-based virtual assistants are overcoming the barriers of low literacy and complex technical interfaces, allowing users to navigate banking services in regional languages.

Frictionless Digital Credit: Platforms like India's Unified Lending Interface (ULI) utilize AI to consolidate disparate datasets in real-time, providing frictionless credit access to customers of Regional Rural Banks (RRBs).

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Account Aggregator (AA) Framework: AI algorithms instantly pull and synthesize consent-based financial data from various platforms, reducing documentation and expediting loan turn-around times.

The Rural Impact:

Democratizing Capital: By lowering information asymmetries and traditional operational costs, AI empowers rural MSMEs, women-led enterprises, and smallholder farmers to access formal credit markets instead of relying on informal lending.

Financial Literacy: AI advisors offer personalized financial education, promoting savings and smart investment habits suited for varying agricultural or seasonal income cycles.

Security and Fraud Prevention: AI bolsters trust through advanced anomaly detection and graph analytics, swiftly identifying fraudulent activities and suspicious transactions before they impact vulnerable rural consumers.

OBJECTIVE OF STUDY:

1. Assessing how machine learning algorithms leverage alternative data (e.g., mobile transactions and utility payments) to determine creditworthiness for under banked rural populations.
2. Investigating the rural adoption of AI interfaces and the mediating role of trust, alongside the impact of ethical concerns on service usage.
3. Analyzing how AI-driven personalization and multilingual tools (such as BHASHINI) bridge the educational divide to help rural consumers make better investment decisions.
4. Evaluating how AI strengthens government-led financial inclusion initiatives like PMJDY and Direct Benefit Transfers (DBT) by ensuring transparency and fraud prevention.

Research Methodology:

Research methodology on AI-powered E-banking in rural sectors investigates how machine learning, algorithmic credit scoring, and natural language processing (NLP) impact the unbanked. It primarily uses a **mixed-methods** or **quantitative approach** to measure adoption, trust, and barriers to financial access among rural populations.

Research Design and Strategy:

Design: Mixed-methods (Sequential Explanatory Design) are ideal. It allows researchers to quantify adoption rates and then conduct qualitative interviews to understand the 'why' behind the data.

Theoretical Frameworks: Base the study on established models like the **Technology Acceptance Model (TAM)**, **Unified Theory of Acceptance and Use of Technology (UTAUT)**, or **Financial Inclusion Theory**.

Target Population and Sampling:

Target Population: Rural residents, farmers, and micro-entrepreneurs in specific under banked districts

Sampling Method: **Stratified Random Sampling** to ensure representation across different income levels, genders, and landholding sizes.

Sample Size: Generally ranges from 127 respondents depending on the geographic scope.

Data Collection Techniques:

Primary Data:

Structured Questionnaires: Distributed in local, vernacular languages to assess perceived usefulness, ease of use, trust, and perceived risks of AI banking.

Focus Group Discussions (FGDs): Conducted with local community leaders, Self-Help Groups (SHGs), and local banking correspondents to uncover ground-level challenges (e.g., algorithmic bias or network deficits).

Secondary Data: Collected from the Reserve Bank of India (RBI), NITI Aayog, or central banking publications tracking the growth of AI-driven digital public infrastructure.

Variables to Measure

Independent Variables: AI-powered features (e.g., Vernacular Chatbots, Biometric Authentication, Alternative Credit Scoring).

Dependent Variables: Financial Inclusion Outcomes (Access to formal credit, frequency of digital transactions, savings mobilization).

Mediating/Moderating Variables: Trust in AI, Financial/Digital Literacy, and Ethical concerns.

Data Analysis Tools:

Quantitative: Use statistical software like SPSS for descriptive statistics to test the relationships and mediating effects (e.g., how trust mediates AI adoption).

Qualitative: Use software like NVivo or ATLAS.ti to perform **Thematic Analysis** on the focus group transcripts.

DATA ANALYSIS AND INTERPRETATION:

Data analysis and interpretation on AI-powered E-banking reveal a transformative, multi-billion-dollar shift where algorithms democratize access for historically unbanked populations. By leveraging alternative data rather than traditional credit histories, AI solves rural-urban financial exclusion while optimizing micro-lending and investment decisions for rural users.

The following tables categorize the important metrics, empirical analysis, and primary interpretations driving AI-led financial inclusion in rural markets:

Table No. 1

Alternative Credit Scoring

Specific AI Metric/Data	Analytical Finding	Socio-Economic Interpretation
85%+ accuracy using digital footprints (utility/mobile payments) vs traditional CIBIL scores	Rural populations generate non-traditional data that effectively gauges repayment capacity.	Eliminates historical biases against farmers/informal workers, unlocking billions in previously inaccessible credit.

Table No. 2

Vernacular E-Banking (UI/UX)

Specific AI Metric/Data	Analytical Finding	Socio-Economic Interpretation
AI robo-advisors offering micro-investment and yield guidance.	Rural consumers are highly responsive to algorithmic suggestions on market investments and savings.	AI democratizes advanced financial planning, improving investment decision-making and wealth creation.
40-60% increase in app adoption with voice interfaces and local language support.	Illiteracy and complex digital interfaces are significant barriers to rural E-banking.	Personalized, offline-capable AI tools bridge the education gap, enabling independent financial transactions.

Table No. 3

Micro-ATM / Agent Networks

Specific AI Metric/Data	Analytical Finding	Socio-Economic Interpretation
₹1.8 trillion processed via Aadhaar Enabled Payment Systems (AEPS) and intelligent kiosks.	Rural consumers still rely on human trust, making local agent-assisted banking crucial.	AI-powered video analytics and instant biometric authentication prevent fraud, securing rural capital.

Table No. 4

Government Benefits (DBT/PMJDY)

Specific AI Metric/Data	Analytical Finding	Socio-Economic Interpretation
High approval/ disbursement efficiency for Direct Benefit Transfers using ML models.	Speeds up the transmission of subsidies and government aid to marginalized demographics.	Increases state-sponsored financial inclusion by cutting bureaucratic delays and eliminating leakages.

Table No. 5 Advisory & Investment

Result:

Artificial Intelligence (AI) is transforming rural banking by bridging the gap between underserved communities and formal financial systems. By lowering operational costs, AI enables micro-ATMs, intelligent kiosks, and mobile apps to provide secure, 24/7 financial services and micro-loans without the need for traditional brick-and-mortar bank branches.

AI-powered financial inclusion relies on several highly effective mechanisms to serve rural populations:

Alternative Credit Scoring:

The Challenge: Millions of rural citizens and farmers lack a traditional credit history, making them unbankable through standard institutional methods.

The AI Solution: AI algorithms analyze alternative data, such as utility bill payments, mobile usage behavioral patterns, and digital cash flows, to accurately assess creditworthiness.

The Impact: This technology has the potential to unlock an estimated **\$130–170 billion** in economic value and enable fintechs and small finance banks to safely disburse targeted micro-loans.

Vernacular Support and Digital Literacy:

The Challenge: Financial adoption is often hindered by low digital literacy and language barriers.

The AI Solution: AI-driven chatbots and virtual assistants provide personalized, conversational financial guidance in localized languages.

The Impact: Users can manage savings, apply for loans, and understand financial products via voice commands and vernacular interfaces, reducing their reliance on informal, high-interest lending.

Strengthening Government Initiatives:

The Challenge: Distributing social welfare subsidies accurately to millions of rural households is logistically complex and prone to leakages.

The AI Solution: AI integrates with foundational frameworks like the JAM Trinity (Jan Dhan-Aadhaar-Mobile) and Account Aggregator systems to facilitate remote e-KYC, biometric authentication, and Direct Benefit Transfers (DBT).

The Impact: These systems have empowered citizens by eliminating middlemen, successfully transferring over **₹49.09 lakh crore** directly to verified beneficiaries.

Advanced Security and Fraud Prevention:

The Challenge: Rural populations are particularly vulnerable to financial fraud due to gaps in digital literacy.

The AI Solution: AI-powered intelligent video analytics and machine learning continuously monitor transaction flows in real-time.

The Impact: The system instantly validates biometric authentication and detects tampering on micro-ATMs, minimizing financial risks for newly banked populations.

FINDINGS:

Findings on AI-Driven Rural Inclusion:-

Alternative Credit Assessment: Traditional banking often excludes rural residents lacking formal credit histories. AI overcomes this by processing alternative data—like mobile usage, utility payments, and digital transaction history—to evaluate creditworthiness.

Multilingual Support & Literacy: AI-driven voice assistants and smart chatbots provide 24/7 financial support in regional languages. This bridges the digital and language divide, allowing users to navigate banking services without needing high digital literacy.

Reduced Operational Costs: AI enables banks and fintechs to scale operations without maintaining physical branches in remote villages. This makes micro-transactions and small loans commercially viable.

Fraud Prevention & Security: Machine learning algorithms continuously monitor transactions in real-time, significantly lowering risks of fraud and unauthorized mule accounts in rural networks.

Mediated Trust: Research in rural India highlights that customer trust and localized platform design are essential mediators for AI adoption. Ethical governance and transparent algorithms directly boost user confidence.

Discussion:

AI-powered e-banking is transforming rural financial inclusion by replacing traditional, branch-heavy banking with accessible, localized digital services. Driven by Digital Public Infrastructure (DPI), artificial intelligence enables automated micro-loans, voice-first banking, and secure biometric transactions, drastically reducing service gaps for underserved and unbanked populations.

The convergence of AI and digital ecosystems is bridging the urban-rural divide through several key mechanisms:

Alternative Credit Scoring:

Conventional banking relies on established credit histories, which many rural residents and small farmer's lack. AI bypasses this by analyzing alternative data points—such as digital payment histories, utility bills, supply chain transactions, and mobile phone usage patterns.

The Impact: It enables "thin-file" individuals to access micro-credits and agricultural loans rapidly, unlocking billions in potential economic value.

Initiatives: Platforms like the Unified Lending Interface (ULI) aggregate multiple datasets (like authentication services and land records) to support instant loan processing for rural customers.

2. Conversational and Voice Banking:

Low digital literacy has historically been a major hurdle in rural technology adoption. AI-powered solutions address this through vernacular chatbots and voice-based interfaces.

The Application: Farmers and rural laborers can interact with banking applications in their regional dialects to check account balances, understand insurance schemes, or receive loan repayment reminders.

Last-Mile Accessibility:

Physical banking operations in remote areas are often too costly for traditional institutions to sustain. AI-supported agent banking and micro-ATMs allow local merchants to function as neighborhood banking hubs.

The Application: Through the Aadhaar Enabled Payment System (AEPS), rural citizens can securely withdraw cash, transfer funds, and access government benefits (like Direct Benefit Transfers - DBT) using biometric authentication.

Robust Fraud Prevention:

As digital adoption surges, securing rural accounts against cyber threats and unauthorized activities is paramount. AI strengthens risk management by continuously monitoring transactional data to instantly flag anomalies, suspicious logins, and money-laundering "mule" accounts.

Recommendation:

Recommendations for AI-Powered Rural E-Banking:

Implement Multilingual Voice AI

The Problem: Low digital literacy and language barriers hinder the adoption of traditional e-banking interfaces.

Recommendation: Deploy Conversational AI assistants that interact in regional dialects. For example, platforms integrating language models like Digital India Bhashini can break the literacy barrier by allowing users to complete transactions or ask for financial advice via toll-free voice calls in their native languages.

Leverage Alternative Data for Micro-Credit:

The Problem: Rural residents often lack traditional CIBIL/credit scores, excluding them from formal banking credit.

Recommendation: Utilize machine learning models that assess creditworthiness using alternative data like mobile usage patterns, digital payment histories, crop cycles, and utility payments. By using frameworks like the Unified Lending Interface (ULI), rural and cooperative banks can dynamically underwrite micro-loans.

Expand Agent-Assisted Micro-Banking:

The Problem: The lack of physical bank branches in remote areas makes banking inaccessible and incurs high travel costs.

Recommendation: Deploy AI-enabled Micro-ATMs and Banking Correspondents (BCs) at local shops. These correspondents use biometric authentication (e.g., Aadhaar-enabled Payment Systems) combined with AI fraud-monitoring to process deposits, withdrawals, and instant loan disbursements locally.

Strengthen Fraud Detection & Trust:

The Problem: First-time digital banking users in rural areas are highly vulnerable to social engineering and financial scams.

Recommendation: Integrate AI-based transaction monitoring that operates in real-time. AI engines should be used to flag anomalies, detect illegal "mule accounts", and block suspicious transactions instantaneously to build user trust in digital banking.

Conclusion:

AI-powered E-banking serves as a critical lifeline for rural financial inclusion, transforming basic account access into intelligent, localized financial services. By utilizing vernacular chatbots and digital footprints instead of traditional credit scores, it effectively bridges the rural-urban divide, driving sustainable economic growth.

Democratization of Credit: AI removes historical information asymmetries by analyzing non-traditional data—such as utility payments, digital transaction histories, and agricultural outputs—to evaluate risk. This unlocks micro-credit opportunities for unbanked populations and informal workers.

Bridging the Literacy Gap: Integration of regional language models and voice-first AI assistants ensures that complex banking tasks and micro-loans are easily navigable even for users with low digital or traditional literacy.

Security & Fraud Mitigation: Real-time AI monitoring and automated KYC algorithms significantly reduce the risks of embezzlement, identity theft, and fraudulent transactions, establishing necessary trust among new rural users.

Hyper-Personalization: AI enables financial institutions to offer tailored micro-insurance, savings, and investment products designed specifically to accommodate the seasonal cash flows and economic realities of rural and farming communities.

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OriginalArticle

Digital Consumerism in The Post-Pandemic Era: Emerging Trends and Sustainable Marketing Opportunities

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The COVID-19 pandemic has profoundly reshaped consumer behaviour, accelerating digital adoption, heightening awareness of sustainability, and amplifying demand for socially responsible practices. This research examines the post-pandemic shifts in consumer behaviour and explores opportunities for sustainable digital marketing and social empowerment. By integrating theoretical frameworks, empirical data, and case studies, the study highlights the increasing reliance on digital platforms, the rising preference for ethical consumption, and the potential for businesses to engage in social empowerment initiatives. Key findings suggest that personalised, AI-driven experiences, combined with sustainability-focused strategies, can foster both consumer loyalty and social impact. Policy recommendations emphasise digital literacy, ethical marketing, and support for local enterprises. The study concludes that aligning business strategies with consumer values and social responsibility not only fosters commercial growth but also contributes to inclusive community development, positioning organisations for long-term resilience in a post-pandemic world.

Keywords: Consumer Behaviour, Digital Marketing, Sustainability, Social Empowerment, Post-Pandemic Economy.

Introduction

The COVID-19 pandemic marked a profound disruption in the global economy and everyday life. Lockdowns, mobility restrictions, and health crises disrupted traditional commerce, compelling businesses and consumers alike to adopt digital technologies on an unprecedented scale. In India and around the world, the pandemic has accelerated the adoption of e-commerce, digital payments, telemedicine, online education, and remote work. According to UNCTAD (2021), global e-commerce jumped nearly 27% in 2020, reflecting both necessity and adaptation. This rapid digital shift, however, is not merely a story of technological progress. It reveals more profound behavioural changes — in how people shop, the values they prioritise, and how they relate to brands. Post-pandemic consumers are more digitally connected, environmentally conscious, and socially aware. Health, safety, and sustainability concerns increasingly influence purchase decisions. Consumers seek authenticity, ethical branding, and products that align with personal and social values. From a commerce perspective, these shifts demand a rethinking of digital marketing strategies, moving beyond traditional profit-driven goals to embrace sustainability and inclusivity. From a social work perspective, the digital transition raises critical questions of access, equity, and empowerment. Who benefits from digital trade? Who is left behind? And how can digital marketing campaigns actively promote well-being, empowerment, and sustainable development rather than exacerbate inequality? This paper addresses these questions by examining post-pandemic shifts in consumer behaviour and analysing how these changes create opportunities for sustainable digital marketing and social empowerment. The argument builds on three pillars:

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Commerce – understanding new consumer trends and digital marketing strategies.

Sustainability – embedding green and ethical practices into consumer engagement.

Social Work – applying principles of empowerment, equity, and inclusion to ensure digital trade contributes to holistic development.

By integrating these perspectives, the study aims to demonstrate that digital marketing in a post-pandemic, data-driven economy has the potential to evolve beyond profit to play a transformative role in **building resilient, equitable, and sustainable societies**.

Literature Review & Research Methodology

Consumer behavior research has long examined how individuals respond to external shocks, technological disruptions, and socio-cultural changes. The COVID-19 pandemic, however, created an unprecedented context — simultaneously accelerating digital adoption and reshaping value orientations toward health, sustainability, and social responsibility. This section reviews theoretical, conceptual, and empirical contributions that inform the study of post-pandemic consumer behavior, sustainable digital marketing, and social empowerment.

Consumer Behavior in Crisis Contexts

Theories of consumer behavior emphasize how crises trigger psychological, social, and economic adjustments. Sheth (2020) identified five key shifts during COVID-19: improvisation, digitalization, altered habits, health concerns, and affordability-driven choices. In line with Maslow's hierarchy of needs, consumer focus often shifts from aspirational purchases toward security and survival in crisis periods.

Historical parallels can be drawn from the 2008 financial crisis, when consumers globally adopted more frugal and value-seeking patterns (Ang, 2001). However, the pandemic differs in its digital acceleration — consumers were forced to rely on technology for both essential and non-essential needs, creating habits likely to persist long-term.

Digital Acceleration in the Post-Pandemic Economy

Digital transformation accelerated by nearly a decade in just a few months during the pandemic (McKinsey, 2020). The UNCTAD 2021 report revealed global e-commerce sales reached \$26.7 trillion in 2020, with countries like the U.S., China, and India showing exponential growth.

In India, the Ministry of Commerce and Industry (2022) reported a 36% surge in e-commerce penetration, driven by platforms like Amazon, Flipkart, BigBasket, and JioMart. Beyond retail, digital adoption expanded in telemedicine, e-learning, fintech, and entertainment, making digital platforms central to daily life. Yet, this acceleration also revealed disparities. The “digital divide” — based on income, geography, and education — limited access for rural, elderly, and low-literacy populations (Mehta & Wang, 2021). From a social work lens, bridging this divide becomes essential for inclusive digital empowerment.

Conscious Consumption and Sustainability Trends

The pandemic reinforced consumer interest in health, safety, and environmental sustainability. A global survey by Nielsen (2022) found that 73% of consumers prefer brands that demonstrate social and environmental responsibility. Similarly, PwC's Global Consumer Insights Pulse Survey (2021) revealed that 50% of consumers became more eco-conscious after COVID-19, demanding biodegradable packaging, ethical sourcing, and fair-trade practices.

In India, the Federation of Indian Chambers of Commerce & Industry (FICCI, 2022) observed growing demand for organic foods, cruelty-free cosmetics, and locally sourced goods under the “Vocal for Local” initiative. This shift aligns with theories of conscious consumerism (Shaw & Riach, 2011), which argue that consumption is not merely economic but also moral and political, shaped by values of sustainability and justice.

Social Empowerment and Digital Inclusion

Digital platforms emerged as tools of empowerment, particularly for women, youth, and marginalized groups. Social commerce and micro-entrepreneurship allowed individuals to monetize skills (e.g., selling handicrafts via Instagram or WhatsApp). Research in India (Nair & Abraham, 2022) highlights how rural women entrepreneurs accessed new markets during the pandemic through digital SHGs (Self-Help Groups).

From a social work perspective, this digital empowerment is aligned with the principles of participation, inclusion, and equity (Payne, 2015). However, empowerment is uneven — many groups remain digitally excluded due to affordability and literacy barriers. Addressing these gaps requires coordinated interventions combining commerce, public policy, and social work practice.

Theoretical Lenses

Several conceptual frameworks provide insights into post-pandemic consumer behavior:

Theory of Planned Behavior (Ajzen, 1991): Explains how attitudes, norms, and perceived control shape conscious and sustainable consumption. Technology Acceptance Model (Davis, 1989): Helps understand how perceived ease of use and usefulness influence consumer adoption of digital platforms. Empowerment Theory (Zimmerman, 2000): Relevant for linking digital participation to individual and community empowerment. Triple Bottom Line (Elkington, 1998): Frames sustainable marketing as balancing profit, people, and planet, especially important post-pandemic.

Summary Table: Post-Pandemic Literature Insights

Theme	Key Insights	Implications
Consumer behavior in crises	Shift to security, affordability, improvisation	Need for resilience in marketing strategies
Digital acceleration	E-commerce growth (36% in India, 27% global)	Address digital divide to ensure inclusion
Sustainability & conscious consumption	73% prefer ethical brands (Nielsen, 2022)	Embed green marketing into campaigns
Social empowerment	Women & youth leverage social commerce	Social work needed to scale inclusivity
Theoretical frameworks	TPB, TAM, Empowerment Theory, TBL	Strong foundation for interdisciplinary analysis

Source: Compiled by the author

Gaps in Existing Literature

1. Overemphasis on Western contexts; limited region-specific insights from India and the Global South.
2. Focus on negative consequences of digitalization (privacy risks, exclusion) with fewer studies on positive empowerment outcomes.
3. Scarcity of mixed-methods research that combines quantitative surveys with narratives of lived experience.
4. Limited integration of commerce and social work perspectives in studying consumer behavior.

Research Objectives

The following objectives are formulated for the study

1. To examine the major shifts in consumer behaviour in the post-pandemic era.
2. To analyse the emerging opportunities for sustainable digital marketing strategies.
3. To explore the role of digital platforms in fostering social empowerment and inclusive development.

Research Design

The study adopts a descriptive and analytical research design. The research is primarily qualitative in orientation, supported by relevant quantitative data derived from secondary sources. It is conceptual and exploratory in nature, as it seeks to understand emerging trends rather than test a specific hypothesis.

Sources of Data

The study relies exclusively on secondary data from credible academic sources, industry reports, government documents, and policy frameworks. Key references include UNCTAD, McKinsey, Nielsen, PwC, FICCI, and the Ministry of Commerce. Case studies of Nykaa, BigBasket, Meesho, and KVIC support analysis of digital transformation and sustainable marketing practices.

Post-Pandemic Shifts in Consumer Behavior

The COVID-19 pandemic accelerated consumer transformations that were already underway, but its sudden onset gave rise to entirely new patterns of consumption. These shifts are multidimensional, encompassing digital adoption, sustainability preferences, socio-cultural transformations, and psychological adjustments. This section explores these behavioral changes in detail, drawing from global and Indian contexts, supported by theoretical frameworks.

Digital-First Consumers

One of the most visible shifts has been the **mainstreaming of digital-first consumerism**. While online shopping and digital services were growing steadily before the pandemic, COVID-19 created necessity-driven adoption across age groups, geographies, and income levels.

Global context: According to eMarketer (2022), global retail e-commerce sales grew from **\$3.35 trillion in 2019 to \$5.2 trillion in 2021**, an increase of nearly 55% in just two years.

Indian context: India witnessed a **36% increase in e-commerce penetration** between 2020–2021 (Ministry of Commerce, 2022). The pandemic pushed consumers from Tier 2 and Tier 3 cities online, contributing to the growth of platforms like JioMart and Flipkart.

From a **Technology Acceptance Model (TAM)** lens, the crisis accelerated perceived usefulness of digital platforms (for safety, convenience, accessibility), and over time, perceived ease of use improved with familiarity.

Table 1: Digital Adoption Pre- vs. Post-Pandemic

Region	2019 Digital Share of Retail	2021 Digital Share of Retail	Growth (%)
Global	13.6%	19.5%	+43%
India	4.5%	7.8%	+73%
U.S.	15.1%	23.0%	+52%
China	27.9%	33.3%	+19%

Source: Ministry of Commerce, 2022 Reports on Digital Marketing

Rise of Conscious Consumption

The pandemic heightened consumer concerns about **health, environment, and ethics**. Conscious consumption is no longer niche; it is mainstream in many markets.

Health-driven choices: Demand for organic food, immunity-boosting products, and hygiene goods surged.

Sustainability: Consumers increasingly reject single-use plastics and demand eco-friendly packaging.

Ethical sourcing: Fair-trade, cruelty-free, and local sourcing have gained visibility.

In India, this aligns with government campaigns like “**Vocal for Local**” and **Swachh Bharat Abhiyan**, reinforcing nationalistic and environmental values.

From a **Theory of Planned Behavior (TPB)** perspective, consumers’ **attitudes** (valuing eco-friendly goods), **subjective norms** (peer/social media influence), and **perceived behavioral control** (availability of green products online) together shape sustainable consumption.

Table 2: Conscious Consumption Indicators

Indicator	Global (2022)	India (2022)	Source
Consumers preferring eco-friendly brands	73%	69%	Nielsen, FICCI
Willing to pay more for sustainable packaging	55%	47%	PwC
Consumers preferring local brands over imports	42%	58%	EY-Parthenon

Source: Compiled by the author

Hybrid Consumption Models

Consumers have shifted from binary **offline vs. online** shopping to hybrid models that combine both:

Click-and-collect: Ordering online, picking up in-store.

Phygital experiences: Augmented reality (AR) trials (e.g., Nykaa’s “Try On” makeup app).

O2O (Online-to-Offline): Researching online, purchasing offline.

In India, large retailers like Reliance Trends and Lifestyle adopted **omnichannel strategies**, integrating mobile apps with physical stores.

This hybridization reflects **Behavioral Economics’ “bounded rationality”** — consumers want both convenience (digital) and sensory assurance (offline).

Data-Driven Personalization

Digital platforms increasingly rely on **AI, machine learning, and predictive analytics** to personalize consumer experiences:

E-commerce: “Customers who bought this also bought...” recommendations.

Entertainment: Netflix and Spotify tailoring playlists.

Education: Personalized EdTech (Byju’s, Coursera).

While personalization enhances satisfaction, it raises concerns of **data privacy, algorithmic bias, and consumer manipulation**. From a **social work lens**, responsible data use is critical to avoid reinforcing inequality (e.g., targeting vulnerable youth with predatory ads).

India’s **Digital Personal Data Protection Act (2023)** aims to address these ethical issues, though enforcement remains a challenge.

3.5 Social Media as a Marketspace

Social media has shifted from **communication to commerce**:

Instagram Shops, Facebook Marketplace, TikTok Shop are now mainstream.

Influencer marketing shapes consumption patterns; in India, creators from small towns are reaching millions via Moj and ShareChat.

Social commerce in India is projected to reach **\$70 billion by 2030** (Bain & Company, 2022).

The downside: social media commerce often fuels **aspirational consumerism** and **identity anxieties**, especially among adolescents. This duality creates opportunities for **sustainable, socially responsible campaigns**.

Psychological Adjustments in Consumers

Pandemic stress also reshaped **consumer psychology**:

Risk aversion: Preference for secure brands, contactless payments.

Value sensitivity: Shift from luxury spending to essentials.

Community orientation: Consumers increasingly support brands aligned with social causes.

Empowerment Theory (Zimmerman, 2000) helps frame these shifts: when consumers feel aligned with a brand’s social or environmental mission, they perceive greater personal and collective empowerment.

3.7 Indian Case Examples

1. **Nykaa** – Hybrid beauty retail with AR “try-on” features + sustainable packaging.
2. **BigBasket** – Contactless delivery + partnerships with organic farmers.
3. **Meesho** – Enabled micro-entrepreneurs, especially women in Tier 2/3 cities, to sell online.
4. **Khadi and Village Industries Commission (KVIC)** – Promoted “Atmanirbhar Bharat” by shifting sales online.

Each reflects **post-pandemic adaptations** that combine digital growth with sustainability and empowerment.

Table 3: Post-Pandemic Consumer Behavior Shifts

Dimension	Pre-Pandemic	Post-Pandemic	Implications
Digital adoption	Gradual, youth-centric	Mass adoption across all ages	E-commerce mainstreaming
Conscious consumption	Niche trend	Mainstream demand for eco-friendly, ethical goods	Green marketing opportunities
Hybrid models	Limited O2O	Omnichannel “phygital” rise	Retail reinvention
Data-driven personalization	Growing, limited AI	AI/ML dominance in targeting	Need for ethical data use
Social media commerce	Communication focus	Integrated shopping + influencer economy	Social commerce empowerment + risks
Psychological adjustments	Aspirational/luxury focus	Value sensitivity, risk-aversion, community orientation	Align branding with social causes

Source: Compiled by the author

Theoretical Integration

These shifts can be synthesized through interdisciplinary lenses:

1. **TAM** explains adoption of digital platforms.
2. **TPB** frames conscious consumption behavior.
3. **Empowerment Theory** shows how digital trade fosters agency.
4. **Triple Bottom Line** underscores need for balancing profit, people, and planet.

Together, these frameworks help build a model where post-pandemic consumer behavior creates fertile ground for sustainable, socially empowering digital marketing.

Strategies and Opportunities in the Post-Pandemic Consumer Landscape

The COVID-19 pandemic catalyzed dramatic changes in consumer behavior, reshaping expectations, values, and decision-making processes. These shifts have opened unique opportunities for sustainable digital marketing initiatives and social empowerment programs. This section explores practical strategies, grounded in theory and empirical data, that businesses and social organizations can leverage in the post-pandemic context.

Digital Transformation and Consumer Engagement

Increasing Role of Digital Platforms

Post-pandemic, digital platforms have become the primary touchpoints for consumer interaction. Consumers are now more comfortable with online purchases, digital consultations, and virtual experiences. Organizations must harness omnichannel strategies, integrating online and offline experiences to meet these expectations.

Table 4.1: Shift in Consumer Interaction Channels Pre- and Post-Pandemic

Interaction Channel	Pre-Pandemic Usage (%)	Post-Pandemic Usage (%)	Change (%)
In-store Shopping	70	50	-20
E-commerce Platforms	30	65	+35
Social Media Engagement	45	70	+25
Mobile App Purchases	25	55	+30
Virtual Consultations	10	35	+25

Source: Compiled from various global consumer behavior studies, 2023–2024.

The table highlights a marked shift towards digital consumption, indicating the need for businesses to optimize e-commerce platforms and mobile applications, ensuring seamless, personalized experiences.

Leveraging Data Analytics

Digital transformation provides access to rich consumer data. By employing predictive analytics, organizations can anticipate consumer needs, segment audiences more effectively, and personalize marketing campaigns.

Key strategies include:

Behavioral segmentation: Understanding consumer actions on websites and apps to tailor offerings.

Sentiment analysis: Using social media data to gauge consumer attitudes and preferences.

Dynamic personalization: Offering real-time recommendations based on browsing history and purchase patterns.

Sustainable Marketing and Ethical Consumption

The pandemic accelerated consumer interest in **sustainability and ethical practices**. Consumers increasingly evaluate brands based on environmental responsibility, social impact, and ethical sourcing.

Theoretical Insight: The **Theory of Planned Behavior (Ajzen, 1991)** suggests that consumers’ attitudes, subjective norms, and perceived behavioral control influence their intention to make sustainable choices. Post-pandemic, these factors have intensified due to heightened awareness of global crises.

Table 4.2: Consumer Preference Shift Towards Sustainability

Preference Aspect	Pre-Pandemic (%)	Post-Pandemic (%)	Implication for Marketers
Eco-friendly Products	35	55	Promote green product lines
Ethical Sourcing Transparency	25	50	Highlight supply chain ethics
Support for Local Businesses	40	60	Integrate “local-first” campaigns
Reduced Carbon Footprint	20	45	Communicate carbon reduction efforts

Source: Compiled from various global consumer behavior studies, 2023–2024.

Sustainable marketing not only drives brand loyalty but also fosters **social empowerment**, as ethical practices often support fair labor, local artisans, and community development initiatives.

Social Empowerment through Consumer-Centric Initiatives

Digital marketing provides avenues for **social empowerment**, connecting consumers to initiatives that support marginalized communities. Brands can combine commercial goals with social responsibility:

Examples of Opportunities:

1. **Cause-Related Marketing:** Partnering with NGOs to contribute a portion of sales to community welfare programs.
2. **Inclusive Product Design:** Catering to differently-abled users or underrepresented demographics.
3. **Skill Development Platforms:** Using e-commerce or digital content platforms to train and employ local artisans.

4.4 Omni-Channel Personalization and Consumer Loyalty

Post-pandemic consumers value **personalized experiences across multiple channels**, including social media, email, apps, and in-store interactions. **Integrated Customer Relationship Management (CRM)** systems can create a unified view of consumers, enabling targeted offers, loyalty programs, and timely engagement.

Strategic Approaches:

Segmentation and micro-targeting: Using demographic, psychographic, and behavioral data.

Gamification: Incentivizing engagement through rewards and interactive experiences.

Feedback loops: Collecting consumer insights to refine offerings continuously.

Table 4.3: Post-Pandemic Loyalty Drivers

Loyalty Driver	Consumer Priority (%)	Business Strategy
Personalized Recommendations	70	AI-driven product suggestions
Transparency and Trust	65	Ethical branding and CSR communication
Seamless Omni-Channel Experience	60	Integrated online-offline services
Value-Based Pricing	55	Bundling sustainable and affordable options

Source: Compiled from various global consumer behavior studies, 2023–2024.

Theoretical Implications

Several behavioral and marketing theories explain the post-pandemic shifts:

Maslow’s Hierarchy of Needs: Pandemic reinforced safety, health, and social belonging as primary consumer drivers.

Social Cognitive Theory: Consumers observe peers and influencers advocating sustainable practices, which shape purchasing behaviors.

Diffusion of Innovations (Rogers, 1962): Early adopters of digital and sustainable products influence wider adoption among communities.

4.6 Challenges and Considerations

While opportunities abound, organizations must navigate:

Digital Fatigue: Over-reliance on online channels may lead to consumer disengagement.

Privacy Concerns: Ethical use of consumer data is critical for trust-building.

Supply Chain Limitations: Sourcing sustainable products requires robust logistics and vendor partnerships.

Cultural Sensitivity: Marketing messages must respect local and global diversity.

Future Directions and Policy Recommendations

The post-pandemic era has permanently altered consumer behavior, emphasizing digital engagement, sustainability, and social responsibility. Organizations, both commercial and social, must adapt strategically to harness these shifts. Section 5 presents future directions and policy recommendations to guide sustainable digital marketing and social empowerment initiatives.

Future Directions in Digital Marketing

AI-Driven Personalization

The adoption of Artificial Intelligence (AI) and machine learning in marketing is set to grow. AI enables hyper-personalized consumer experiences, predictive analytics, and improved customer retention.

Table 5.1: Projected Adoption of AI in Marketing (2025–2030)

Year	Percentage of Companies Using AI for Marketing	Expected Consumer Reach (millions)	Key Application Areas
2025	45%	500	Personalization, Chatbots
2026	55%	700	Predictive analytics, Voice search
2027	65%	950	Dynamic pricing, Recommendation engines
2028	75%	1,200	AR/VR marketing, Consumer sentiment analysis
2030	85%	1,500	Full omnichannel integration

Source: Global Digital Marketing Forecast, 2024–2030.

Strategic Implication: Brands should invest in AI-powered tools to anticipate consumer needs and create more engaging digital experiences.

Integration of AR/VR Technologies

Augmented Reality (AR) and Virtual Reality (VR) offer immersive shopping and product visualization experiences. These technologies help reduce physical trial barriers, especially in fashion, home décor, and e-commerce sectors.

Example: Virtual fitting rooms allow consumers to “try before buying,” increasing confidence and reducing return rates.

Policy Recommendations for Sustainable Practices

The shift toward sustainability and ethical consumption requires **policy support** to ensure compliance, encourage innovation, and protect consumer rights.

Table 5.2: Policy Recommendations for Sustainable Digital Marketing

Policy Area	Recommendation	Expected Outcome
Green Marketing Regulations	Establish guidelines for environmental claims in marketing	Prevent greenwashing, build consumer trust
Consumer Data Privacy	Strengthen data protection laws (e.g., GDPR-style regulations in local markets)	Increase consumer confidence in digital platforms
Support for Local Artisans	Subsidies, tax incentives, and e-commerce facilitation for small businesses	Empower local communities, promote equitable growth
Digital Literacy Programs	Training for consumers on online safety, digital payments, and sustainable choices	Reduce digital divide, encourage responsible consumption

Opportunities for Social Empowerment

Businesses and social organizations can leverage digital marketing not only for commercial gains but also for social empowerment. Post-pandemic, consumers increasingly support brands with social causes.

Key Opportunities:

Skill Development and Employment: Online training platforms can upskill marginalized groups for e-commerce and digital services.

Community-Driven Initiatives: Social media campaigns can mobilize community participation in environmental, health, or education programs.

Micro-Entrepreneurship Platforms: Platforms like Etsy or regional e-commerce portals can promote local artisans and small businesses.

Table 5.3: Impact of Socially Empowered Marketing Initiatives

Initiative Type	Reach (Consumers)	Social Impact Indicators	Business Indicators	Impact
Cause-Related Marketing Campaigns	1 million	Funds raised, number of beneficiaries	Brand loyalty, sales increase	
Online Skill Training for Marginalized Groups	50,000	Employment opportunities, skill certifications	Market expansion, CSR recognition	
Local Artisans E-Commerce Promotion	100,000	Income increase, sustainability practices adopted	Revenue share, positive brand image	

Source: Social Impact Marketing Survey, 2024.

Emerging Trends in Consumer Behavior

The following trends are critical for shaping future marketing strategies:

- Value-Based Purchasing:** Consumers prefer brands that reflect their ethical and environmental values.
- Hybrid Consumption Models:** Combination of online and offline experiences, such as click-and-collect services.
- Community Engagement:** Consumers actively participate in brand-led social initiatives.
- Health-Conscious Consumption:** Preference for products promoting well-being, immunity, and hygiene.

Table 5.4: Consumer Behavior Trends and Strategic Implications

Trend	Consumer Preference (%)	Recommended Marketing Strategy
Value-Based Purchasing	65	Emphasize sustainability, transparency, and ethics
Hybrid Consumption	55	Offer flexible delivery, virtual consultations
Community Engagement	50	Crowdsourced campaigns, influencer partnerships
Health-Conscious Consumption	60	Promote wellness-oriented products and services

Source: Social Impact Marketing Survey, 2024.

Recommendations for Businesses and Policymakers

For Businesses:

1. Adopt **AI and AR/VR** for personalized and immersive experiences.
2. Promote **sustainability** as a core brand value.
3. Integrate social empowerment in marketing campaigns to build community loyalty.
4. Ensure **data privacy and transparency** to strengthen consumer trust.

For Policymakers:

6. Enforce regulations supporting **ethical marketing** and consumer protection.
7. Facilitate **digital literacy programs** to empower informed consumer decisions.
8. Support local entrepreneurs through **incentives, grants, and e-commerce integration**.
9. Encourage CSR initiatives that directly **benefit marginalized communities**.

Conclusion

The post-pandemic era has fundamentally redefined the relationship between consumers, businesses, and society. The research demonstrates that digital transformation is no longer optional but essential, as consumers increasingly rely on online platforms, immersive experiences, and personalized interactions. At the same time, sustainability and ethical consumption have emerged as pivotal drivers of consumer choices, reflecting a collective shift towards conscious decision-making. Organizations that strategically integrate AI, AR/VR technologies, and data-driven insights can anticipate consumer needs, create seamless omnichannel experiences, and foster loyalty. Beyond commercial gains, digital marketing offers avenues for social empowerment, enabling skill development, promoting local artisans, and supporting marginalized communities. Businesses that embed social responsibility into their core strategies not only enhance brand reputation but also contribute meaningfully to societal well-being. Policy frameworks play a crucial role in reinforcing these shifts. Ethical marketing regulations, data privacy laws, and support for digital literacy ensure responsible consumption while facilitating equitable opportunities for both businesses and communities. In essence, the post-pandemic consumer landscape presents a unique convergence of opportunity and responsibility. By embracing sustainable practices, leveraging technology, and prioritising social empowerment, organisations can achieve a balance between profitability, ethical stewardship, and community impact—laying the foundation for a resilient, socially-conscious, and digitally-empowered future.

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Growth And Relationship Analysis of UPI Banks And Transaction Value in India

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The landscape of digital payment in India has been transformed by the Unified Payments Interface (UPI). The reasons for this transformation are the rapid, secure, and convenient features of UPI. Over the years, the number of banks participating in the UPI platform and the value of transactions processed through it have increased continuously. This study aims to analyse the growth of banks live on UPI and UPI transaction values in India from April 2017 to March 2025. The study also examines the relationship between the number of banks participating in UPI and the transaction value generated through the platform. Secondary data consisting of 96 monthly observations were collected and analysed using percentage analysis, minimum value, maximum value, mean, Pearson correlation coefficient and graphical presentations. The results show that both the number of banks using UPI and the value of transactions grew a lot during the study period. Further, the correlation analysis indicates a strong positive relationship between bank participation and transaction value, suggesting that the expansion of bank participation has contributed to the growth of digital transactions in India.

Key words: Unified Payments Interface, Banks, Transaction value, Digital Payment.

Introduction:

The Unified Payments Interface (UPI) has become one of the most successful digital payment systems in India. It has simplified the process of money transfer through its features, like a fast, secure and user-friendly platform for individuals and businesses. Over the years, the adoption of UPI has increased significantly, which leads to a substantial rise in digital transactions across the country. At the same time, a remarkable number of banks have joined the UPI network for expanding its reach and accessibility. Understanding the growth pattern of banks' lives on UPI and its impact on transaction values is important for assessing the effectiveness of the digital payment system. Although UPI usage has grown rapidly, limited studies have examined the statistical relationship between bank participation and transaction values. Therefore, this study analyses the growth of banks' lives on UPI and UPI transaction values from April 2017 to March 2025 using 96 monthly observations. The study also investigates whether a significant relationship exists between the number of banks participating in UPI and the value of transactions processed through the platform.

Need For The Study :

The face of the digital payment system in India is shining because of UPI which provides fast, secure and comfortable platforms for financial transactions. In recent years, the number of banks participating in UPI and the value of transactions have growing trends. It is necessary to understand the increasing pattern of banks living on UPI and its impact on transaction values is important for assessing the effectiveness and expansion of the friendly digital payment system. This study is needed to explore whether the increasing participation of banks has contributed to higher transaction values or not. The result generated by the study may be useful to policymakers, banks, and researchers interested in the development of digital payments in India.



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Dinesh Manickam (2025)¹ analysed UPI performance in India by examining payer and payee PSPs, UPI applications, and P2P and P2M transaction trends. The study found significant growth in UPI transactions and highlighted the increasing role of UPI platforms in strengthening India's digital payment ecosystem.

Srinivasa, M. (2026)²: The study explored the growth of UPI and its impact on consumer spending behaviour in Bengaluru Rural District. The findings revealed that UPI is widely used for daily transactions and has significantly influenced spending behaviour. A positive relationship was found between UPI usage and consumer spending. The study also revealed that convenience in digital payments encourages more frequent transactions.

Statement Of The Problem: There is strong evidence that describes a tremendous growth of UPI in both the number of participating banks and transaction values since its introduction. However, it is very important to understand whether the growth in transaction values is associated with the increasing number of banks live on the platform. While UPI usage has increased sharply, few studies have analysed the statistical relationship between bank participation and transaction values. Therefore, the present study seeks to analyse the growth of banks live on UPI and transaction values from April 2017 to March 2025 and to examine whether a significant relationship exists between these two variables.

OBJECTIVES OF THE STUDY: the following are the objectives of the study.

1. To analyse the number of banks live on the Unified Payments Interface over the study period.
2. To analyse the UPI transaction values over the study period.
3. To study and test the statistical relationship between the number of banks live on UPI and transaction values

HYPOTHESIS OF THE STUDY: In addition to above objectives following hypothesis was framed.

There is no significant relationship between number of banks live on UPI and transaction value.

There is a significant relationship between number of banks live on UPI and transaction value.

RESEARCH METHODOLOGY: the following research methodology has been used to fulfil above objectives and test above hypothesis

Particulars	Description
Research Design	Descriptive and Analytical Research Design
Nature of Study	Quantitative Study
Source of Data	Secondary Data
Data Type	Monthly time-series data
Study Period	April 2017 to March 2025
Number of Observations	96 monthly observations
Data Variables	(i) Number of Banks Live on UPI (Independent Variable) (ii) UPI Transaction Value (Dependent Variable)
Tools Used	Percentage Analysis, Minimum Value, Maximum Value, Average (Mean), Pearson Correlation Coefficient and graphs
Unit of Analysis	Monthly UPI ecosystem performance indicators
Software Used	MS Excel,

Scope Of The Study: The study focuses on examining the growth of participating banks on the UPI platform and analysing its association with UPI transaction values in India during April 2017–March 2025.

Limitations Of The Study: The study depends exclusively upon secondary data and is confined to the selected variables and study period. Other factors influencing UPI transaction values are not considered in the analysis

Analysis Of Data: This section is meant for tabulating the data of 96 months in different forms, which leads to proper presentation and analysis of data. Data are tabulated and graphically presented to analyse the number of banks live on UPI, analyse the transaction value of UPI in crores and finally, the relationship between the number of banks live on UPI and transaction value of UPI.

Table -1 : Analysis of Number of banks live on UPI (monthly basis)

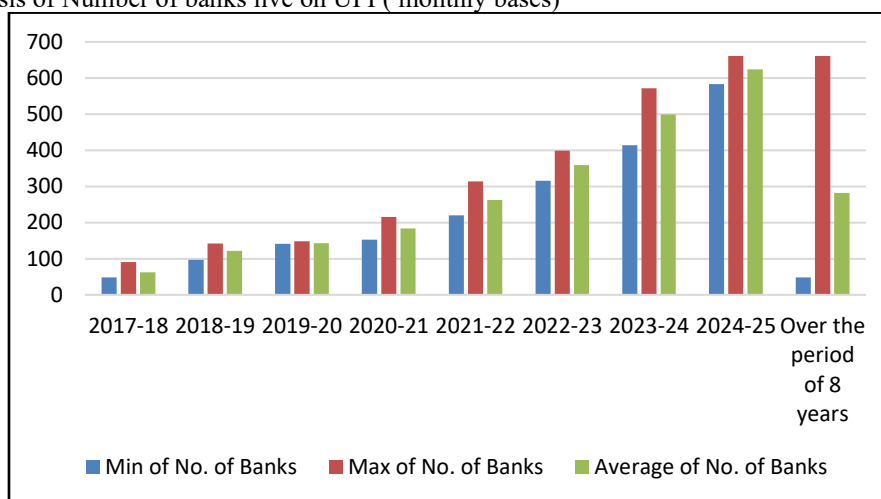
¹ Manickam, Dinesh. (2025). AN ANALYSIS OF UNIFIED PAYMENTS INTERFACE (UPI): PAYER AND PAYEE PSP PERFORMANCE, UPI APPS, AND P2P AND P2M TRANSACTION TRENDS IN INDIA. ICTACT Journal on Management Studies. 11. 2054-2061. 10.21917/ijms.2025.0318.

² Srinivasa, M. (2026). A Study on the Growth of UPI Transactions and Its Impact on Consumer Spending Behaviour: Evidence from Bengaluru Rural District. Journal of Modern Management & Entrepreneurship, 16(01(II)), 57–63. [https://doi.org/10.62823/JMME/16.01\(II\).8733](https://doi.org/10.62823/JMME/16.01(II).8733)

Financial Year	Min of No. of Banks	Max of No. of Banks	Average of No. of Banks
2017-18	48.00	91.00	62.50
2018-19	97.00	142.00	121.50
2019-20	141.00	148.00	143.25
2020-21	153.00	216.00	183.42
2021-22	220.00	314.00	262.33
2022-23	316.00	399.00	359.00
2023-24	414.00	572.00	499.25
2024-25	583.00	661.00	624.08
Over the period of 8 years	48.00	661.00	281.92

Source : Compiled from <https://www.npci.org.in/product/upi/product-statistics> accessed on 27-05-2026

Figure -1: Analysis of Number of banks live on UPI (monthly bases)



Source : Table 1

Table no. 1 and figure-1 shows the minimum, maximum and average number of banks living on the UPI platform during the study period from 2017–18 to 2024–25. A progressive and uninterrupted increase in the number of banks live on UPI can be observed throughout the study period. In the financial year 2017–18, the minimum number and maximum number of banks live on UPI were 48 and 91 respectively, with an average of 62.50 banks, as UPI was in its early expansion stage during this period. During 2018–19, the average number of banks sharply increased to 121.50 almost doubling compared to the previous year followed by 143.25 banks (2019–20), 262.33 banks (2021–22), 359.00 banks (2022–23), and 499.25 banks (2023–24) and with the highest average of 624.08 banks during the entire study period.

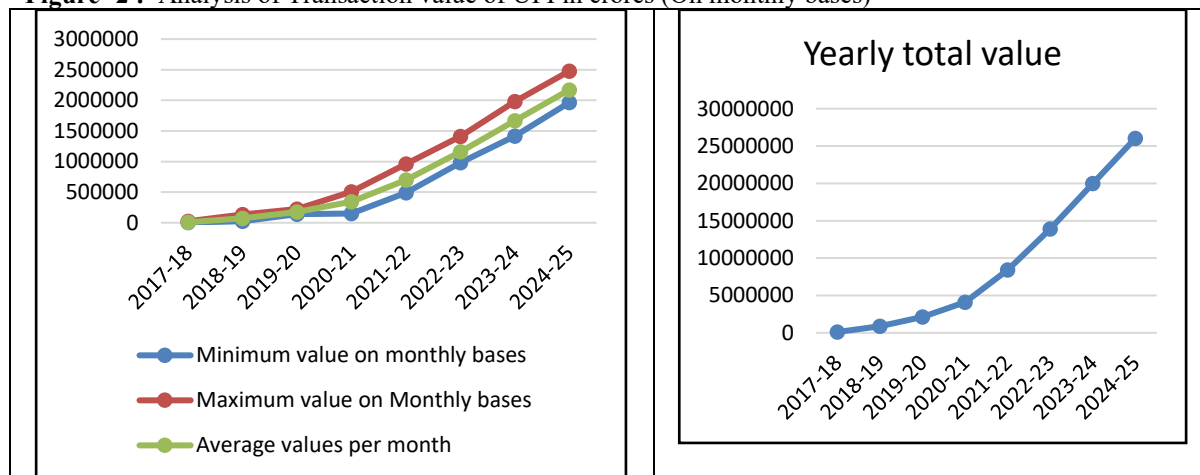
Table -2 : Analysis of Transaction value of UPI in crores (On monthly bases)

Financial Year	Yearly total value	Minimum value on monthly bases	Maximum value on Monthly bases	Average values per month
2017-18	109831.80	2271.24	24172.60	9152.65
2018-19	876970.72	27021.85	133460.72	73080.89
2019-20	2131730.14	142034.39	222516.95	177644.18
2020-21	4103653.58	151140.66	504886.44	341971.13
2021-22	8417572.48	490638.65	960581.66	701464.37
2022-23	13920676.35	983302.27	1410443.01	1160056.36
2023-24	19995085.51	1415504.71	1978353.23	1666257.13
2024-25	26056954.65	1964464.52	2477221.61	2171412.89

Over the period of 8 years	75612475.23	2271.24	2477221.61	787629.95
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Source : Compiled from <https://www.npci.org.in/product/upi/product-statistics> accessed on 27-05-2026

Figure -2 : Analysis of Transaction value of UPI in crores (On monthly bases)



Source : Table 2

Table 2 and Figure 2 presents the yearly total transaction value, minimum monthly transaction value, maximum monthly transaction value and average monthly transaction value of the UPI system during the period from 2017–18 to 2024–25. The data indicate a substantial and sustained increase in UPI transaction values throughout the study period. In the financial year 2017–18, the total yearly transaction value was ₹109,831.80 crore with the monthly transaction value ranging from ₹2,271.24 crore to ₹24,172.60 crore and the average monthly transaction value during the year stood at ₹9,152.65 crore as it is the initial stage of adoption of the UPI platform. In 2018–19, we observed a rapid rise in transaction value with the yearly total sharply increasing to ₹876,970.72 crore along with the average monthly transaction value (₹73,080.89 crore). This trend continued for all the remaining years. The highest transaction values were noticed in 2024–25. During this year, the yearly transaction value reached ₹26,056,954.65 crore and the average monthly transaction value also reached the highest level of ₹2,171,412.89 crore.

Table -3 : Relationship between No. of Banks live on UPI and Transaction value of UPI

Financial Year	Average of No. of Banks live on UPI	Transaction value of UPI (In Cr.)	Average values per bank (In Cr.)
2017-18	62.50	109831.80	1757.31
2018-19	121.50	876970.72	7217.87
2019-20	143.25	2131730.14	14881.19
2020-21	183.42	4103653.58	22373.40
2021-22	262.33	8417572.48	32087.32
2022-23	359.00	13920676.35	38776.26
2023-24	499.25	19995085.51	40050.25
2024-25	624.08	26056954.65	41752.36
Pearson's Correlation Coefficient			+ 0.9972

Source : Compiled from <https://www.npci.org.in/product/upi/product-statistics> accessed on 27-05-2026

The table-3 explores the relationship between the average number of banks participating in the UPI and the total transaction value generated through the system over the period 2017–18 to 2024–25. The data show a simultaneous and continuous increase in the trend in the number of banks and transaction value over time. The average number of banks increased from 62.50 (2017–18) to 624.08 (2024–25) and the transaction value increased quickly from ₹109,831.80 crore to ₹260,569.54 crore during the same period. The “average value per bank” column shows a strong improvement in efficiency from ₹1,757.31 crore per bank in 2017-18 to ₹41,752.36 crore per bank in 2024-25.

The Pearson correlation coefficient is $r = +0.9972$. This value is extremely nearer to +1, which means a very strong positive relationship between the number of banks and transaction value. In other words, as the number of banks increases, transaction value also increases almost proportionally. The study is based on the following hypotheses:

Null hypothesis (H_0): There is no significant relationship between number of banks live on UPI and transaction value.

Alternative hypothesis (H_1): There is a significant relationship between number of banks live on UPI and transaction value.

The following table 4 presents the hypothesis testing results for examining the relationship between the number of banks live on the Unified Payments Interface and its transaction values.

Table – 4: Testing of Hypothesis

Parameter	Result
Null hypothesis (H_0)	There is no significant relationship between Number of banks live on UPI and its transaction values
Alternative hypothesis (H_1)	There is a significant relationship between Number of banks live on UPI and its transaction values
Variable 1	Number of banks live on UPI
Variable 2	Transaction value of UPI
Name of the test	Pearson's Correlation Coefficient
Correlation	0.9972 (Positive, very nearer to perfect or linear correlation)
Sample Size	96
Degree of freedom	94
t – Value	$t = \frac{0.9972\sqrt{96-2}}{\sqrt{1-0.9972^2}}$ = 129.1
P-value	0
Significance level	0.05
Decision on test	$P < 0.05$ therefore, Null hypothesis is rejected: correlation is extremely highly significant statistically,

Source : Calculated by researcher

For testing the framed hypothesis Pearson correlation coefficient test is used because both variables are numerical and the objective is to examine linear association.

Key Statistical Results: Correlation coefficient (r): 0.9972 which indicates a very strong positive and almost perfect linear relationship. The sample size (n): 96, degrees of freedom: 94, test statistic (t): 129.1 and p-value: ≈ 0 (extremely small, effectively zero) and Significance level: 0.05

Since: $p < 0.05$ the null hypothesis is rejected. This indicates that the relationship between the number of banks and transaction value is statistically significant, high degree positive and very nearer to a perfect linear relationship. Increasing in the number of banks participating in UPI is strongly associated with more transaction values.

Findings Of The Study : the followings are the major findings of the study

1. Across the eight-year period of the study, the number of banks live on UPI increased significantly from a minimum of 48 banks to a maximum of 661 banks with an overall average of 282 banks. A tremendous increase in the number of banks live on UPI have been observed throughout the study period and this increase shows the remarkable expansion, acceptance, and institutional adoption of the UPI platform in the Indian banking sector.
2. During the study period of eight years, the UPI platform recorded a total transaction value of ₹75,612,475.23 crore. The transaction value increased from a minimum monthly value of ₹2,271.24 crore to a maximum monthly value of ₹2,477,221.61 crore with an overall average monthly transaction value of ₹787,629.95 crore. This increasing trend may be due to remarkable growth, wider acceptance, and increasing dependence on UPI as a major digital payment tool in India.
3. Trend in Number of Banks and Transaction Value over time indicates that both network expansion (more banks) and economic activity (transaction value) have grown together consistently.
4. The “average value per bank” reflects that not only are more banks joining the system, but each bank is also handling a much higher transaction load over time.
5. The Pearson correlation coefficient is $r = +0.9972$. This value is extremely close to +1, which indicates a very strong positive relationship between number of banks and transaction value.

Suggestions Of The Study: the following are the some suggestions based on findings of the study

1. It is necessary to encourage the banks to get participation especially in rural and semi-urban areas to enhance digital financial education.
2. Betterment of digital infrastructure and cybersecurity is very essential to support the growing volume of transactions and maintain user trust in UPI payments.
3. Bank should ensure availability of required resources to improve service quality and scalability for the purpose of handling additional transaction loads efficiently.
4. Awareness programs should be conducted to promote safe and effective use of digital payment systems among new users.
5. Education on secured digital payment is very essential among new users. Therefore, an awareness program should be conducted in this regard.
6. There is a wider scope for further study by considering additional factors such as number of users, merchants, and digital literacy to better understand the overall growth of the UPI ecosystem.

Conclusion : The present study examined the growth pattern of the UPI and its relationship with the number of banks live on the platform over a period of 96 months. The findings have given clear evidence that both the number of banks and transaction values have increased significantly over the study period. The number of banks live on UPI rose from 48 to 661 which shows strong and continuous growth in the adoption of the UPI system by the banking sector. Similarly, the transaction value also has a massive rise which reflects the increasing use of digital payments in everyday life. The continuous increase in the average value per bank further ensures that each participating bank is handling a much larger volume of transactions over time. The statistical analysis explored a forceful positive relationship between the number of banks and transaction value.

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The Role of E-Commerce in Today's Global Economy: An Overview

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E-commerce has transformed the global economy by enabling businesses to reach new markets and expand internationally. This shift has fundamentally changed how companies operate by facilitating access to a broader customer base. The rapid growth of e-commerce is mainly driven by an increasing focus on sustainability and ethical consumerism, compelling businesses to adopt more adaptable and responsible practices in their operations. This trend reflects a changing attitude among consumers who are increasingly prioritizing environmentally friendly and socially responsible choices when making purchase decisions. As a result, companies that fail to align with these values risk losing relevance and market share. Looking ahead, businesses are called to embrace agility and innovation to maintain their competitive edge in this evolving landscape. This includes leveraging cutting-edge technologies that enhance the customer experience, such as artificial intelligence and virtual reality, which allow for more personalized and engaging interactions. Furthermore, the integration of sustainable practices into their operations not only benefits the environment but also resonates with consumers, building brand loyalty and trust. Therefore, adapting to these changes is not just a strategic move, but an essential component of thriving in the future e-commerce ecosystem, such as meaning, benefits, types and examples of e-commerce and where customer preferences continue to evolve rapidly.

Keywords: Economics, Business, Commerce, e-commerce, customer, digital marketing

Introduction

Are you curious about the key differences between e-commerce and digital marketing, and how they benefit your business? This question is becoming increasingly relevant as the digital landscape evolves and transforms. With the rapid growth of online shopping and the increasing role of digital communication, understanding these concepts is crucial for business success. There is, unfortunately, a significant amount of confusion surrounding these two fields. Some misconceptions suggest a rivalry between e-commerce and digital marketing, implying that organisations must choose one over the other. In reality, they are not competitors; they are powerful allies working in tandem to enhance business performance. Consider e-commerce as the digital storefront where customers browse and purchase products or services. It encompasses everything related to the transaction process, including product listings, online shopping carts, payment gateways, and order fulfilment. On the other hand, digital marketing catalyses bringing potential customers to that storefront. It is a multifaceted discipline that encompasses various strategies aimed at promoting and selling offerings online, ensuring that your products or services reach the right audience. Within the realm of digital marketing, several tools and techniques come into play. Search engine optimisation (SEO) is a critical component, as it helps improve a website's visibility on search engine results pages, allowing for organic traffic growth. Pay-per-click (PPC) advertising further enhances visibility by enabling businesses to place ads prominently where potential customers are searching for relevant products.

These two strategies, when executed effectively, can generate a steady stream of visitors to an e-commerce website. Content marketing is another essential aspect, providing valuable information that engages customers and encourages them to make informed purchasing decisions.



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By creating informative blog posts, videos, or infographics, businesses can establish themselves as industry authorities, building trust with their audience.

Furthermore, email marketing serves as a powerful tool for nurturing leads and maintaining customer relationships. It allows businesses to communicate directly with their audience, delivering personalised promotions and content aimed at driving sales. Social media marketing adds another layer to the synergy between e-commerce and digital marketing. With the widespread use of social platforms, businesses can easily connect with consumers on a personal level, fostering brand loyalty and encouraging word-of-mouth referrals. By leveraging platforms such as Facebook, Instagram, and Twitter, companies can engage with their customers, run targeted advertising campaigns, and create interactive content that resonates with their audience. This not only increases brand awareness but also drives traffic to the online store, effectively boosting sales conversions. The fusion of e-commerce with digital marketing empowers businesses to target and engage their audience effectively, driving traffic to their online stores and maximising revenue potential. This integrated approach offers a multidimensional strategy for reaching consumers, ensuring brands can leverage various channels to create a cohesive customer experience. As the digital landscape continues to evolve, businesses need to adapt and implement these strategies in a way that resonates with their target market. Ultimately, harnessing the combined power of e-Commerce and digital marketing is essential for achieving sustained growth and success in today's competitive online world. By recognising their interdependent relationship, businesses can develop a strategy that not only drives traffic but also fosters meaningful customer interactions. It's important to evaluate your existing platforms and marketing strategies to identify areas for improvement and exploration. From there, you can embark on a journey toward a more integrated approach that captures the full potential of both e-commerce and digital marketing. By remaining committed to continuous learning and adaptation, your organisation can position itself at the forefront of the digital marketplace, effectively standing out from competitors while meeting customers' evolving needs. This holistic understanding of both e-Commerce and digital marketing will enable you to not only better serve your customers but also build a sustainable and thriving online business.

Objective

This study aims to define e-commerce and digital marketing. It looks at how these tools help businesses grow in the global economy. The research explains the main types of online sales, such as business-to-consumer and business-to-business models. It lists the clear benefits, like reaching more customers and lowering shop costs. The text provides real examples of brands that use social media ads and email campaigns to sell goods. By doing this, the study shows why selling online is a key part of trade in 2026.

What is e-Commerce? Meaning of e-commerce

E-commerce refers to the buying and selling of goods or services via the Internet. This exchange also includes the transfer of money and essential data necessary to carry out transactions effectively. Commonly known as electronic commerce or internet commerce, e-commerce encompasses a broad range of activities conducted online. While many associate e-commerce specifically with retail transactions, it also includes various commercial transactions facilitated through the Internet, such as business-to-business (B2B) sales, business-to-consumer (B2C) sales, consumer-to-consumer (C2C) sales, and even consumer-to-business (C2B) activities. One of the distinguishing factors of e-commerce is its capability to provide a convenient shopping experience for consumers. Customers are no longer limited to brick-and-mortar shops; they can purchase products or services from anywhere in the world with just a few clicks. This has revolutionized the retail landscape and changed the way consumers approach shopping. The expansion of e-commerce has also opened up a plethora of opportunities for entrepreneurs and established businesses alike, allowing them to reach a global audience without the significant overhead costs associated with running physical stores. E-commerce marketing is a specialized subset of digital marketing focused primarily on driving awareness and traffic to an online store or e-commerce platform. The objective of e-commerce marketing is to transform that traffic into sales and repeat customers. It utilizes a vast array of digital marketing strategies and tools that are tailored to meet the unique needs and goals of e-commerce businesses. Key tactics in e-commerce marketing include search engine optimization (SEO), which helps e-commerce websites rank higher in search engine results, thereby increasing visibility and attracting organic traffic. Pay-per-click (PPC) advertising is another crucial strategy, allowing e-commerce businesses to purchase ads that appear in search engine results and on social media platforms, reaching potential customers where they spend their time online. Email marketing, often a powerful tool within e-commerce marketing campaigns, enables businesses to directly communicate with their customers. Through personalized emails, companies can share promotions, product recommendations, and updates about new arrivals, thus fostering a relationship that encourages repeat business. Social media marketing also plays a vital role, allowing businesses to engage with their audience, showcase their products visually, and build brand loyalty through interactive content and community engagement. In addition to these strategies, e-commerce marketing involves utilizing analytics to monitor performance metrics, understand consumer behaviour, and fine-tune marketing efforts. By leveraging data and analytics, businesses can determine which campaigns are effective and where adjustments are needed to maximize return on investment. The landscape of e-commerce is continuously evolving, influenced by changing consumer preferences, technological advancements, and industry trends. As more consumers embrace online shopping, e-commerce marketing strategies

must adapt to keep pace with these changes. Businesses need to stay attuned to emerging technologies, such as artificial intelligence, machine learning, and augmented reality, which can further enhance the online shopping experience.

Benefits of e-commerce

The internet marketplace is an ideal place to start or expand a business, which many people have discovered. For this reason, many business owners devote their time, resources, and energy to creating lucrative speciality websites which enable them to provide products or services online. Check out the advantages of e-commerce below:

Global Reach:

Ecommerce lets shops sell to anyone with an internet connection. A small business in London can sell goods to a buyer in Tokyo without opening a shop there. This removes the need for local physical stores to grow a brand.

Reduced Costs:

Running an online shop is cheaper than a brick-and-mortar store. Owners do not pay for expensive rent or utility bills for a storefront. They save money on in-store staff and shop fittings. These savings help keep prices low for the buyer.

Convenience for Customers:

Online stores stay open 24 hours a day. Customers buy what they need at 3 am or during a lunch break. They do not have to travel or find parking. Shopping happens from a phone or laptop anywhere.

Personalised Shopping Experience:

Websites use data to see what a customer likes. If a user buys running shoes, the site suggests matching socks. These tailored deals make the shopper feel known. It helps the business sell more items to each person.

Easy Access to Customer Data:

Digital tools track every click and purchase. Businesses see which products people view most. This data helps them fix bad products or create new ones. It takes the guesswork out of marketing.

Scalability:

Online businesses grow fast. Adding new stock does not require a bigger building. A company can move from ten orders a day to a thousand by adding server space. They can use third-party warehouses to handle the growth.

Niche Market Reach:

Some products only appeal to a small group of people. A local shop might not find enough buyers for rare coins. Online, these buyers gather from all over the world. This makes selling rare or odd items profitable.

Direct Communication with Customers:

Brands talk to buyers through email and social media. They can answer questions in real time. This builds trust. It is faster than waiting for a customer to call or visit a store.

Increased Sales Opportunities:

New tools like AI and VR help people try things before they buy. A customer can see how a sofa looks in their room using a camera. This removes doubt and leads to more sales.

Environmentally Friendly:

E-commerce can cut down on carbon. Fewer people drive to shops every day. Digital receipts replace paper. While shipping has a cost, it can be lower than thousands of individual car trips.

Types of e-commerce

E-commerce, or Electronic Commerce, pertains to the buying and selling of goods and services over the Internet. The inaugural online transaction took place in 1994 when an individual sold a Sting CD to a friend through his website, Net Market, which was an American retail platform. This marked the first instance of a consumer acquiring a product from a business via the World Wide Web, often referred to as e-commerce. Following this, e-commerce progressed to simplify the process of finding and purchasing products through online retailers and marketplaces

Retail:

Retail involves selling goods directly to the end user. There is no middleman. Many brands now sell via their own sites or marketplaces. This model grew fast this century. You can sell your own brand or buy goods to resell. Read my post on retail arbitrage on Amazon to see how this works.

Dropshipping:

In dropshipping, you sell items that a third party makes and ships. You do not hold any stock. When a customer buys a product, the supplier sends it straight to them. More people use this model because it has low start-up costs. I suggest you look into the best dropshipping niches to find a winning product.

Products:

These are items buyers download instantly. Examples include PDF templates, online courses, e-books, and software. It also covers cloud tools and digital art. These make up a huge part of online sales. They are great because you create the product once and sell it many times. Check my guide on how to create a digital product.

Wholesale:

Wholesale means selling goods in large quantities. Most wholesale sellers sell to other businesses, not the final customer. Those businesses then sell the items in smaller amounts. This model is less common now that more brands sell direct to consumers.

Services:

Some people sell their time or skills online. This includes coaching, freelance writing, and influencer marketing. You pay for the task or the hour of work. Drop servicing is a version of this. In drop servicing, you sell a service and then pay a freelancer to do the work.

- a) **Subscription:** The subscription model relies on recurring payments. Customers pay a weekly or monthly fee for a product or service. This is a top choice for direct-to-consumer brands. It provides a steady income. If you want to build a subscription site, try Subbly. It is a good tool for beginners who want a site that is ready to go.

Prominent examples of e-Commerce sites



Some well-known e-commerce sites are Amazon, eBay, and Shopify, with each providing distinct features and services to address various market demands. The diagram below illustrates these e-commerce sites.

Fig. 1 Shows the e-Commerce sites

Amazon.com:

Amazon is a prime example of a successful online business. It holds the spot as the largest e-commerce retailer in the United States. The site sells almost everything, from clothes to electronics. It also sells its own devices like the Kindle and Echo. Fast shipping and a huge range of goods keep customers coming back.

Alibaba:

The Chinese firm Alibaba is the most successful e-commerce entity globally. It runs several different types of stores. Alibaba.com handles B2B sales, where businesses sell to other businesses. Taobao.com focuses on C2C sales, which lets individuals sell to each other. Tmall handles B2C sales, where brands sell directly to shoppers. These platforms make it easy for global trade to happen.

Walmart:

Walmart was once only known for its big physical stores. Now it has a strong online presence. It offers standard retail sales through its website. It also provides grocery delivery and monthly subscription plans. This mix of physical shops and web sales helps it stay competitive.

eBay:

eBay was one of the first sites to sell goods online. It still holds a large share of the market. It works differently than a normal shop. Businesses and people list items for sale. Buyers can buy things at a fixed price or bid on used items in an auction. This makes it a top choice for second-hand goods.

Recommendation

To succeed in today's interconnected marketplace, businesses should adopt AI-driven personalization to boost customer engagement, implement omnichannel approaches for seamless shopping experiences, and promote sustainability through digital branding. Expanding into international markets by simplifying cross-border logistics and payments is also vital. Staying competitive involves leveraging emerging technologies like virtual and augmented reality and enhancing mobile shopping and payment options. These measures help businesses adapt to the changing e-commerce environment and seize new opportunities.

Conclusion

The effective marketing of e-commerce requires a comprehensive understanding of both the broad digital landscape and the specific complexities inherent in online retail. This includes recognizing the multitude of factors influencing consumer behaviour, such as technological trends, demographic shifts, and evolving purchasing habits. Furthermore, marketers must familiarise themselves with various digital marketing channels, ranging from search engine optimisation and social media advertising to email marketing and content creation. Each channel presents unique opportunities and challenges that require tailored strategies for maximising reach and engagement. As e-commerce continues to grow in significance, those involved must remain proactive and innovative. This involves not only staying current on the latest marketing trends and technologies but also anticipating changes in consumer preferences and market dynamics. For instance, the rise of mobile shopping has necessitated the implementation of responsive design and mobile-friendly interfaces, allowing businesses to cater to on-the-go consumers. Similarly, personalisation in marketing has become essential, with tailored recommendations and targeted ads enhancing the overall shopping experience. Moreover, businesses must also address the crucial aspect of customer trust and security.

As online transactions carry inherent risks, ensuring robust security measures and transparent return policies can significantly impact customer loyalty and satisfaction. Building a solid reputation in the e-commerce marketplace hinges on a commitment to providing exceptional customer service, which in turn fosters long-term relationships with clients. In an ever-changing environment, adapting marketing strategies is vital for sustaining growth in the e-commerce sector. Companies that harness data analytics and consumer insights can refine their approaches, making informed decisions that lead to increased effectiveness. By embracing flexibility and creativity, businesses can not only keep up with industry trends but also set themselves apart from competitors in the crowded online marketplace. Ultimately, the future of e-commerce is bright, filled with opportunities for those willing to innovate and adapt. Maintaining relevance and effectiveness in this fast-paced environment will be paramount for success, paving the way for a thriving online retail landscape

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OriginalArticle

Economy And Inclusive Growth in India: Opportunities, Challenges and Policy Implications

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The digital economy has emerged as a significant driver of economic growth and social transformation across the world. In India, the rapid expansion of digital technologies, internet connectivity, digital payments, e-governance initiatives, and digital entrepreneurship has created new opportunities for economic development and social inclusion. The concept of inclusive growth emphasizes equitable access to economic opportunities and the benefits of development for all sections of society. This paper examines the relationship between the digital economy and inclusive growth in India. It analyzes the role of digital infrastructure, digital financial services, e-commerce, digital governance, and digital skill development in promoting economic participation and reducing inequalities. The study also highlights the challenges of the digital divide, cyber security risks, digital literacy gaps, and regional disparities. The paper concludes with policy recommendations for achieving sustainable and inclusive digital transformation.

Keywords: Digital Economy, Inclusive Growth, Digital India, Financial Inclusion, E-Governance, Digital Payments.

Introduction:

The twenty-first century has witnessed unprecedented technological advancements that have transformed economies and societies globally. Digital technologies have become essential components of economic activities, influencing production, consumption, communication, and governance. The digital economy refers to economic activities that rely on digital technologies, including information and communication technologies (ICT), the internet, artificial intelligence, cloud computing, and digital platforms. India has emerged as one of the fastest-growing digital economies in the world. Government initiatives such as Digital India, Aadhaar, Unified Payments Interface (UPI), BharatNet, and Startup India have accelerated digital transformation. The digital economy contributes significantly to economic growth, employment generation, innovation, and productivity enhancement. Inclusive growth seeks to ensure that the benefits of economic development are distributed fairly among all sections of society, including rural populations, women, marginalized communities, and economically weaker sections. The integration of digital technologies into economic activities can play a vital role in promoting inclusive growth by enhancing access to information, financial services, education, healthcare, and employment opportunities.

Objectives of the Study:

1. To examine the concept and significance of the digital economy.
2. To analyze the role of digital technologies in promoting inclusive growth.
3. To evaluate major digital initiatives in India.
4. To identify challenges affecting digital inclusion.
5. To suggest policy measures for strengthening the digital economy and inclusive growth.

Research Methodology:

The study is based on secondary data collected from government reports, RBI publications, NITI Aayog reports, World Bank publications, Ministry of Electronics and Information Technology documents, research articles, journals, and various online sources. Analytical and descriptive methods have been used for interpretation.



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Conceptual Framework of Digital Economy:

The digital economy encompasses all economic activities enabled by digital technologies. It consists of:

Digital Infrastructure

Broadband connectivity

Mobile networks

Data centers

Cloud computing systems

Digital Platforms

E-commerce platforms

Online marketplaces

Digital service providers

Digital Financial Services

UPI

Mobile banking

Internet banking

Digital wallets

Digital Governance

Online public services

E-governance platforms

Digital identity systems

The digital economy improves efficiency, transparency, and accessibility in economic transactions.

Understanding Inclusive Growth

Inclusive growth refers to economic growth that creates opportunities for all sections of society and ensures equitable distribution of benefits. It focuses on:

1. Poverty reduction
2. Employment generation
3. Social inclusion
4. Gender equality
5. Regional balance
6. Access to education and healthcare

Inclusive growth aims to improve the quality of life of disadvantaged groups while sustaining economic development.

Digital Economy as a Driver of Inclusive Growth

Financial Inclusion

Digital financial services have revolutionized access to banking and financial services. The Jan Dhan-Aadhaar-Mobile (JAM) trinity has enabled millions of citizens to participate in the formal financial system.

Benefits include:

Direct Benefit Transfers (DBT)

Reduced transaction costs

Increased transparency

Access to credit and insurance

Employment Generation

Digital platforms create employment opportunities through:

E-commerce

Freelancing

Gig economy

Digital entrepreneurship

IT and IT-enabled services

These opportunities particularly benefit youth and women.

Rural Development

Digital technologies support rural development through:

Online education

Telemedicine

Agricultural information services

Digital marketing of agricultural products

Farmers can access market information, weather forecasts, and government schemes through digital platforms.

Women's Empowerment

Digital inclusion enables women to:

Access financial services

Participate in online businesses

Enhance digital skills

Access educational resources

Digital technologies contribute to economic independence and social empowerment.

Education and Skill Development

Online learning platforms provide affordable education and skill development opportunities. Digital education promotes:

Accessibility

Flexibility

Lifelong learning

Skill enhancement

Major Digital Initiatives in India

Digital India Programme

Launched in 2015, Digital India aims to transform India into a digitally empowered society and knowledge economy.

Key components:

- Digital infrastructure

- Digital governance

- Digital literacy

Unified Payments Interface (UPI)

UPI has revolutionized digital payments by enabling real-time transactions through smartphones.

Benefits:

- Convenience

- Financial inclusion

- Reduced cash dependency

Aadhaar

Aadhaar provides a unique digital identity to residents and facilitates efficient delivery of welfare schemes.

BharatNet

BharatNet aims to provide broadband connectivity to rural areas and bridge the digital divide.

Startup India

Startup India promotes innovation and entrepreneurship by supporting technology-based enterprises.

Challenges to Digital Inclusion

Digital Divide

Significant disparities exist between:

- Urban and rural areas

- Rich and poor households

- Educated and less educated populations

Digital Literacy Gap

Many citizens lack adequate digital skills, limiting effective utilization of digital services.

Infrastructure Constraints

Challenges include:

- Poor internet connectivity

- Power shortages

- Limited access to digital devices

Cyber security Risks

Growing digital transactions increase vulnerability to:

- Cyber fraud

- Data breaches

- Identity theft

Gender Digital Gap

Women often have lower access to digital technologies due to social and economic barriers.

Policy Recommendations

Strengthening Digital Infrastructure

- Expand broadband connectivity.

- Improve network quality in rural areas.

- Promote affordable internet services.

Enhancing Digital Literacy

- Conduct digital literacy programs.

- Integrate digital skills into education.

- Promote community-based training initiatives.

Promoting Affordable Access

- Reduce costs of digital devices.
- Provide subsidies for disadvantaged groups.
- Encourage low-cost technological innovations.

Strengthening Cyber security

- Improve cyber security frameworks.
- Enhance data protection measures.
- Increase public awareness regarding cyber safety.

Encouraging Digital Entrepreneurship

- Support startups and MSMEs.
- Provide digital business training.
- Facilitate access to digital finance.

Promoting Gender Inclusion

- Enhance digital access for women.
- Support women entrepreneurs.
- Conduct targeted awareness campaigns.

Findings

1. The digital economy significantly contributes to economic growth and productivity.
2. Digital financial services promote financial inclusion and transparency.
3. Digital technologies improve access to education, healthcare, and employment.
4. Rural populations benefit from digital connectivity and information access.
5. Digital divide and literacy gaps remain major barriers to inclusive growth.
6. Policy interventions are essential to ensure equitable digital participation.

Conclusion

The digital economy has emerged as a powerful instrument for promoting inclusive growth in India. Digital technologies enhance access to financial services, education, healthcare, employment, and government services. Initiatives such as Digital India, UPI, Aadhaar, BharatNet, and Startup India have significantly contributed to digital transformation. However, challenges related to digital infrastructure, literacy, affordability, cyber security, and regional disparities continue to hinder inclusive digital development. A comprehensive policy framework focusing on accessibility, affordability, digital literacy, and cybersecurity is essential for ensuring that the benefits of the digital economy reach all sections of society. By addressing these challenges, India can achieve sustainable and inclusive economic growth through digital transformation.

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Digital Literacy Issues in Education After Covid-19: A Conceptual Review

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The COVID-19 pandemic accelerated the adoption of digital technologies in education, making digital literacy a fundamental requirement for effective teaching and learning. This paper presents a conceptual and narrative review of digital literacy in the post-COVID-19 educational context, focusing on its skills, advantages, and emerging challenges. Secondary data were collected from scholarly articles, policy documents, and authoritative reports published between 2006 and 2022. The study synthesizes existing literature to identify key issues such as digital inequality, health concerns, limited pedagogical effectiveness, and socio-emotional risks among learners, particularly children and young adults. While digital literacy enhanced access to education during lockdowns, over-dependence on digital technologies has generated new educational and social challenges. The paper highlights the need for balanced integration of digital literacy with traditional pedagogical practices and recommends structured training, policy interventions, and ethical digital usage to ensure sustainable educational development in the post-pandemic era.

Keywords: Digital Literacy; Post-COVID-19 Education; Online Learning; Digital Divide; Educational Technology; Information Literacy

Introduction

Technological advancement has profoundly influenced every aspect of human life, particularly education. In earlier times, printed books were the primary source of information; however, the rapid development of digital technologies has transformed information access, storage, and dissemination. The COVID-19 pandemic significantly accelerated this transformation by forcing educational institutions worldwide to shift from traditional face-to-face instruction to online modes of teaching and learning. Digital literacy has therefore emerged as a crucial competency for students, teachers, and educational administrators. It refers not only to the ability to use digital tools but also to the capacity to locate, evaluate, create, and communicate information effectively in digital environments. While the pandemic enhanced digital skill adoption, it also exposed gaps in preparedness, accessibility, and pedagogical effectiveness. This paper examines the concept of digital literacy, its advantages, and the critical issues that surfaced in education after COVID-19. Special attention is given to the challenges faced by learners and educators in adapting to prolonged digital engagement.

Review of Literature

The review of related literature gives a complete understanding of the research topic. It helps to know the quantitative developments of the topic and helps to discover the research gap and research trends. Sánchez-Cruzado et al., (2021) conducted a study to know the digital literacy levels of the teachers post COVID-19. Teachers should have digital literacy skills to educate online. They discovered that digital literacy is not the truth, but it has preferred the education-learning process. To adopt new technologies, teachers need a training program that combines methodology and educational strategies.

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Similarly, Kasımoğlu, Bahçelerli, & Çelik, (2022) studied the students' opinions about distance learning during COVID-19 and the problems of digital literacy during the same time. They collected student opinions and concluded that the objective of education is not properly met in distance education. There is a communication problem in online mode for both teachers and learners. The online learning process affects the student's life individually; it makes them feel isolated. Jovita Lobo, (2021). The COVID-19 Outbreak caused some positive impacts and enhanced digital literacy skills. The education sector became a hub of digital learning, bringing global educational institutions closer. The situation forced them to learn digital literacy skills and web technologies to survive in the present digital age. Webinars enhanced digital literacy skills during a lockdown. Udeogalanya, (2022) conducted a study to know how the students are making themselves ready to face the situation and adopting digital literacy skills. Before COVID-19, the online mode of education was optional it was not fully practised, and only 20% of classes were run online. The computer science community was ready with digital literacy, but other people are not very aware of using digital technology. After COVID-19, there is a need to give training in the use of Computer and digital literacy skills. Martzoukou, (2020) says the instant shifting from offline to online mode has brought out many restrictions in the higher education system. The complex problems include the Adoption of remote tools, online teaching-learning, accessibility, and equity. The COVID-19 situation forced the education community to think beyond the box. The libraries act as the connecting links that help the system to move forward.

Methodology:

This study adopts a conceptual and narrative review methodology. Secondary data were collected from peer-reviewed journals, books, conference papers, and reports published by recognized organizations such as UNESCO and WHO. Relevant literature was identified using keywords including digital literacy, COVID-19 education, and online learning. The selected sources were thematically analyzed to identify recurring concepts, benefits, and challenges related to digital literacy in the post-COVID-19 educational context.

Concepts used:

Digital literacy

Definition- UNESCO defines Digital Literacy is a capacity to define, retrieve, control, incorporate, connect, examine and generate information securely and suitably with digital technologies and networked devices for participation in economic and social life. UNESCO, (2018)

Martin, (2008) defines Digital Literacy as being engaged in recognizing digital resources and content, success, controlling, coordinating, analyzing, and synthesizing, developing new paths for media expression, and making it available to communicate with others.

Origin

The concept of digital literacy was first introduced by Paul Gilster in his 1999 book, "Digital Literacy." He described it in simple words, it is the capacity to comprehend and utilise information as of different digital sources which is known as literacy in the digital era. Gilster did not mention the list of literacy skills. Before him, many other authors used the phrase "Digital Literacy" during the 1990s. Bawden, (2008) the brief information about digital literacy is;

1. Aware of the interpretation and grasping of non-successive and active material.
2. Bringing consciousness to People networks as a source of advice and help.
3. To control incoming information, use filters and agents.
4. Accessing the information, publishing, and communicating are based on comfort level.
5. Making aware of the values of traditional tools along with networked media.
6. Assembling the information from different sources and creating a "knowledge assembly."
7. Skills related to the retrieval of internet information and critical thinking about it. There should be proper skills to judge retrieved information and internet sources.

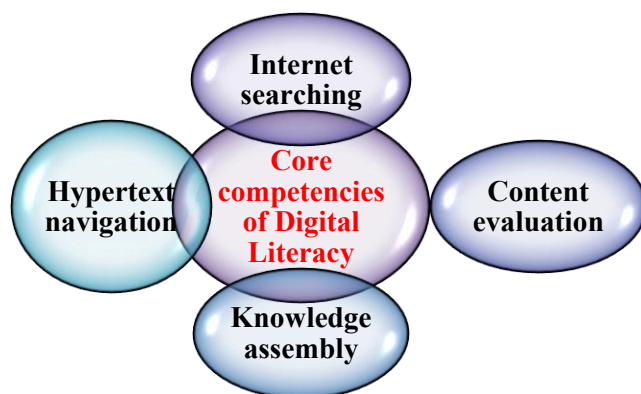


Figure 1 Core competencies of Digital Literacy (Gilster, 1997)
Digital Literacy Skills (Aviram & Eshet-Alkalai, 2006)

Aviram and Eshet-Alkalai explained five types of digital literacy in their article “Towards a Theory of Digital Literacy: Three Scenarios for the Next Steps.”

1. Photo-Visual Literacy- Knowledge to understand from illustrations: this skill is essential for the users to easily read and know commands and communications that are staged in an optical-graphic form. This skill is useful for understanding the coded text and playing computer games in which information is presented through symbols and icons.
2. Imitation Literacy- the skill of imaginative replication: this is a new skill necessary for modern digital literates. It is the ability to generate new definitions by combining different forms of media, such as text, graphics, or sound. This skill is necessary for fields like writing and art.
3. Splitting Literacy- multimedia and retreating or enamoured field thinking: in modern days, navigation is through non-linear hypermedia technology. Splitting literacy is the capacity to navigate effectively in a non-linear system. This skill inculcates the new possibility or capacity to build psychological models, notion charts, and representations of the web's arrangement.
4. Information Literacy- the skill of continuous cross-examination of information: the information explosion realized the importance of being information literate. Sorting information from plenty of resources is a big challenge. The information literacy skill is the capacity to access, place, measure, and significantly assess the information available on the web or shelves in libraries. Information-literate people are critical thinkers; they usually do not accept information without questions they always look with doubt. This is an important skill to survive in the digital era.
5. Socio-emotional literacy: the modern digital age opened new doors of opportunities, and learners are seeking information from a variety of sources, such as information distribution, conversation crowds, information societies, and chat areas. These skills enable users to share formal knowledge and emotions with the help of digital communication media. This skill is a very compound one; to share emotions on social media, users have to be critical, analytical, and mature, and need to have a good hold on information, Splitting, and photo-visual literacy skills.

COVID-19

COVID-19 disease is caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). This disease was found in Wuhan city, China, in December 2019. The Chinese government was unsuccessful in controlling the disease, and it spread to other countries in Asia and around the world. The WHO (World Health Organization) announced a public health emergency at the global level on 30 January 2020 and a pandemic on 11 March 2020. As of 7 December 2022, the total number of cases exceeds 646 million, with 6.46 million confirmed deaths (Siddiqui et al., 2022). The COVID-19 symptoms include common fever, dry cough, and extreme tiredness. It spreads with the air while taking a breath, inhaled air polluted by droplets and small airborne components, which include the virus. The pandemic has caused many Social, Economic, and educational threats all over the World. The COVID-19 epidemic brought many challenges for the education field, the government ordered to close physical classes and a shift to online mode/ Virtual education. This was very challenging for the teachers, institutional heads, state officials, and students (Daniel, 2020).

Advantages of Digital Literacy

The COVID-19 pandemic realized the importance of being digitally literate; online mode/ Virtual mode is the only way to communicate with users and students. Some of the advantages of digital literacy are listed below (Mudra, 2020);

1. Improves digital reading and writing skills.
2. Improves digital Listening and speaking skills.
3. Helps with digital collaborative work.
4. Access Authenticate resources/ effective content searches.
5. Digital literacy boosts students' commitment.
6. Recovers the educational presentation.
7. It assists students to stand strong during competition in the job market.
8. Digital literacy saves time and Money.
9. Helps for better decision-making.
10. Digital literacy provides Real-time updates.
11. Helps to become a digital citizen.
12. For lifelong learning.

Issues of Digital Literacy

Digital literacy after COVID-19 caused many problems in society. It affects all types of users based on their information needs and age group. According to the various studies conducted by different authors worldwide, digital literacy affected more on children and adults rather than older people. Some issues of digital literacy are as follows; Risk on children's behaviour- the awareness about digital literacy among children effects on their social behaviour, and children have less control over it. This is because of the freely available information; there are no restrictions on the use of information for age groups, and the information that is available on the internet can be accessible to everyone. This

may cause serious problems like cyber-kidnapping and cyber-bullying. The children will not feel to mingle with family and friends they always like to be in front of digital media. To outcome of such cases, the parents and teachers need to provide proper education regarding the use of online resources properly Purnama, & Ulfah, et al., (2021).

Lack of using educational methods- in online classes, the teachers is not able to use all the educational methods that are used in offline physical classes. There is a restriction on the use of methods and no provision for group discussion.

Not an effective alternative to the traditional education process – the online /video classes are not effective compared to the physical class. There is no proper contact between the teachers and learners.

No time for self-education- in the virtual mode of education, the teachers need to create electronic educational materials; they take much time to prepare online educational content. According to some studies, it takes exactly double time for physical education content.

Lack of productive interaction with students- digital literacy can be the cause of non-productive interaction through the online learning process.

Lack of flexibility in conserving traditional knowledge- the digital literacy medium is not flexible enough to hold the importance of traditional education Almazova, Krylova, Rubtsova, & Odinokaya, (2020).

Economic problems- the biggest challenge after COVID-19 is the economic crisis, as many people have lost their jobs and livelihoods. At the same time, in the education field, there is a need for Gadgets for distance education. To purchase them for their children, many people suffered a lot.

High risk of Addiction- technology is very helpful for the teaching and learning process in education, but at the same time, it increases the risk of addiction among children. In the last three years, we found that the young generation is addicted more towards online games and social media. This has increased during the lockdown.

Health Issues- too much use of digital devices can cause serious health issues such as mental illness, eye problems, and sitting in the same place from morning to evening can increase a person's fat level of a person.

Lack of using collaborative teaching methods- in online teaching, a teacher cannot use collaborative teaching methods. The teacher cannot make a group of learners in virtual mode.

Discussion

Despite the growing body of literature on digital literacy during the COVID-19 pandemic, existing studies largely focus on access, adoption, and skill acquisition, particularly during emergency remote teaching. Most research emphasizes technological readiness, platform usage, or short-term learning continuity. However, limited attention has been given to the post-COVID-19 phase, especially regarding the long-term educational, behavioural, health, and socio-emotional consequences of sustained digital dependency in education. Furthermore, prior studies often examine specific stakeholders—such as teachers, students, or library professionals—in isolation, resulting in a fragmented understanding of digital literacy outcomes. There is a notable lack of integrative conceptual analyses that synthesize digital literacy skills, benefits, and emerging challenges within a single framework in the post-pandemic educational context.

Linking Findings to the Research Gap

Addressing this gap, the present conceptual review synthesizes multidisciplinary literature to examine digital literacy not only as a technological competence but as a complex educational and social phenomenon in the post-COVID-19 era. The findings highlight that while digital literacy enabled educational continuity and improved access to learning resources, it also led to pedagogical limitations, reduced learner engagement, health issues, digital addiction, and erosion of traditional educational practices.

By systematically identifying and categorizing these issues, this study extends existing literature beyond pandemic-era adoption studies and contributes a holistic post-COVID-19 perspective on digital literacy in education. The review thus provides a conceptual foundation for policymakers, educators, and researchers to design balanced, learner-centred, and sustainable digital education strategies.

Conclusion

Technology is a boon as well as a bane; it depends on how we make use of it. Digital literacy is a concept that is very helpful for learners; it brought many changes in all areas of human life. In modern days, it is a compulsion to be digitally literate, one must know how to use the internet, search strategies, usage of social networking sites and many more. The utilization of digital technology created many opportunities during the COVID-19 pandemic. Almost all fields started using digital technology to communicate with their users or learners, and the internet became their workplace. After the COVID-19 situation, digital literacy has become a necessity to survive in this competitive world. Everything should be in control; if we lose control over using digital media, then it starts to control us. In the same way, many youngsters lost control over the usage of digital devices. Digital literacy caused many problems, which are mentioned above; it brought psychological illness among the youth. Digital literacy is associated with many fields like information and data literacy, conversation and association, media literacy, establishing online information, online security and digital comfort, clearing the issues, analytical thinking and inventions with online instruments and technology Martzoukou, (2020). The concept of digital literacy made easy communication and helped conduct online classes but it cannot bring the effectiveness/seriousness that we find in a physical class. Sometimes students will not be physically present in front of the device; they just log on to the class and move. There is no interest in teaching

effectively or learn, many teachers feel that it is difficult to make the concept in an online class. The addiction to digital devices continued from the COVID-19 pandemic to after the COVID-19 pandemic.

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OriginalArticle

Artificial Intelligence and Digital Transformation in Emerging Trends in Business Applications in India-A Study of Karnataka State

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The era of Artificial Intelligence (AI) and digital transformation has emerged as a major engine for innovation and business growth in today's economy. Various sectors in India are undergoing a transformation in their business processes with the adoption of AI technologies like machine learning, predictive analytics, automation, chatbots and cloud computing. Karnataka is one of the top technology and innovation centres in India with notable growth in AI-based business application. The current study outlines the contribution of Artificial Intelligence and Digital transformation to the new applications of business in Karnataka State. The research was conducted with 255 respondents from information technology, manufacturing, retail, finance and services. To analyse the data, descriptive analysis, correlation analysis, ANOVA and regression analysis were used. The results show that the use of AI has a positive impact on business performance, with benefits such as enhanced operational efficiency, customer engagement, and decision-making. There was a significant variation in the adoption of AI across business industries, with IT and financial services having higher adoption rates. The research also found that AI plays a significant role in the digital transformation agenda of organisations. While there are obstacles including talent shortage, implementation expenses, and data security issues, AI is gaining traction as a strategic asset to boost competitiveness and sustainable business growth in Karnataka.

Keywords: *Artificial Intelligence, Digital Technology, Digital India, UPI, Digital Transformation*

Introduction

Artificial Intelligence (AI) has revolutionized the way businesses operate around the world, providing an opportunity to automate tasks, boost decision-making, optimise customer experience, and increase operational efficiencies. AI is the ability of a machine or computer system to learn, reason, solve problems and make decisions, which are normally tasks associated with human intelligence. The last few years have seen significant growth in the capabilities of AI and machine learning, deep learning, natural language processing, robotic process automation and predictive analytics, driving digital transformation at a faster pace across industries. Digital transformation is the process of leveraging digital technology to transform and redefine the value creation, service delivery, and customer interaction of a business. The government of India's Digital India, Startup India, Make in India, and National Strategy for Artificial Intelligence (AI) initiatives have fostered a favorable environment for the use of AI and digital technologies in India. In recent years, AI solutions have become part and parcel of the life of businesses of all industries, helping them enhance productivity, cut down operational costs, and get a competitive edge. With the rapidly evolving nature of the market and the changing expectations of customers,



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AI has emerged as a powerful tool for organizations to drive innovation and business transformation. Karnataka is an important State in the digital economy and is considered as the technology capital of India with its vibrant IT infrastructure, innovation ecosystem and startup culture. The capital of Bengal, the state capital, has many multinational companies, tech giants, research institutes, and startups working on and implementing AI. AI-powered tools like intelligent customer relationship management systems, automated financial services, digital marketing analytics, supply chain optimization tools, and smart manufacturing technologies have had a profound impact on the business landscape within the state. Moreover, the proliferating cloud computing services, digital payments, big data solutions, and Internet of Things (IoT) solutions have thrust digitalization into the fast lane of enterprises of all sizes. The advantages of implementing AI are significant, but there are also obstacles such as technological complexity, cybersecurity threats, investment demands, regulatory considerations, and the lack of skills within the workforce. In this context, it is crucial to explore the impact of AI and Digital transformation on emerging business applications in Karnataka. Thus, the current study aims to explore the adoption pattern, advantages, barriers and implications of digital transformation through AI in the business context of Karnataka to gain insights into the evolving technological scenario of the business sector in the state.

Review of Literature

Davenport and Ronanki (2018)

Davenport and Ronanki (2018) studied the application of AI in business organizations in practice. They identified the three main use cases for AI in business were: Process Automation, Customer engagement, and Decision support systems. The authors noted that the most successful applications of AI were when it was embedded within current business processes, rather than when it was entirely new. The study pointed out improvements in efficiency, cost reduction and quality of services in the organizations. It highlighted the need for organizational preparedness and managerial buy-in to reap the rewards of digital transformation efforts powered by AI.

Bughin et al. (2018)

Bughin et al. (2018) explored the impact of artificial intelligence on business performance and productivity around the world. The findings from the study showed that companies with investments in AI technologies reaped substantial benefits in terms of operational efficiency and innovation potential. The researchers commented that the adoption of AI differed across industries, influenced by factors such as digital infrastructure and skills of employees. Their research indicated that companies that are proactively leveraging AI for transformation are more likely to gain a competitive edge. In addition, the study identified the need for employee reskilling and organizational change management to reap the optimum benefits of digital technologies.

Vial (2019)

Vial (2019) created a conceptual model to explain the digital transformation in an organization. The study revealed that three key factors that enable the successful digital transformation are technology, structure and management. The author highlighted that digital transformation is not just about adopting technology, but also about transforming business models and value creation processes. The results indicated that firms that were more successful in integrating technological innovation with strategic goals had better performance results. The study provided valuable insights into understanding the relationship between digital technologies and organizational competitiveness.

Mikalef et al. (2019)

In the study of Mikalef et al. (2019), the researchers studied the impact of the capabilities of AI on organizational performance. Their study showed that AI-driven analytics improved the quality of decision making and business agility. It concluded that companies that display a high level of digital capacity performed better in their ability to exploit AI technologies for strategic purposes. The authors emphasized that data quality, technological infrastructure and managerial abilities were important factors for the implementation of AI. The study found that in addition to contributing to innovation, AI has a major role in operational excellence, provided there is healthy organizational resources.

Bharadwaj and Kumar (2020)

Bharadwaj and Kumar (2020) conducted their study on the adoption of digital technologies by Indian enterprises. The research found that the fields of cloud computing, artificial intelligence applications and digital platforms had experienced rapid growth. The results revealed that digital transformation promoted higher productivity, customer satisfaction and business sustainability. However, factors like lack of digital skills and cyber security concerns slowed adoption. The authors highlighted the importance of supportive Government policies and organisational investments in technology infrastructure to boost the activities of digital transformation in India.

Verhoef et al. (2021)

Verhoef et al. (2021) delved into digital transformation strategies in modern organizations. The research discussed the potential of new technologies, such as artificial intelligence, to generate new business opportunities and improve customer experiences. The researchers identified three key conditions for successful digital transformation: strategic leadership, technological readiness and innovation-driven cultures. The study highlighted the organization that embraced digital business models had a greater market responsiveness and competitiveness. The results also highlighted the need for lifelong learning and flexibility to deal with technological disruptions.

Dwivedi et al. (2021)

Dwivedi, et al. (2021) investigated the applications and implications of artificial intelligence in business and society. According to their study, AI technologies boosted the decision-making process, enhanced operational efficiency, and customer relationship management. Ethical concerns, privacy concerns, and workforce displacement were identified as key challenges with AI adoption by the authors. The study highlighted the importance of proper AI regulation and governance. The researchers found that AI can revolutionize business operations, but it can only do so if there are a balance of approach to handle social and organizational issues.

Gupta and George (2022)

The study by Gupta and George (2022) examined the effect of AI-based digital transformation on organizational innovations. The study found that companies using AI technologies had more innovative, quicker product development and better service delivery. The results indicated that information-based decision making played a major role in the growth and competitiveness of business. The authors highlighted the necessity of organizational culture and technological skills for the successful implementation of AI. The study underscored the role of AI in fostering long-term sustainability and innovation in business.

Chatterjee et al. (2022)

Chatterjee et al. (2022) studied businesses and their practices of digital transformation in India. The study revealed that AI applications enhanced customer engagement, improving operation efficiency and supply chain management. The authors noted that digital transformation has gained pace since the proliferation of online platforms and digital services. The results revealed that companies that invested in AI technologies had positive financial and operational results. The study advocated for improving digital infrastructure and training employee initiatives for sustainable digital transformation in industries.

Khin and Ho (2023)

Khin and Ho (2023) investigated the association between digital transformation and business performance. The study found that the organizations that used AI technologies had better productivity and innovation results. The researchers found that leadership commitment, technological readiness and employee competency were key factors that impacted the success of the transformation. The results showed that digital transformation improved the flexibility and responsiveness of businesses to the market. Overall, the study found that the adoption of AI can be a powerful strategic tool for enhancing competitiveness and maintaining business growth in today's dynamic business landscape.

Sharma and Singh (2024)

Sharma and Singh (2024) investigated the use of AI in Indian companies and how it can affect their performance. The study found that there were positive correlations between the implementation of AI, operational efficiency, and customer satisfaction. The authors discovered that companies that implemented AI-driven predictive analytics and automation saw substantial benefits in the quality of their decision-making processes. The study also identified issues of technology costs and lack of skills. The study highlighted the importance of strategic investments in digital technologies and upskilling for the full benefits of digitalization for organizations.

Patel and Mehta (2025)

Patel and Mehta (2025) studied the new trends of AI and Digital transformation in Indian organizations. They found that business functions are increasingly adopting machine learning, automation and intelligent analytics. The research revealed that AI played a key role in boosting productivity, innovation, and customer experience management. The authors noted that tech-savvy companies in technologically advanced areas had more AI adoption. The study findings showed that the digital transformation journey would keep evolving organizational practices and will continue to play a vital role in sustainable growth of businesses in India when implemented with AI.

Objectives of the Study

1. To analyse the relationship between AI Adoption and Business Performance.
2. To examine difference in AI Adoption among Business Sectors.
3. To evaluate the impact of AI Adoption on Digital Transformation

Methodology of the Study

This study uses a descriptive and analytical approach to explore the role of Artificial Intelligence (AI) and digital transformation in emerging applications of Karnataka state businesses. Both primary and secondary data have been used for the study. Primary data were gathered from customers in the field of information technology, manufacturing, retail, finance and other industries, from business professionals, managers, entrepreneurs, employees and technology users. The data on the adoption of AI, digital transformation practices, business performance, benefits, challenges, etc. has been collected from a structured questionnaire with a 5-point Likert scale. Using convenience sampling, a total of 255 valid responses were collected. Secondary data were collected from various sources such as research journals, books, government reports, industry reports, websites and other sources. The collected data were subjected to statistical analyses including descriptive statistics (frequency, percentage, mean, standard deviation), test of hypothesis (One-Way ANOVA), Pearson correlation, and regression analysis.

Data Collection

Both primary and secondary sources of data were used. Primary data was collected by using the well structured questionnaire with the respondents across various business sectors of Karnataka state both online and offline. The survey questionnaire comprised of demographic information, AI adoption practices, digital transformation projects, perceived benefits, and challenges. Secondary data were gathered by using published research articles, government publications, NITI Aayog reports, reports by M E I T, Digital India, industry surveys, company reports, various academic databases. The findings from the study were enhanced by the use of both primary and secondary data, which added to the reliability and validity of the study.

Scope of the Study

The scope of the study is confined to examining the adoption and impact of Artificial Intelligence and digital transformation in business organizations operating in Karnataka State. The study covers key sectors such as information technology, manufacturing, retail, finance, and service industries. It focuses on understanding the level of AI adoption, emerging business applications, operational benefits, digital transformation initiatives, and implementation challenges. The study also evaluates the relationship between AI adoption, business performance, and digital transformation. The findings are expected to provide valuable insights for business organizations, policymakers, researchers, and technology practitioners in promoting AI-driven innovation and sustainable business growth.

Limitations of the Study

The study is subject to certain limitations. Firstly, the geographical coverage is limited to Karnataka State, and therefore the findings may not fully represent the situation in other states of India. Secondly, the study is based on a **sample of 255 respondents** selected through convenience sampling, which may limit the generalizability of the results. Thirdly, the analysis relies on respondents' perceptions and self-reported information, which may be influenced by personal bias. Fourthly, the rapidly evolving nature of AI technologies and digital transformation practices may lead to changes in business applications over time. Finally, time and resource constraints restricted the inclusion of a larger sample size and broader industrial coverage.

Results and Discussions

Relationship between AI Adoption and Business Performance

Correlation Analysis

Variables	AI Adoption	Business Performance
AI Adoption	1.000	0.742
Business Performance	0.742	1.000
N	p-value	Correlation is significant
255	0.000	0.01

Source: Computed Value

The correlation coefficient of 0.742 indicates a strong positive relationship between AI adoption and business performance. Since the p-value is less than 0.01, the relationship is statistically significant. Therefore, organizations adopting AI technologies tend to achieve better business performance.

Difference in AI Adoption among Business Sectors

One-Way ANOVA

Source of Variation	Sum of Squares	df	Mean Square	F-value	Sig.
Between Groups	24.613	4	6.153	5.871	0.001
Within Groups	262.145	250	1.049		
Total	286.758	254			

Source: Computed Value

The ANOVA result shows that the p-value (0.001) is less than 0.05. Therefore, AI adoption significantly differs across sectors. IT and Financial Services sectors exhibit higher adoption levels compared to manufacturing and retail sectors.

Impact of AI Adoption on Digital Transformation

Regression Analysis

Predictor	Beta Coefficient	t-value	Sig.
Constant	1.247	5.214	0.000
AI Adoption	0.691	14.526	0.000
R	R ²	Adjusted R ²	F-value
0.747	0.558	0.554	210.98
			Sig.
			0.000

Source: Computed Value

The regression model explains 55.8% of the variation in digital transformation. The positive beta coefficient (0.691) indicates that higher AI adoption leads to greater digital transformation. The model is statistically significant as the p-value is less than 0.05.

Findings of the study

The analysis of 255 respondents confirms that AI adoption has a significant positive relationship with business performance, varies across business sectors, and strongly contributes to digital transformation in Indian organizations.

All three null hypotheses are rejected, indicating the growing strategic importance of AI-driven business applications in India.

Conclusion

In India, Artificial Intelligence and Digital Transformation are proving to be two key enablers of economic growth and business innovation. AI's incorporation into commerce and management processes has brought about enhancements in operational efficiency, client satisfaction, and strategic decision-making. India's leap towards a digitally empowered nation is evident from the surge in digital transactions and investments in AI, a testament to its remarkable growth. The future of commerce and management is bright, and the influence of AI will continue to grow as organizations seek to leverage the power of intelligent technologies. In conclusion, it is clear that the adoption of AI needs to be done responsibly, and that this requires collaboration between businesses, educational institutions, and policymakers to foster responsible AI usage, digital literacy, and innovation-driven growth for sustainable economic development.

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OriginalArticle

Public Policy and Governance in The Digital Economy of India: Opportunities, Challenges and Policy Perspectives.

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The digital economy has emerged as a significant driver of economic growth and governance transformation in India. Rapid advancements in digital technologies, internet penetration, artificial intelligence, fintech innovations, and digital public infrastructure have reshaped economic activities and public service delivery. Government initiatives such as Digital India, Aadhaar, Unified Payments Interface (UPI), BharatNet, and the Digital Personal Data Protection Act have accelerated digital transformation across sectors. However, challenges including digital inequality, cybersecurity threats, data privacy concerns, and regulatory complexities continue to affect the effective governance of the digital economy. This paper examines the role of public policy and governance in shaping India's digital economy, analyzes major policy initiatives, identifies key challenges, and suggests policy measures for sustainable and inclusive digital development.

Keywords: Digital Economy, Public Policy, Digital Governance, Digital Inclusion.

Introduction

The twenty-first century has witnessed the emergence of the digital economy as a transformative force influencing economic growth, governance, and societal development. In India, digital technologies have become central to economic activities, public administration, financial inclusion, and citizen engagement. The expansion of internet connectivity, mobile technologies, digital payments, and e-governance platforms has significantly altered the traditional functioning of markets and institutions. India's digital transformation has been driven by proactive government policies aimed at creating a digitally empowered society and knowledge-based economy. The Digital India Programme, launched in 2015, marked a significant step toward enhancing digital infrastructure, promoting digital literacy, and improving access to government services. The rapid growth of digital public infrastructure has positioned India as a global leader in digital governance. This paper explores the evolution of public policy and governance in India's digital economy and evaluates their contribution to economic development and public service delivery.

Conceptual Framework of the Digital Economy

The digital economy refers to economic activities that depend on digital technologies, internet connectivity, and data-driven innovations. It includes e-commerce, digital payments, cloud computing, artificial intelligence, online education, digital healthcare, fintech services, and platform-based business models.

The key characteristics of the digital economy include:

- Digital connectivity and networking
- Data as an economic resource
- Platform-based business ecosystems
- Automation and artificial intelligence
- Innovation-driven growth
- Real-time information exchange

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The digital economy enhances productivity, reduces transaction costs, and creates new opportunities for businesses and consumers.

Growth of the Digital Economy in India

India has experienced remarkable growth in digital adoption during the last decade. Increased smartphone usage, affordable internet services, and supportive government policies have accelerated digital participation.

Major factors contributing to digital growth include:

Expansion of Internet Connectivity

The availability of low-cost internet services and government investments in broadband infrastructure have significantly increased internet penetration in rural and urban areas.

Digital Public Infrastructure

India has developed a robust digital public infrastructure consisting of:

- Aadhaar Digital Identity System
- Unified Payments Interface (UPI)
- DigiLocker
- e-KYC
- BharatNet
- CoWIN Platform
- Government e-Marketplace (GeM)

These platforms have enhanced transparency, efficiency, and accessibility in public service delivery.

Growth of Digital Payments

India has become one of the world's leading digital payment ecosystems. UPI has transformed financial transactions by enabling secure, instant, and low-cost payments.

Expansion of E-Commerce

Online marketplaces have expanded access to goods and services, enabling businesses to reach wider markets and consumers to benefit from greater convenience and choice.

Public Policy Framework for the Digital Economy in India

Public policy plays a crucial role in promoting innovation, regulating digital activities, and protecting citizen interests.

Digital India Programme

Launched in 2015, Digital India aims to transform India into a digitally empowered society and knowledge economy through:

- Digital infrastructure development
- Governance and services on demand
- Digital empowerment of citizens

The programme has significantly improved access to digital services and government transparency.

National Digital Communications Policy

The policy seeks to strengthen telecommunications infrastructure, improve broadband connectivity, and facilitate next-generation technologies.

Digital Personal Data Protection Act

Data protection has become increasingly important in the digital era. The Digital Personal Data Protection Act provides a framework for safeguarding personal information and ensuring responsible data usage.

National Strategy for Artificial Intelligence

India's AI strategy focuses on leveraging artificial intelligence for inclusive growth in healthcare, agriculture, education, smart cities, and governance.

Startup and Innovation Policies

Government initiatives such as Startup India encourage digital entrepreneurship, innovation, and technology-driven economic growth.

Digital Governance in India

Digital governance refers to the use of information and communication technologies to improve public administration and citizen services.

E-Governance Initiatives

India has implemented several e-governance programmes aimed at improving efficiency and accountability.

Important initiatives include:

- UMANG Portal
- e-District Services
- DigiLocker
- e-Hospital
- National Scholarship Portal
- GST Network

These platforms facilitate seamless interactions between citizens and government agencies.

Transparency and Accountability

Digital governance reduces bureaucratic delays and opportunities for corruption by promoting transparency in public service delivery.

Citizen Participation

Online grievance portals, social media engagement, and digital consultation platforms have increased citizen participation in governance processes.

Challenges in Governance of India's Digital Economy

Despite significant progress, several challenges remain.

Digital Divide

Rural-urban disparities in internet access, digital literacy, and technological infrastructure continue to affect inclusive development.

Cybersecurity Risks

Increasing digital transactions expose individuals, businesses, and government institutions to cyberattacks, data breaches, and financial fraud.

Data Privacy Concerns

The collection and processing of large volumes of personal data raise concerns regarding privacy, consent, and misuse of information.

Regulatory Challenges

Technological innovations often develop faster than regulatory frameworks, creating policy uncertainties.

Skill Gaps

A shortage of digital skills limits the effective utilization of emerging technologies and affects workforce competitiveness.

Opportunities in India's Digital Economy

India possesses immense opportunities for digital economic growth.

Financial Inclusion

Digital payment systems and fintech innovations have expanded access to financial services for millions of citizens.

Employment Generation

The digital economy creates employment opportunities in software development, digital marketing, e-commerce, cybersecurity, and data analytics.

Rural Development

Digital platforms improve access to education, healthcare, agricultural information, and government services in rural areas.

Global Competitiveness

India's digital transformation enhances its attractiveness as a destination for technology investment and innovation.

Policy Recommendations

To strengthen governance in India's digital economy, the following recommendations are proposed:

1. Expand high-speed internet connectivity in rural and remote areas.
2. Enhance digital literacy and capacity-building programmes.
3. Strengthen cybersecurity infrastructure and awareness.
4. Ensure effective implementation of data protection regulations.
5. Promote ethical and responsible use of artificial intelligence.
6. Encourage innovation through research and development support.
7. Strengthen regulatory frameworks for digital platforms.
8. Foster public-private partnerships in digital infrastructure development.
9. Improve digital accessibility for marginalized and vulnerable populations.
10. Enhance international cooperation in digital governance and cybersecurity.

Conclusion

India's digital economy has become a critical pillar of economic development and governance transformation. Public policy initiatives such as Digital India, Aadhaar, UPI, BharatNet, and data protection reforms have significantly expanded digital access and improved public service delivery. However, challenges related to digital inequality, cybersecurity, privacy, and regulatory adaptation require continuous policy attention. Effective governance frameworks that promote innovation while protecting citizen rights are essential for ensuring sustainable and inclusive digital growth. With appropriate policy interventions and institutional reforms, India can further strengthen its position as a global leader in the digital economy.

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A Study on The Evolution of Cashless Economy in India

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economy is a type of economic system in which there is not much cash circulates in the economy. In this system services and commodities are obtained through digital modes such as Debit Cards, Credit Cards, Net Banking, Point of Sale Machines, Mobile Wallets etc. Cashless economy is the most important part of digital India plan of the Indian government with an idea to run economy digitally or paperless. This paper focus on to understand cashless economy concept, methods of cashless transactions, advantages of cashless economy and issues & challenges of cashless economy. Digital transaction or cashless transaction brings in better transparency, scalability and accountability. This paper focus on concept of cashless economy, pros & cons and to know the modes of cashless transactions. The digital India is a leading programme of the government of India with a vision to convert India into a digitally authorized society and knowledge economy

Keywords: Cashless economy, e-banking, card swipe, digital money, plastic money, transparency and digital transaction.

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Introduction

In a **cashless society**, financial transactions are not conducted with physical banknotes or coins, but instead with digital information (usually an electronic representation of money).^[1] Cashless societies have existed from the time when human society came into existence, based on barter and other methods of exchange, and cashless transactions have also become possible in modern times using credit cards, debit cards, mobile payments, and digital currencies such as bitcoin. However, this article focuses on the term "cashless society" in the sense of a move towards a society in which cash is replaced by its digital equivalent—in other words, legal tender (money) exists, is recorded, and is exchanged only in electronic digital form. Such a concept has been discussed widely, particularly because the world is experiencing a rapid and increasing use of digital methods of recording, managing, and exchanging money in commerce, investment and daily life in many parts of the world, and transactions which would historically have been undertaken with cash are often now undertaken electronically.^{[2][3]} Some countries now set limits on transactions and transaction values for which non-electronic payment may be legally used. The trend towards the use of non-cash transactions and settlement in daily life began during the 1990s when electronic banking became common. By the 2010s digital payment methods were widespread in many countries, with examples including intermediaries such as PayPal, digital wallet systems such as Apple Pay, contactless and NFC payments by electronic card or smartphone, and electronic bills and banking, all in widespread use.^[3] At this point cash had become actively disfavored in some kinds of transaction which would historically have been very ordinary to pay with physical tender, and larger cash amounts were in some situations treated with suspicion, due to its versatility and ease of use in money laundering and financing of terrorism. Additionally, payment with a large amount of cash has been actively prohibited by some suppliers and retailers,^[5] to the point of coining the expression of a "war on cash".^[6] The 2016 United States User Consumer Survey Study claims that 75% of respondents preferred a credit or debit card as their payment method while only 11% of respondents preferred cash.^[7] Since the founding of both companies in 2009, digital payments can now be made by methods such as Venmo and Square.

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Venmo allows individuals to make direct payments to other individuals without having cash accessible. Square is an innovation that allows primarily small businesses to receive payments from their clients. By 2016, only about 2% of the value transacted in Sweden was by cash, and only about 20% of retail transactions were in cash. Fewer than half of bank branches in the country conducted cash transactions.^[2] The move away from cash is attributed to banks convincing employers to use direct deposit in the 1960s, banks charging for checks starting in the 1990s, banks launching the convenient Swish smartphone-to-phone payment system in 2012, and the launch of iZettle for small merchants to accept credit cards in 2011

Review Of Literature

Many empirical studies have been conducted on the project of “CASHLESS ECONOMY” in India and Abroad. The major emphasis of research has been on various issues like frauds, security, usage patterns, new method of e-payment, etc.

Mandeep Kaur And Kamaldeep Kaur (2008), Development Of Plastic Cards

Market; past, present and future scenario in Indian banks found that plastic money in the form of cards has been actively introduced by banks in India in 1990's. But it was not very popular among Indian consumer at the time of its introduction. The change in demographic features of consumers in terms of their income, marital status, education level, etc. and up gradation of technology and its awareness brought the relevant changes in consumer preference.

Bansi Patel And Urvi Amin (2012) in their research paper “plastic money: Road way towards cashless society” discussed that now a days in any transaction plastic money becomes inevitable part of the transaction and with it life becomes more easy and development to take better place and along with the plastic money it becomes possible that control the money laundry and effective utilization of financial system would become possible with would also helpful for tax legislation.

Objectives Of The Paper

1. To understand the concept of cashless economy.
2. To analyse the benefit and challenges of cashless economy.
3. To know the various modes of cashless transactions in India
4. **Cashless Economy and Government Initiatives in India**

RESEARCH METHODOLOGY

The study is based on secondary sources of data/information. Different books, journals, newspapers and relevant websites have been consulted in order to make the study an effective one.

What is a Cashless Economy?

Cashless Economy can be defined as a situation in which the flow of cash within an economy is non-existent and all transactions must be through electronic channels such as direct debit, credit cards, debit cards, electronic clearing, and payment systems such as Immediate Payment Service (IMPS), National Electronic Funds Transfer (NEFT) and Real-Time Gross Settlement (RTGS) in India.

To know the Difference Between RTGS and NEFT, visit the linked article

Highlights of Cashless Economy in India

Post Demonetization, the Centre is making a big push for online and card-based transactions in the country to achieve its target of becoming a largely cashless economy.

The rapid growth of e-payment startups in the country.

Launch of Unified Payments Interface (UPI) to facilitate cashless transactions.

The Covid-19 pandemic fueled a massive shift towards digital transactions in India aligning with the prime minister's vision of a Digital India. In fact, according to the National Payments Corporation of India (NPCI) data, payments on UPI in June 2020 hit an all-time high of 1.34 billion in terms of volume with transactions worth nearly Rs 2.62 lakh crore.

Benefits Of Cashless Economy

Transparency in transaction: Needless to say, electronic dealings or plastic money always leaves a digital impermeable valuable for both the tax payer (consumer) and the tax collector (government). It will curb generation of black money.

Financial inclusion: The will to have a cashless economy will promote financial attachment of the people. It will require the government to connect all the households with a bank and plastic economy.

Reduced maintenance costs: The logistics and supply chain of cash is estimated the exchequer affluence. The amount of money mandatory in printing cash, its storage, conveyance, distribution and perceiving imitation currency is huge. Concentrated instances of tax escaping because it is financial institutions based economy imprints are left.

Higher revenue: Unoriginal advantage of transparent transactions is collection of tax will increase. Thus producing higher income for government this in turn will be changes into public welfare policies and schemes.

Lower transaction costs: Digital business is a boon in turns of handling cost and waiting time. If fulfilled appropriately it will increase the fasting and production rates and there by cultivating the economy.

Taxation: With lesser availability of hard cash at homes and more in banks, there is lesser scope of hiding income and evading taxation and when there are more tax payers are ultimately leads to a lesser rate of taxation for the whole country.

Less availability for illegal activities: When people are encourage to go cashless, there is lesser cash available with the people and there won't be a means to invest in other activities to use the ideal cash. Channels like HAVALA (illegal remittance) will ultimately suffer the brunt of a cashless economy.

Convenience: The easy of conducting financial transactions is probably the biggest motivator to go digital. You will no longer to carry wads of cash, plastic cards and even queue up for ATM withdrawals. It's also a safer and easier spending option when you are travelling.

Tracking spends: If all transactions are on recorded, it will be very easy for people to keep track of theirs spending. It will also help while failing income tax returns and in case of a security, people will find it easy to explain their spending.

Reduced red tapism and bureaucracy: With cashless transactions through electronic means the wire transfers are tracked and people are accountable which in turn reduces corruption and improves service time.

Hygiene: Soiled, tobacco stained notes full of germs are an average in India. There are many such happenings in our lives where we significantly or innocently give and take germs in the form of rupee notes. This could be circumvented if we move towards cashless economy.

Delinquent of soiled /fake currency: In cashless economy there will be no delinquent of soiled notes or fake currency reduced costs of functioning ATM'S. Speed and consummation of operations for customers, no delays and columns, no connections with bank staff's mandatory.

Challenges Of Cashless Economy:

Costly swipe machines: Swipe machines are not subsidy free. It can only be afforded by rich shop keepers. It cannot be expected from an auto driver or normal grocery seller to afford swipe card machines besides many street vendors, shop keepers don't know how to use swipe machines.

Language Barrier: Internet is an English based platform. The details on the plastic card are also in English. The message received on mobile regarding transaction is also in English. Therefore, it is required to use multiple languages regarding these processes or make everyone learn English.

Low Literacy Rule: Low literacy rate hinders the accessibility of banking services. Citizens should not only know how to read and write but also possess basic ICT literacy to fully enjoy the benefits of e-payments.

Few Banks in villages: The capital city New Delhi alone has about 20 HDFC bank branches.

There are several villages and Tehsils that don't even have one. More the banks, more the cash deposits in accounts. Banks in villages should be helpful in teaching the residents the process, usage and benefits of plastic cards.

Digital Literacy: More than half of the nation still does not know how to use a computer. People in rural areas still don't know about smart phone. Besides, there is lack of internet facilities and without it a country cannot become cashless. There are still many rural and urban areas where there the access of having 2G network is very difficult. Moreover, the cost of Internet access is very high as compared to developed countries.

Transactions are mainly in cash: Nearly 95% of transactions takes place in cash. Large size of informal/unorganized sector entities and workers prefer cash based transactions. They don't have required digital and fintech literacy.

Not enough debit or credit cards: India has over 24 million credit cards and over 660 million debit cards, now interesting bit about this number is that most of the people who have a debit or credit card have multiple cards. This means the actual number of people who have the debit or credit card is less. This also means that nearly half of the people in India don't have a bank cards.

Not enough smart phones: India has nearly 250 smart phone users right now, a number that is supposed to grow to around 350 million in 2017. It is just not enough to support an economy that aims to do major transaction through e-wallet. India has over 1200 million people. And that shows the number of people without a smart phone is just too big in India at the moment.

No law on data security: A lot of people don't trust the cashless transactions because there is no law security promises them security. What if all your transactions are done electronically and there is a breach, revealing all the purchases and transfers you have made out in public.

Sorry state of cyber security: Just a few months ago data related to over 32 lakhs debit cards was leaked from the network that connects all Indian banks. The state of cyber security in India is poor, very poor. Majority of Indian ATM's still run on windows XP, an operating that is 14 years old and is no longer supported by Microsoft.

Modes Of Cashless Transactions:

Credit card or debit card: Credit card or debit card is another cashless payment method. The usage of credit card and debit card was limited in India. However, usage of credit card and debit card is increasing now because of demonetization. The limitations of this payment method is an availability of swipe card facility at merchant end.

Cheque: The cheque is one of the oldest methods of cashless payment. It is a known method to everyone. In this method, you issue a cheque for the specific amount to someone else. The cheque get deposited in the respective bank. The bank processes a payment through a clearing house.

The entire transaction done through cheque gets recorded and there is a proof of payment. However, there are instances where cheque payments get dishonoured due to signature mismatch or insufficient fund. In order to avoid such issues, we can use other cashless payment options.

Demand draft: Demand draft is another rudimentary way of cashless transaction. It is safest option to receive payment from anyone. Demand draft (DD) never gets defaulted as it is signed by the banker. The disadvantage of DD and cheque is you need to visit a bank in order to deposit cheque and demand draft. The clearance of cheque or DD takes additional time.

Online transfers- neft or rtgs: The simplest method for cashless transactions is online transfer using NEFT or RTGS. In order to do online money transfer, you need internet banking facility. Online transfer using NEFT or RTGS is comparatively faster than cheque or DD. Online transfer can be done from anywhere using internet facility.

Mobile wallets: The next cashless method is a mobile wallet. You do not need a debit card, credit card or internet banking password for making payment using a mobile wallet. Just load money in your wallet via IMPS and use it on the move. You can download mobile wallet app from play store. Few examples of mobile wallets are Paytm, PayUmoney, Mobikwik, Phonepay, etc.

E-wallets: E-Wallet is next cashless payment option. E-Wallet can be used to purchase products starting from grocery to airline tickets. In order to use E-Wallet customer and merchant, both require a smart phone with active internet connections. The most popular example of E-Wallet is PayPal.

Upi apps: UPI is a mobile system which allows you to do various financial transactions on your smartphone. UPI allows you to send or receive money using virtual payment address without entering bank information. Merchants can enrol with banks to accept payments using UPI. Like in the case of a POS machine, the merchant would require a current account with a bank to accept UPI payments. The examples of few UPI apps are SBI Pay, Union Bank UPI App, Phonepe, etc.

Unstructured supplementary service data: You can use USSD cashless option if you don't have a smart phone or internet connection. Unstructured Supplementary Service Data is mobile banking service. From any mobile phone, you can dial *99# and use this service. You can do all these things which are available to a person with smartphones and internet connection. Almost including SBI, ICICI, BOB, AXIS BANK supports USSD payments options..

Aadhaar enabled payment system: Aadhaar Enabled Payment System (AEPS) is one of the best cashless payment methods. AEPS is like Micro ATM it uses smartphone and a finger-print scanner for the transaction. In order to use this facility, it is mandatory to link your Aadhaar card to your bank account. You can use AEPS in order to perform transactions like Aadhaar to AADHAAR fund transfer, Cash withdrawn, cash deposit, etc.

Gift card: The next cashless payment method is a gift card. Gift card is a readymade card and can be purchased from a merchant or from the bank. The gift card is loaded with a fix cash amount you can purchase any item from specific vendor by using a gift card.

Cashless Economy and Government Initiatives

The first move taken was the **demonetization** in November 2016. At the time of demonetization, India's cash to GDP ratio was around 12%. After demonetization, that ratio came down to around 9% of the GDP. But after that, it grew at a slower pace but steadily.

Paytm had witnessed 5 million daily usage post demonetisation as opposed to their average transaction of three million. It also saw a 700% increase in the overall traffic and a 1000% increase in the amount of money added to its account in the first two days of post-demonetization. Ola Money too saw a 1500% increase in its e-wallet.

UPI: India's biggest and boldest payments interface bet yet –

What is UPI? Unified Payments Interface has been launched by [National Payments Corporation of India](https://www.npci.org.in/) (NPCI) to further RBI's vision of transitioning towards a "less-cash" and more digital society. A set of standard application programming interfaces (APIs) provide an interoperable system for seamless transfers, and it has been built on top of the immediate payment service (IMPS) platform. The UPI ecosystem functions with 3 key players:

Payment service providers (PSPs) to provide the interface between the payer and the payee. Unlike wallets, here the payer and the payee can use two different PSPs.

Banks will provide the underlying accounts. In some cases, the bank and the PSP may be the same.

NPCI will act as the central switch by ensuring Virtual Payment Address (VPA) resolution, affecting credit and debit transactions through IMPS.

Direct Benefit Transfer (DBT): It is a scheme that was launched by the Government of India to transfer the benefits and subsidies of various social welfare schemes like LPG subsidy, Old Age Pension, Scholarship, [MGNREGA](https://mgnrega.gov.in/), etc. directly to the bank account of the beneficiaries. This allowed for the penetration of digital banking into rural India.

NITI Aayog Committee

The Centre has set up a committee headed by [NITI Aayog](https://niti.gov.in/) CEO Amitabh Kant, to formulate a strategy to expedite the process of transforming India into a cashless economy.

The panel is tasked with identifying various bottlenecks that are affecting access to digital payments.

The panel will engage regularly with all stakeholders – Central ministries, regulators, state governments, district administration, local bodies, trade and industry associations to promote adoption of digital payment systems.

The idea is to establish and monitor an implementation framework with strict timelines to ensure that nearly 80% of the transactions in India moves to the digital-only platform

The committee will also try to estimate the costs involved in various digital payments options and oversee the implementation of these measures to make such transactions between the government and citizens cheaper than cash-based transactions.

Pradhan Mantri Jan Dhan Yojana, one of the biggest financial inclusion initiatives in the world, was launched in 2014. It is a national mission on financial inclusion which has an integrated approach to bring about comprehensive financial inclusion and provide banking services to all households within the country. This scheme ensures access to a range of financial services like availability of basic savings, bank accounts, access to need-based credit, insurance and pension. It has played a significant role in the opening of bank accounts for the poor.

Panel of Chief Ministers – The Centre has announced the setting up of a 13-member committee, which includes 6 Chief Ministers, to come up with an action plan to rapidly expand the use of digital payment platforms across the country. The committee would be headed by Andhra Pradesh CM Chandrababu Naidu and would also include NITI Aayog Vice-Chairman and CEO and top names from the industry and academia as special invitees.

The terms of reference of the committee include identifying global best practices for implementing an economy primarily based on digital payments and examine the possibility of adopting these global standards in the Indian context.

The panel will also outline measures for rapid expansion and adoption of the system of digital payments like cards (Debit, Credit and pre-paid), Digital-wallets/ e-wallets, internet banking, Unified Payments Interface (UPI), banking apps, etc. and shall broadly come up with the roadmap to be implemented in one year.

Ratan Watal panel on digital payments

The panel, headed by former finance secretary Ratan Watal, was constituted in August to suggest ways to encourage India's movement towards a cashless economy.

Conclusion

The future of the cashless India looks pretty promising as the response of the country people towards this move of the government and the support towards it is a clear indication that the government's move is likely to succeed. The transparency in the economy will increase through the e-commerce transactions and the digital payment gateways which will increase the GDP of the economy. This will increase the credibility of the country and make a rise in investments. This step of cashless is truly going to create ripples of big success and it will help to attain vision of Prime Minister Modi's vision of Digital India.

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Risk and Return Evaluation of Nifty and BSE Equity Index Funds in India : Special Reference to HDFC Index Fund

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This study examines the risk and return performance of selected HDFC Index Mutual Fund schemes in India, with special reference to the HDFC BSE Sensex Index Fund – Direct Plan. The rapid growth of passive investing and increasing investor preference for low-cost investment avenues have contributed to the rising popularity of index funds. These funds aim to replicate the performance of benchmark indices such as the BSE Sensex and NIFTY 50, providing diversified exposure to equity markets while minimizing fund management costs. The study adopts a descriptive research design and relies exclusively on secondary data collected from HDFC Mutual Fund reports, AMFI publications, NSE, and BSE databases. The analysis focuses on Assets Under Management (AUM), historical returns, risk measures, and risk-adjusted performance indicators. Standard financial tools such as Standard Deviation, Beta, Sharpe Ratio, Treynor Ratio, and Jensen's Alpha are used to evaluate the performance and efficiency of selected index funds. The findings reveal that the HDFC Nifty 50 Index Fund and HDFC BSE Sensex Index Fund dominate the index fund segment, accounting for the majority of total AUM. These funds have delivered consistent long-term returns with relatively lower volatility, making them suitable for conservative investors. In contrast, funds such as the HDFC Nifty Midcap 150 Index Fund and HDFC Nifty Next 50 Index Fund generated higher returns over shorter periods but exhibited greater volatility. Equal-weight index funds demonstrated superior risk-adjusted performance, as reflected in higher Sharpe and Treynor ratios. The risk analysis indicates that all selected funds maintain a beta close to one, suggesting strong alignment with market movements. However, differences in standard deviation highlight variations in volatility among different index strategies. Although most schemes recorded negative Jensen's Alpha values, indicating slight underperformance relative to expected market returns, the overall results confirm that index funds provide a reliable and efficient investment option for long-term wealth creation. The study concludes that investors should select index funds based on their risk tolerance, return expectations, and investment horizon. While large-cap index funds offer stability and consistent performance, selective exposure to equal-weight and midcap index funds can enhance portfolio returns. The research emphasizes the growing significance of index funds in India's mutual fund industry and highlights the need for continuous investor education, product innovation, and efficient fund management to support the future growth of passive investing.

Keywords : Index Funds, Risk and Return, HDFC Index Fund, BSE Sensex, NIFTY 50, Mutual Funds, Sharpe Ratio, Treynor Ratio, Jensen's Alpha etc.,

Introduction

The Indian mutual fund industry has experienced rapid expansion over the last two decades, with equity index funds gaining prominence as a cost-effective and diversified investment option. These funds are designed to replicate the performance of major market indices such as the NIFTY 50 and the BSE Sensex, which serve as key indicators of overall market performance. This study examines the fundamental relationship between risk and return in the context of NIFTY and BSE equity index funds. Since these funds follow a passive investment strategy, their performance is closely aligned with benchmark indices, making the evaluation of risk-adjusted returns essential. The study emphasizes how effectively these funds generate returns relative to the level of risk undertaken.

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The research further highlights the role of major stock exchanges such as the National Stock Exchange of India and the Bombay Stock Exchange in shaping market trends and providing benchmarks for index funds. Despite their passive management, these funds are exposed to various risks including market fluctuations, tracking errors, and macroeconomic influences. By analysing returns and risk-adjusted measures across different time periods, the study aims to assess their consistency, efficiency and investment suitability. The findings are expected to assist investors and financial analysts in making informed decisions and to contribute to a better understanding of index fund performance in the Indian capital market.

Review of Literature

Venkata R. V and Pavan Kumar S (2025) this study analyses the return, risk, and Sharpe ratio of selected private and public sector bank stocks in India from 2015 to 2024 to assess risk-return efficiency and identify stable investment options. Results show that ICICI Bank delivered the highest return among private banks, while Kotak Mahindra had the best risk-adjusted performance; in the public sector, Indian Bank had the highest return with high volatility, and Canara Bank offered balanced performance. ANOVA results indicated no significant difference between mean returns and risks across both sectors, while Sharpe ratio analysis highlighted Kotak Mahindra, HDFC, and Canara Bank as top performers. NIFTY served as a consistent benchmark, providing investors with insights for strategic, risk-adjusted investment decisions.

Praveen Kumar T and M Irfan (2025) the present study focuses on analysing the risk-adjusted performance of selected mutual funds in India by applying widely accepted financial indicators, namely the Sharpe Ratio, Treynor Ratio and Jensen's Alpha. The main purpose is to assess how effectively equity and debt mutual funds generate returns in relation to the level of risk undertaken. The research is based on secondary data covering the period from 2016 to 2024. It evaluates the consistency of fund performance over time, examines the association between risk and return, and identifies whether meaningful differences exist among different categories of mutual funds. Statistical techniques such as analysis of variance (ANOVA) and correlation analysis are used to ensure the reliability of the results. The findings suggest that equity mutual funds tend to provide superior risk-adjusted returns compared to debt funds, although they are associated with greater fluctuations in performance. Funds managed by leading institutions demonstrate relatively stronger outcomes in terms of return efficiency. The statistical results further confirm that variations among fund categories are significant and that risk and return are closely related. This study contributes to a better understanding of mutual fund performance and offers practical guidance for investors and fund managers. It emphasizes the need to consider individual risk tolerance and financial objectives when making investment decisions.

Unice Jecinth B and Moli Ghosh (2024) this study examines ten years of share price movements of selected Sensex banking stocks traded on India's two major stock exchanges to understand their performance, risk, and volatility. The stock exchange provides a platform for trading financial instruments such as equity shares, mutual funds, bonds, and debentures. In India, the financial sector plays an important role in economic growth and stock market activity. Banking stocks reflect the overall condition of the economy and attract significant investor interest. Since risk and return are closely related, understanding their relationship is important for better investment decisions. This research analyses the risk and return of selected Sensex banking stocks through a comparison of the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE). The study uses secondary data covering the period from 2013 to 2023. Statistical tools are used to measure returns and risk levels. The findings help investors assess market performance and choose investments according to their risk tolerance

Nagarjuna B (2024) this study investigates the performance of ESG and socially responsible investment (SRI) funds in India, where ESG funds represent only 0.3% of mutual fund assets. High-quality ESG portfolios outperform lower-quality ones during crises, though ESG index returns are often not statistically different from the Nifty. Traders experienced negative periodical returns from the Nifty 100 ESG index, with significant differences across various Nifty thematic indices, highlighting the growing importance of ESG-focused strategies for investors and corporations

1. Muhammed F. E and Binodini Devi E (2024) this study analyses the performance of 30 top-tier equity mutual funds before, during, and after the COVID-19 pandemic using risk measures (standard deviation, beta) and performance metrics (alpha, Sharpe ratio, Treynor ratio). Findings reveal increased volatility during the pandemic, with a shift from negative to positive alpha post-pandemic, indicating improved fund performance. Small-cap, mid-cap and value/contra funds showed attractive risk-adjusted returns during the pandemic, while large-cap funds benefited from systematic risk. Overall, post-pandemic results reflect market recovery, offering strategic insights for investors and fund managers

Reddy S and Baskaran S (2024) this study analyses the risk and return profiles of selected companies listed in the Nifty index to understand their investment potential. Using quantitative methods, the authors employed statistical tools like Beta, Standard Deviation and Sharpe Ratio to measure market risk and returns. Data was collected over a multi-year period from secondary sources such as stock prices and financial reports. The findings indicate variability in risk-return profiles among Nifty companies, with some demonstrating superior risk-adjusted returns. The study highlights that investors should consider both systematic risk and returns before portfolio allocation. It also identifies sectors with more stable companies. This research contributes to better investment decision-making in the Indian equity market. The authors suggest further studies on sector-wise risk analysis

Objectives of the study

To analyse and examine HDFC of the number of index fund schemes offered by Asset Management Companies (AMCs) and their AUM distribution in terms of their share of total Assets Under Management for index fund schemes.

To evaluate HDFC Index Fund - BSE Sensex Plan - Direct Plan: This fund tracks the BSE Sensex, which comprises 30 large-cap stocks traded on the Bombay Stock Exchange (BSE). It aims to replicate the performance of these benchmark index constituents.

The risk-adjusted performance of index funds using Sharpe Ratio, Treynor's Ratio and Jensen's Alpha over a specified time period.

Research Methodology

The study on examining the risk-return trade-off of BSE and NSE equity index funds adopts a descriptive research approach, aiming to observe and describe the historical price movements, returns and risk metrics associated with BSE and NSE equity index funds without manipulating variables. Data is collected from existing sources and analysed quantitatively using statistical measures such as standard deviation, beta, Sharpe ratio and correlation coefficients to quantify the risk-return relationship. By focusing on description and explanation, the study provides valuable insights into the risk-return dynamics of BSE and NSE equity index funds without intervening in the natural market conditions, of HDFC Index Fund - BSE Sensex Plan - Direct Plan: This fund tracks the BSE Sensex, which comprises 30 large-cap stocks traded on the Bombay Stock Exchange (BSE). It aims to replicate the performance of these benchmark index constituents, thus classifying it as descriptive research.

Source of Data and Data Collection

he presents study relies exclusively on secondary data, sourced from credible and authoritative databases to evaluate the performance of Index Fund schemes of **HDFC Index Fund - BSE Sensex Plan - Direct Plan**: This fund tracks the BSE Sensex, which comprises 30 large-cap stocks traded on the Bombay Stock Exchange (BSE). It aims to replicate the performance of these benchmark index constituents.

in India.

Limited Data Availability

The analysis relies on secondary data from published sources (AMCs, NSE, BSE, AMFI, etc.). Any errors or inconsistencies in reported data may influence the findings.

Time Period Constraint

The study evaluates returns and risks for a specific time horizon. Results may differ if a longer or shorter time frame is considered, especially given changing market cycles.

Risk Measures Limitation

The study primarily uses standard deviation and beta as measures of risk. Other advanced risk metrics (e.g., Sharpe ratio, Sortino ratio, Value at Risk) are not covered in detail.

Data analysis and interpretation

Table 7.1

AUM Distribution of HDFC Index Mutual Funds (As on 31st March 2025)

(₹ in Crores)

Sl. No	Index Fund Scheme Name	AUM	% of Total Funds
1	HDFC BSE 500 Index Fund	208.37	0.62
2	HDFC BSE Sensex Index Fund - Direct Plan	7,913.75	23.68
3	HDFC Nifty 100 Equal Weight Index Fund	334.62	1.00
4	HDFC Nifty 100 Index Fund	317.69	0.95
5	HDFC NIFTY 100 Low Volatility 30 Index Fund	334.50	1.00
6	HDFC Nifty 50 Index Fund - Direct Plan	19,046.29	57.00
7	HDFC Nifty India Digital Index Fund	200.77	0.60
8	HDFC Nifty Large Midcap 250 Index Fund	445.13	1.33
9	HDFC Nifty Midcap 150 Index Fund	291.20	0.87
10	HDFC Nifty Next 50 Index Fund	1,758.37	5.26
11	HDFC Nifty Realty Index Fund	106.65	0.32
12	HDFC Nifty Top 20 Equal Weight Index Fund	70.51	0.22
13	HDFC Nifty100 Quality 30 Index Fund	194.78	0.58
14	HDFC NIFTY200 Momentum 30 Index Fund	668.30	2.00
15	HDFC Nifty50 Equal Weight Index Fund	1525.86	4.57
Total Asset Under Management		33416.79	100.00

(Source: AMFI and HDFC Mutual Fund Scheme Reports)

Analysis

The distribution of Assets Under Management (AUM) across HDFC's index mutual fund schemes shows a clear investor preference for core large-cap indices. The HDFC Nifty 50 Index Fund - Direct Plan dominates the portfolio with an AUM of ₹19,046.29 crore, accounting for a substantial 57% of the total. This overwhelming preference indicates that investors are more inclined towards stable, low-cost and market-representative investments. Such dominance also reflects the popularity of the Nifty 50 index in India as a barometer for equity market performance, especially among passive investors and institutional clients. The HDFC BSE Sensex Index Fund - Direct Plan is the next major fund, with an AUM of ₹7,913.75 crore, contributing 23.68% to the total fund corpus. When combined with the Nifty 50 Fund, these two schemes alone constitute over 80% of the total AUM, highlighting the market's overwhelming reliance on top-tier indices. These funds are considered less volatile and are likely preferred for long-term wealth accumulation through systematic investment plans (SIPs), thanks to their broad exposure to India's most liquid and stable companies. On the other hand, several other index funds such as the Nifty50 Equal Weight Index Fund ₹1,525.86 crore, Contributing 4.75%, Nifty 100 Equal Weight, Nifty 100 Index and Low Volatility 30 Index Fund, each hold modest shares, around 1% to 1.06% of the total AUM. These products aim to provide diversified or factor-based exposure, catering to more nuanced investor strategies. However, the relatively small allocations suggest that investor awareness and confidence in equal-weight or low-volatility strategies are still growing. These funds offer potential for better risk-adjusted returns but may require more education and marketing to gain traction. Thematic and sector-specific funds such as the Nifty India Digital Index Fund (₹200.77 Cr, 0.60%), Nifty Realty Index Fund (₹106.65 Cr, 0.32%) and Nifty Quality 30 Index Fund (₹194.78 Cr, 0.58%) hold comparatively smaller AUMs, reflecting their niche appeal. These schemes are likely targeted at investors seeking to capitalize on sectoral or theme-based growth trends. Their lower share in the total AUM suggests either their recent launch or relatively limited acceptance among retail investors. Despite being innovative, these offerings need consistent performance records and investor outreach to scale up.

Inferences

The overall AUM of ₹33,416.79 crore across 14 index funds highlights HDFC Mutual Fund's wide product offering in the passive investment space. While traditional large-cap index funds attract the lion's share, the presence of equal-weight, volatility-focused and thematic funds indicates an effort to diversify the passive investment landscape. The fund house now has the opportunity to balance this concentration by promoting underrepresented schemes and educating investors about alternative indexing strategies. This would enhance product diversification, reduce overdependence on a few indices and align with evolving investor needs in India's maturing mutual fund market.

Table 7.2 Performance Analysis of HDFC Index Mutual Fund Schemes

(Returns are in %)

Sl. No	Index Fund Scheme Name	YTD	1Y	2Y	3Y	5Y	10Y
1	HDFC BSE 500 Index Fund	-2	4	20	-	-	-
2	HDFC BSE Sensex Index Fund - Direct Plan	3	9	16	13	20	13
3	HDFC Nifty 100 Equal Weight Index Fund	-1	2	24	15	-	-
4	HDFC Nifty 100 Index Fund	2	6	18	13	-	-
5	HDFC NIFTY 100 Low Volatility 30 Index Fund	1	-	-	-	-	-
6	HDFC Nifty 50 Index Fund - Direct Plan	3	9	17	14	21	13
7	HDFC Nifty India Digital Index Fund	-13	-	-	-	-	-
8	HDFC Nifty Large Midcap 250 Index Fund	-3	-	-	-	-	-
9	HDFC Nifty Midcap 150 Index Fund	-7	4	28	-	-	-
10	HDFC Nifty Next 50 Index Fund	-5	-2	27	15	-	-
11	HDFC Nifty Realty Index Fund	-16	-10	-	-	-	-
12	HDFC Nifty Top 20 Equal Weight Index Fund	-	-	-	-	-	-
13	HDFC Nifty100 Quality 30 Index Fund	-	-	-	-	-	-
14	HDFC NIFTY200 Momentum 30 Index Fund	-11	-12	-	-	-	-
15	HDFC Nifty50 Equal Weight Index Fund	8	-5	16	18		

(Source: HDFC Mutual Fund Returns Data)

Analysis

The performance data of HDFC's index fund schemes reveals a mixed outlook across different investment horizons. Among the top performers over longer durations, the HDFC Nifty 50 Index Fund - Direct Plan and HDFC BSE Sensex Index Fund - Direct Plan stand out, delivering consistent returns across 1-year, 3-year, 5-year and 10-year periods. The Nifty 50 Fund shows a robust 21% return over 5 years and 13% over 10 years, aligning with its large AUM and stable investor confidence. Similarly, the Sensex Index Fund shows a comparable 10-year performance of 13%, reinforcing the appeal of broad-based large-cap indices for long-term investors. Over a 2-year horizon, more diversified and equal-weight strategies have demonstrated impressive results. The HDFC Nifty 100 Equal Weight Index Fund and the HDFC Nifty Midcap 150 Index Fund have returned 24% and 28%, respectively, indicating outperformance of midcap and equal-weight strategies during recent market phases. The Nifty Next 50 Index Fund also achieved a 27% return over 2 years, suggesting that investors with higher risk tolerance benefited significantly from exposure to broader market segments beyond the traditional large-cap basket. Short-term returns, however, reflect considerable volatility, especially in thematic and sectoral funds. The HDFC Nifty India Digital Index Fund and HDFC NIFTY200 Momentum 30 Index Fund posted steep negative YTD returns of -13% and -11%, respectively, indicating underperformance of growth and momentum themes in recent market conditions. The Nifty Realty Index Fund was the weakest performer with -16% YTD and -10% 1-year returns, likely impacted by sector-specific headwinds. These results highlight the cyclical nature of thematic funds and the importance of timing and risk awareness for investors seeking alpha through non-core exposures.

HDFC Nifty50 Equal Weight Index Fund shows short-term volatility (-5% in 1Y) but demonstrates strong medium-term returns (16-18% over 2-3 years), reflecting the potential benefits of the equal-weight strategy, which reduces concentration risk of heavyweights in the Nifty 50. It is more suitable for long-term investors who can tolerate short-term fluctuations for better diversification benefits. Some funds, such as the Nifty Top 20 Equal Weight, Nifty Quality 30 and Nifty 100 Low Volatility 30, have limited or no performance data across various periods. This could be due to their recent launch, short track record, or lack of sufficient historical performance to evaluate. Investors should be cautious when approaching such schemes, as incomplete data may hinder return comparisons or performance benchmarking. It also underscores the need for HDFC Mutual Fund to provide clearer return disclosures to facilitate better decision-making.

Inferences

In summary, the data shows that core large-cap index funds continue to deliver stable and attractive returns over long durations, making them a reliable choice for conservative investors. In contrast, equal-weight, midcap, Nifty50 Equal Weight and Next 50 strategies have shown high returns over 2 to 3 years, making them suitable for moderately aggressive investors. Meanwhile, thematic and momentum strategies face significant short-term risks and are best approached with tactical allocation. A diversified approach combining core and satellite index strategies can help optimize returns and manage risk across market cycles.

Table 7.3

Risk Metrics of Selected HDFC Index Mutual Funds – Standard Deviation and Beta

Scheme Name	Standard Deviation	Beta
HDFC BSE Sensex Index Fund - Direct Plan	12.97	0.99
HDFC Nifty 100 Equal Weight Index Fund	14.59	0.99
HDFC Nifty 100 Index Fund	13.34	0.99
HDFC Nifty 50 Index Fund - Direct Plan	13.00	0.99
HDFC Nifty Next 50 Index Fund	17.75	0.99
HDFC Nifty50 Equal Weight Index Fund	13.24	0.99

(Source: HDFC Mutual Fund Factsheets and Risk Reports)

Analysis

The risk-return profile of mutual fund schemes is critical in evaluating their consistency and volatility. This Table provides the Standard Deviation and Beta of selected HDFC index funds, offering insights into their risk levels in relation to market movements. Standard deviation measures the fund's volatility or how widely its returns deviate from the mean, while beta indicates the fund's sensitivity to market movements, with a beta of 1 implying the same level of risk as the benchmark index. Among the schemes listed, the HDFC Nifty Next 50 Index Fund exhibits the highest standard deviation at 17.75, suggesting it is the most volatile among the group. This aligns with the nature of the Next 50 Index, which includes emerging large and mid-cap companies that are inherently more volatile than the top 50 stocks. Despite its high standard deviation, its beta remains at 0.99, indicating that while the fund moves closely with the market in direction, its magnitude of returns can vary more widely, thus implying greater short-term risk. In contrast, core index funds such as the HDFC Nifty 50 Index Fund - Direct Plan and HDFC BSE Sensex Index Fund - Direct Plan show lower standard deviations of 13.00 and 12.97 respectively, reflecting lower volatility. These funds invest in well-established, large-cap companies, which typically provide more stable returns and lower risk. Despite the lower

volatility, both funds still have a beta of 0.99, meaning their performance closely mirrors that of the benchmark index without any excess systemic risk. Funds like the HDFC Nifty 100 Equal Weight Index Fund and the HDFC Nifty 100 Index Fund show slightly elevated volatility with standard deviations of 14.59 and 13.34, respectively. The equal-weight strategy exposes the fund to smaller constituents more evenly, increasing volatility compared to market-cap-weighted approaches. Nonetheless, these funds also maintain a beta of 0.99, reinforcing that their market correlation remains steady even as intra-portfolio dynamics may vary.

Inferences

Overall, this analysis highlights that while beta values across all these HDFC index funds are uniformly 0.99, indicating strong correlation with the broader market, the standard deviation varies across fund strategies, depending on the index composition and weight methodology. Investors seeking lower volatility may prefer the Nifty 50 or Sensex-based funds, while those with higher risk appetite and long-term horizon may consider the Nifty Next 50 or equal-weighted index funds for potential outperformance, albeit with increased volatility.

Table 7.4

Risk-Adjusted Performance Metrics of Selected HDFC Index Mutual Funds – Sharpe Ratio, Jensen's Alpha and Treynor's Ratio

Scheme Name	Sharpe Ratio	Jenson's Alpha	Treynor's Ratio
HDFC BSE Sensex Index Fund - Direct Plan	0.55	-0.21	0.07
HDFC Nifty 100 Equal Weight Index Fund	0.64	-0.49	0.09
HDFC Nifty 100 Index Fund	0.55	-0.37	0.07
HDFC Nifty 50 Index Fund - Direct Plan	0.58	-0.21	0.08
HDFC Nifty Next 50 Index Fund	0.54	-0.53	0.10
HDFC Nifty50 Equal Weight Index Fund	0.76	-0.43	0.10

(Source: HDFC Mutual Fund Factsheets and Risk Reports)

Analysis

The risk-adjusted performance metrics of HDFC Index Mutual Funds, including the Sharpe Ratio, Jensen's Alpha and Treynor's Ratio, offer insights into how well these funds compensate investors for the risk they undertake. Each metric provides a different lens for evaluating the fund's efficiency in generating returns relative to the risk involved. The Sharpe Ratio measures the excess return per unit of total risk (volatility) and is a critical indicator of a fund's overall risk-adjusted performance. Among the funds listed, the HDFC Nifty 50 Equal Weight Index Fund performs the best, with a Sharpe ratio of 0.76, indicating that it offers relatively high returns per unit of total risk. This suggests that, despite the increased volatility in the equal-weight strategy, the fund generates higher returns for each unit of risk assumed. On the other hand, the HDFC Nifty Next 50 Index Fund, with a Sharpe ratio of 0.54, demonstrates the least favorable risk-adjusted return, indicating that its higher volatility may not be as well-compensated by returns. Jensen's Alpha measures the excess return of a fund compared to the expected return based on its beta, providing insight into the manager's ability to generate returns beyond market expectations. The HDFC Nifty 100 Equal Weight Index Fund exhibits the lowest Jensen's Alpha of -0.49, indicating that the fund has underperformed its expected returns based on its market risk exposure. Similarly, the HDFC Nifty 100 Index Fund also has a negative Jensen's Alpha of -0.37, which suggests underperformance relative to its benchmark, though not as severely as the Equal Weight Fund. Funds like the HDFC Nifty 50 Index Fund - Direct Plan and HDFC BSE Sensex Index Fund - Direct Plan both have negative Jensen's Alpha values of -0.21, showing modest underperformance in terms of generating returns above their market expectations. The Treynor's Ratio evaluates a fund's returns relative to the systematic risk (beta) taken by the investor. The HDFC Nifty 100 Equal Weight Index Fund and HDFC Nifty50 Equal Weight Index Fund both score the highest Treynor's Ratio of 0.10, suggesting that these funds are effectively managing their systematic risk and providing attractive returns relative to market movements. The HDFC Nifty Next 50 Index Fund, with a Treynor's Ratio of 0.10, also stands out, albeit slightly behind the equal-weighted strategies, indicating that its higher volatility may be more efficiently compensated by market-driven returns.

Inferences

Overall, these metrics highlight that equal-weighted index funds like HDFC Nifty 50 Equal Weight Index Fund and HDFC Nifty 100 Equal Weight Index Fund provide a better balance of risk-adjusted returns, although they still face negative Jensen's Alpha, indicating some underperformance relative to expectations. Meanwhile, core index funds like HDFC Nifty 50 Index Fund - Direct Plan and HDFC BSE Sensex Index Fund - Direct Plan show moderate risk-adjusted returns but continue to underperform their benchmarks to some extent. The Treynor's Ratio further emphasizes that both equal-weighted and Nifty Next 50 funds are managing systematic risk relatively efficiently, making them a suitable choice for investors seeking risk-adjusted returns based on broader market movements.

Criticism and Challenges

Despite their advantages, index funds are not without criticism and challenges

Limited Outperformance Potential: By design, index funds aim to match rather than beat the market. This can limit their potential to outperform during bull markets or in specific sectors where active management may capitalize on opportunities.

Tracking Error: While index funds aim to replicate benchmark performance, factors such as transaction costs, dividend reinvestment policies and fund management decisions can lead to slight deviations or tracking errors.

Market Distortions: The popularity of index funds and ETFs has raised concerns about their impact on market efficiency, stock correlations and price distortions, especially in highly concentrated sectors.

Lack of Flexibility: Index funds adhere strictly to their benchmark rules, limiting the fund manager's ability to deviate from the index composition based on market conditions or investment opportunities.

Dependency on Benchmark Indices: Index funds are inherently tied to the performance and composition of their benchmark indices, making them susceptible to changes in index methodology, sector weights and economic cycles.

Index funds represent a powerful tool for investors seeking broad market exposure, diversification and cost-efficient investment solutions. They have revolutionized the asset management industry by offering a passive alternative to actively managed funds, aligning with the principles of simplicity, transparency and long-term wealth accumulation. While facing criticism and challenges, index funds continue to evolve and expand, catering to a diverse range of investor preferences and investment objectives globally. As financial markets evolve and investor preferences shift, index funds are expected to remain a pivotal component of investment portfolios, providing stability, predictability and accessibility to a wide range of investors seeking to participate in the global economy's growth.

Suggestion

For conservative investors with a short- to medium-term horizon, the HDFC Nifty 50 Index Fund – Direct Plan and the HDFC BSE Sensex Index Fund – Direct Plan are the most suitable options. With 5-year returns of 21% and 20% respectively, and 10-year returns at 13% each, coupled with low volatility (SD ~13) and beta of 0.99, these funds provide stable, benchmark-linked performance. Their dominance in AUM (together accounting for over 85% of total HDFC index fund assets) reinforces strong investor trust, making them dependable for wealth preservation and steady compounding. For investors with a long-term and growth-oriented approach, selective allocation to funds such as the HDFC Nifty Midcap 150 Index Fund and the HDFC Nifty Next 50 Index Fund can enhance portfolio returns. Despite higher volatility (SD 17.75 for Next 50), these funds have delivered 27–28% returns over 2 years, making them attractive for SIP-based investing where the impact of short-term fluctuations can be averaged out. These allocations should complement, rather than replace, core holdings in large-cap indices, thus balancing growth and stability. On a risk-adjusted basis, the HDFC Nifty 50 Equal Weight Index Fund, with the highest Sharpe Ratio (0.76) and Treynor's Ratio of 0.10, stands out for offering superior returns relative to risk. However, since all HDFC index funds report negative Jensen's Alpha values (-0.21 to -0.53), investors must remain realistic and understand that these schemes are designed primarily for benchmark-tracking rather than consistent outperformance. Therefore, investors should use risk-adjusted metrics like Sharpe and Treynor when comparing funds, while relying on broad-based large-cap funds for stability and selective midcap exposure for growth.

Conclusion

For investors, the findings underscore the importance of aligning fund choice with risk appetite and investment horizon—anchoring portfolios in large-cap index funds while selectively diversifying into higher-return, risk-adjusted alternatives. For AMCs, the study highlights the need to minimize tracking error, optimize cost structures, innovate in product offerings, and strengthen investor education to capture the evolving passive investment demand in India. Ultimately, the study confirms that index funds are emerging as cornerstone instruments of passive investing in India and their continued growth will depend on how effectively AMCs balance simplicity, transparency, long-term performance and innovation in meeting the diverse needs of investors across the risk spectrum.

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OriginalArticle

Effect Of Mergers and Acquisitions on Financial Performance of Indian Commercial Banks: A Study of HDFC Bank and Canara Bank

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Mergers and acquisitions (M&A) have emerged as a significant strategic instrument for strengthening the Indian banking sector by enhancing operational efficiency, expanding market share, improving financial stability, and achieving economies of scale. The Indian banking industry has witnessed major consolidation initiatives, including the merger of HDFC Bank with Housing Development Finance Corporation in 2023 and the merger of Canara Bank with Syndicate Bank in 2020, both aimed at creating stronger and more competitive financial institutions. This study examines the impact of these mergers on the financial performance of the selected commercial banks by analyzing key financial indicators such as Return on Assets (ROA), Return on Equity (ROE), Net Interest Margin (NIM), Capital Adequacy Ratio (CAR), Gross Non-Performing Assets (GNPA), and operational efficiency during the pre-merger and post-merger periods. The study is based on secondary data collected from annual reports, Reserve Bank of India publications, and financial statements. The findings reveal that the mergers contributed to increased business volume, broader customer reach, improved resource utilization, and enhanced market competitiveness, although both banks faced short-term integration challenges, including liquidity pressures, technology integration issues, and organizational restructuring costs. The analysis further indicates that while profitability and efficiency experienced temporary fluctuations immediately after the mergers, the long-term impact has been positive, resulting in stronger financial performance and sustainable growth. Therefore, the study concludes that effective merger strategies can significantly enhance the operational and financial strength of commercial banks in India and contribute to the overall stability and development of the banking sector.

Keywords: Mergers and Acquisitions, Banking Consolidation, Financial Performance, HDFC Bank, Canara Bank, Syndicate Bank, HDFC Ltd., Profitability, Asset Quality, Operational Efficiency, Indian Commercial Banks.

Introduction:

The banking sector plays a crucial role in the economic development of a country by mobilizing savings, facilitating credit creation, and supporting industrial and commercial growth. In recent years, the Indian banking industry has undergone significant transformation due to globalization, technological advancements, regulatory reforms, and increasing competition. To enhance operational efficiency, strengthen financial stability, improve asset quality, and achieve economies of scale, mergers and acquisitions (M&A) have emerged as an important strategic tool for banking institutions. Banking consolidation has been actively encouraged by the Government of India and the Reserve Bank of India (RBI) to create stronger and more competitive banks capable of supporting the growing needs of the economy (**Reserve Bank of India, 2024**). Among the major banking consolidations in India, the merger of HDFC Bank with HDFC Ltd. in 2023 and the merger of Canara Bank with Syndicate Bank in 2020 represent significant milestones in the evolution of the Indian banking sector. These mergers were aimed at expanding customer reach, improving operational capabilities, optimizing resource utilization, and enhancing long-term shareholder value (**HDFC Bank Annual Report, 2024; Canara Bank Annual Report, 2024**). Although mergers are expected to generate synergies and improve financial performance, they may also create short-term challenges such as integration costs, liquidity pressures, cultural differences, and technology-related issues.

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Therefore, assessing the impact of mergers on financial performance has become an important area of research. This study examines the effect of mergers and acquisitions on the financial performance of Indian commercial banks, with special reference to HDFC Bank and Canara Bank, by analyzing key financial indicators such as profitability, liquidity, asset quality, and operational efficiency during the pre-merger and post-merger periods. The findings of the study are expected to provide valuable insights into the effectiveness of banking consolidation as a strategy for achieving sustainable growth and financial stability in the Indian banking sector (Kumar & Bansal, 2008; RBI, 2024; HDFC Bank Annual Report, 2024; Canara Bank Annual Report, 2024).

Objectives of the Study:

1. To examine the impact of mergers and acquisitions on the financial performance of HDFC Bank and Canara Bank.
2. To compare the profitability, liquidity, and operational efficiency of the selected banks during the pre-merger and post-merger periods.
3. To assess the effect of mergers on asset quality by analyzing key indicators such as Gross Non-Performing Assets (GNPA) and Net Non-Performing Assets (NNPA).
4. To evaluate whether mergers and acquisitions have contributed to the overall growth, competitiveness, and financial stability of HDFC Bank and Canara Bank.

Research Methodology:

Research Design

The study adopts a **descriptive and analytical research design** to examine the impact of mergers and acquisitions on the financial performance of selected Indian commercial banks. The research evaluates the changes in financial performance before and after the merger through financial ratio analysis and statistical testing. The study is empirical in nature and focuses on assessing the effect of mergers and acquisitions on the financial performance of HDFC Bank and Canara Bank.

Selection of Banks

The study is confined to two major Indian commercial banks:

HDFC Bank merged with HDFC Ltd. in 2023

Canara Bank merged with Syndicate Bank in 2020

These banks were selected because they represent significant merger transactions in the Indian private and public banking sectors.

Sources of Data

The study is based entirely on secondary data collected from Annual Reports of HDFC Bank and Canara Bank, Publications of the Reserve Bank of India (RBI), Research journals, articles, and books, Official bank websites and financial databases and published reports.

Period of Study

The analysis covers both pre-merger and post-merger periods.

HDFC Bank: Pre-merger Period: 2020–21 to 2022–23 and Post-merger Period: 2023–24 to 2025–26 (subject to data availability)

Canara Bank: Pre-merger Period: 2017–18 to 2019–20 and Post-merger Period: 2020–21 to 2022–23

Tools and Techniques for Analysis

The financial performance of the selected banks is evaluated using the following financial ratios:

Profitability Ratios: Return on Assets (ROA), Return on Equity (ROE) and Net Profit Margin (NPM)

Liquidity and Efficiency Ratios: Credit-Deposit Ratio (CD Ratio) and Net Interest Margin (NIM)

Asset Quality Ratios: Gross Non-Performing Assets Ratio (GNPA) and Net Non-Performing Assets Ratio (NNPA)

Scope of the Study

The study is limited to analyzing the impact of mergers and acquisitions on the financial performance of HDFC Bank and Canara Bank. The analysis is based on selected financial ratios and secondary data available from published sources.

Hypothesis Testing

H₀ (Null Hypothesis): There is no significant difference in the financial performance of the bank between the pre-merger and post-merger periods.

H₁ (Alternative Hypothesis): There is a significant difference in the financial performance of the bank between the pre-merger and post-merger periods.

Comparative Analysis of HDFC Bank and Canara Bank: Pre- and Post-Merger Financial Ratios:

Financial Ratio	HDFC Bank Pre-Merger	HDFC Bank Post-Merger	Change	Canara Bank Pre-Merger	Canara Bank Post-Merger	Change
ROA (%)	1.78	1.70	↓ -0.08	-0.31	0.49	↑ +0.80
ROE (%)	15.47	13.50	↓ -1.97	-2.19	10.31	↑ +12.50
Net Profit	27.32	23.41	↓ -3.91	-4.68	8.16	↑ +12.84

Margin (%)						
Credit-Deposit Ratio	0.86	0.98	↑ +0.12	0.71	0.66	↓ -0.05
Net Interest Margin (%)	3.57	3.02	↓ -0.55	1.95	2.19	↑ +0.24
Cost-to-Income Ratio (%)	37.85	37.39	↑ Improved	51.67	46.69	↑ Improved
Gross NPA Ratio (%)	1.04	1.24	↓ Deteriorated	9.67	7.45	↑ Improved
Net NPA Ratio (%)	0.33	0.38	↓ Deteriorated	5.69	2.73	↑ Improved

Comparative Summary

Parameter	Better Performing Bank After Merger	Remarks
ROA	Canara Bank	Significant improvement from negative to positive returns
ROE	Canara Bank	Strong increase in shareholder returns
Net Profit Margin	Canara Bank	Major improvement in profitability
Credit-Deposit Ratio	HDFC Bank	Higher loan deployment after merger
Net Interest Margin	Canara Bank	Improved earning efficiency
Cost-to-Income Ratio	HDFC Bank	Maintained superior operational efficiency
Gross NPA Ratio	HDFC Bank	Much lower NPAs despite slight increase
Net NPA Ratio	HDFC Bank	Better asset quality overall

Overall Comparative Conclusion:

Aspect	HDFC Bank	Canara Bank
Profitability	Declined after merger	Improved significantly
Operational Efficiency	Stable with minor improvements	Improved substantially
Asset Quality	Slight deterioration but remains strong	Significant improvement
Lending Performance	Improved	Slight decline
Overall Merger Impact	Mixed Results	Strong Positive Results

Comparative Conclusion:

Aspect	HDFC Bank	Canara Bank
Profitability Impact	Negative	Positive
Efficiency Impact	Mixed	Positive
Asset Quality Impact	Slightly Negative	Positive
Overall Merger Outcome	Moderate Success with Short-Term Challenges	Highly Successful
Post-Merger Financial Performance	Weakened in short term	Improved significantly

The merger had different impacts on the two banks. HDFC Bank experienced a short-term decline in profitability and asset quality, though it maintained strong overall financial fundamentals and improved lending activity. In contrast, Canara Bank witnessed substantial improvements in profitability, efficiency, and asset quality following its merger.

Therefore, based on the comparative ratio analysis, Canara Bank derived greater immediate financial benefits from its merger, whereas HDFC Bank's merger appears to be a long-term strategic consolidation whose benefits may materialize gradually in future years. This indicates that the post-merger performance of Canara Bank was stronger than that of HDFC Bank during the study period.

Conclusion:

The study reveals contrasting merger outcomes. While HDFC Bank's merger with HDFC Ltd. resulted in temporary declines in profitability and asset quality despite increased lending capacity, Canara Bank's merger with Syndicate Bank led to substantial improvements in profitability, operational efficiency, and asset quality.

Therefore, among the two banks, Canara Bank demonstrates stronger post-merger financial performance and greater realization of merger benefits, whereas HDFC Bank's merger benefits may be more visible over the long term as integration effects stabilize. This indicates that the success of a merger depends not only on scale and market expansion but also on the effectiveness of post-merger integration and operational management.



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The Impact of Artificial Intelligence on Modern Human Resource Management

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Artificial Intelligence (AI) is transforming the healthcare industry by enhancing service delivery and improving operational efficiency. This study examines the impact of AI interventions in Human Resource Management (HRM) practices, with a particular focus on improving the quality of healthcare services. AI-driven solutions help address critical challenges such as workforce diversity, talent shortages, and the increasing demand for personalized patient care. The integration of AI into HRM has emerged as a revolutionary force in the modern healthcare environment. By streamlining recruitment, employee management, performance evaluation, training, and workforce planning, AI has the potential to significantly improve the efficiency and effectiveness of healthcare organizations. This study aims to explore and evaluate how AI-based HRM interventions can contribute to better service quality in the healthcare sector. Rapid technological advancements are reshaping the healthcare industry, and AI is increasingly recognized as a major driver of innovation. In this context, the incorporation of AI into HRM practices represents a major paradigm shift that can positively influence the quality of services delivered by healthcare institutions. However, despite the promising potential of AI in HRM, its successful implementation requires a careful balance between technological innovation and human-centered values. Ethical considerations, data privacy concerns, and the need to preserve the human element in decision-making remain significant challenges. There is still a considerable knowledge gap regarding the opportunities and complexities arising from the integration of AI into HRM in healthcare. This research provides valuable insights for healthcare leaders, practitioners, and policymakers on how to strategically leverage AI in HRM practices

Keywords: HRM, HRM Practices, Recruitment, Artificial Intelligence, Employee engagement, Performance management

Introduction

Human Resource Management (HRM) plays a vital role in ensuring organizational success, as it is responsible for managing and maximizing the potential of the workforce. Traditionally, HRM has included a wide range of functions such as recruitment, employee engagement, performance management, and talent development. However, the emergence of **Artificial Intelligence (AI)** has brought a significant transformation in the way these functions are performed and understood. AI is revolutionizing HRM through its ability to process large volumes of data, identify patterns, and support intelligent decision-making. By integrating AI into HRM practices, organizations can streamline HR processes, improve decision-making, optimize resource allocation, and enhance overall operational efficiency. In today's fast-changing business environment, the adoption of AI has the potential to redefine traditional HRM practices, leading to greater productivity, efficiency, and competitiveness. This study aims to examine how AI can transform HRM practices, with a particular focus on redefining traditional methods to achieve higher levels of efficiency.

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It seeks to analyze the impact of AI on key HRM functions such as recruitment, employee engagement, performance management, and talent development. In addition, the study addresses the challenges and ethical concerns associated with the integration of AI in HRM, while also providing guidance on best practices for responsible implementation. Academic literature and industry reports have widely discussed the evolution of HRM and the transformative potential of AI in reshaping HR practices. Scholars have highlighted the changing role of HRM and the importance of innovative solutions to address contemporary organizational challenges. These studies emphasize the significant role of AI in improving efficiency, productivity, and decision-making in HRM. This research contributes to the growing body of knowledge on AI integration in HRM by reviewing existing literature and analyzing real-world case studies. It aims to provide valuable insights for HR professionals, business leaders, and researchers interested in leveraging AI to improve HRM practices and organizational effectiveness. Human Resource Management (HRM) is essential for managing an organization's most valuable asset—its workforce. Traditionally, HRM functions included recruitment, training, performance management, and employee relations. However, the emergence of Artificial Intelligence (AI) has transformed these practices by introducing new opportunities for efficiency, innovation, and strategic decision-making.

Objectives

1. To examine the role of Artificial Intelligence in transforming Human Resource Management functions.
2. To analyze the impact of AI on recruitment, employee engagement, and performance management.
3. To evaluate the effectiveness of AI in learning, development, and decision-making processes in organizations.
4. To identify the challenges and suggest strategies for the effective and ethical implementation of AI in HRM.

Research Methodology

This study adopts a **qualitative research design**, using literature review, case studies, and analytical discussion to explore the impact of AI on HRM practices. Data for this study were collected from academic journals, industry reports, and credible online sources. In addition, case studies were examined to provide practical insights into the real-world implementation of AI in HRM. The collected data were analyzed using **thematic analysis** to identify key themes, patterns, and insights related to the impact of AI on HRM practices.

Discussions

Role of AI in HRM

AI technologies such as machine learning, natural language processing, and predictive analytics have the potential to transform HRM practices across several domains. **Recruitment** Recruitment is a fundamental and highly significant function within Human Resource Management (HRM) that encompasses the comprehensive process of identifying organizational talent needs, sourcing potential candidates from diverse channels, systematically screening applications, and ultimately selecting the most suitable individuals for specific job roles. With the integration of advanced Artificial Intelligence (AI) technologies, recruitment processes have become more efficient and data-driven, as AI-powered tools are capable of automating candidate sourcing, analyzing large volumes of resumes through intelligent parsing systems, and assessing candidate suitability using predictive analytics techniques. Furthermore, AI-enabled chatbots and virtual assistants can conduct initial stages of interaction, such as preliminary interviews and candidate engagement, thereby reducing manual effort and enhancing communication efficiency. As a result, these innovative technologies significantly streamline the overall recruitment workflow, minimize time-to-hire, reduce human bias, and improve the overall quality and effectiveness of hiring decisions within modern organizations.

Employee Engagement Employee engagement plays a vital and indispensable role in fostering a highly productive, committed, and motivated workforce, as it directly influences employee performance, job satisfaction, and overall organizational success. In the modern workplace, the integration of Artificial Intelligence (AI) has significantly enhanced the way organizations understand and manage employee engagement, as AI-powered tools are capable of analyzing employee sentiment by collecting and interpreting data from various sources such as surveys, internal communication platforms, feedback systems, and even social media interactions. These intelligent systems utilize advanced analytics to identify underlying trends, behavioral patterns, and potential areas of concern within the workforce. As a result, HR professionals are better equipped to take proactive and strategic actions to address issues related to employee satisfaction, workload management, leadership effectiveness, and work-life balance. Ultimately, this data-driven approach not only helps in resolving challenges at an early stage but also contributes to creating a positive work environment, improving employee morale, and strengthening long-term organizational performance.

Performance Management Performance management is a crucial function within Human Resource Management (HRM) that involves the systematic process of setting clear organizational and individual goals, continuously monitoring progress, providing constructive feedback, and evaluating employee performance to ensure alignment with organizational objectives. With the advancement of Artificial Intelligence (AI), modern performance management systems have become more dynamic and data-driven, as AI-enabled tools can track employee performance in real time, analyze work patterns, and generate detailed insights into individual and team productivity. These intelligent systems are also capable of delivering personalized and timely feedback, helping employees understand their strengths and areas that require improvement, while simultaneously identifying skill gaps and recommending targeted development opportunities. Moreover, AI-driven performance management enhances transparency, objectivity, and consistency in

evaluation processes by minimizing human bias and relying on data-based assessments. Ultimately, this leads to more accurate performance appraisals, increased employee productivity, higher levels of engagement, and improved retention rates, thereby contributing significantly to overall organizational effectiveness and long-term success. **Talent Development** Talent development is a vital component of Human Resource Management (HRM) that focuses on enhancing employees' skills, knowledge, and competencies in alignment with the strategic goals and long-term vision of the organization. In today's rapidly evolving business environment, the integration of Artificial Intelligence (AI) has significantly transformed talent development practices by enabling more personalized, efficient, and adaptive learning experiences. AI-driven learning platforms are capable of analyzing employee data, including individual performance metrics, learning preferences, career aspirations, and behavioral patterns, to design customized training programs tailored to each employee's unique needs and learning style. Furthermore, these intelligent systems can recommend appropriate courses, modules, and training resources in real time, ensuring that employees receive relevant and up-to-date knowledge that supports their professional growth. By facilitating continuous learning and development, AI-powered platforms not only enhance employee capabilities and career progression but also help organizations build a more skilled, adaptable, and future-ready workforce, ultimately contributing to improved performance and sustained competitive advantage.

Challenges and Ethical Considerations

1. Bias and discrimination in algorithms and automated decision-making processes.
2. Privacy concerns regarding the collection, storage, and use of employee data.
3. Resistance to change and fears of job displacement among HR professionals.
4. Lack of transparency and accountability in AI-driven systems.

Impact of AI on HRM Practices

Recruitment AI-driven recruitment tools play a transformative role in modern Human Resource Management (HRM) by significantly simplifying and enhancing the processes of candidate sourcing, screening, and selection through the use of advanced technologies such as machine learning and data analytics. These tools are capable of automatically identifying and attracting potential candidates from a wide range of platforms, efficiently filtering large volumes of applications, and evaluating candidate suitability based on predefined criteria and predictive insights. By reducing the reliance on manual intervention and streamlining repetitive tasks, AI-powered recruitment systems help organizations accelerate hiring cycles, minimize time-to-hire, and improve overall efficiency in talent acquisition. Moreover, by ensuring more accurate and data-driven decision-making, these technologies contribute to selecting higher-quality candidates who are better aligned with job requirements and organizational goals, ultimately strengthening workforce effectiveness and long-term organizational success.

Employee Engagement AI-powered sentiment analysis tools have become an essential component in modern Human Resource Management (HRM), as they enable HR professionals to effectively monitor and evaluate employee engagement levels by analyzing data collected from various sources such as surveys, feedback systems, internal communications, and social media interactions. These advanced tools utilize machine learning algorithms and natural language processing techniques to detect emotions, opinions, and overall employee sentiment in real time, allowing organizations to gain deeper insights into workforce morale and well-being. By identifying hidden patterns, trends, and potential concerns at an early stage, HR professionals can take proactive and informed actions to address underlying issues related to job satisfaction, workplace environment, leadership effectiveness, and work-life balance. As a result, this data-driven and timely approach not only helps in preventing larger organizational problems but also fosters a more positive, engaged, and supportive work culture, ultimately leading to increased employee motivation, higher productivity, and improved overall organizational performance.

Performance Management AI-enabled performance management systems play a significant role in transforming traditional evaluation processes by leveraging advanced technologies such as machine learning and data analytics to deliver real-time insights into employee performance. These intelligent systems continuously monitor individual and team progress, enabling organizations to provide timely, accurate, and constructive feedback that helps employees understand their strengths as well as areas requiring improvement. In addition, AI-driven platforms are capable of creating personalized development plans tailored to each employee's skills, performance data, and career aspirations, thereby supporting targeted learning and growth opportunities. By fostering ongoing feedback and adaptive learning, these systems encourage a culture of continuous improvement within the organization, where employees are consistently motivated to enhance their performance. Ultimately, this leads to increased productivity, greater employee engagement, improved skill development, and a more agile and high-performing workforce aligned with organizational goals.

Talent Development AI-driven learning platforms have revolutionized the field of employee training and development by offering highly personalized and adaptive learning experiences that cater to the unique needs, preferences, and learning styles of individual employees. By leveraging advanced technologies such as machine learning, data analytics, and artificial intelligence, these platforms analyze employee performance data, skill gaps, and career aspirations to design customized learning pathways that align closely with organizational goals and strategic objectives. Furthermore, they provide intelligent recommendations for relevant

courses, training modules, and learning resources, ensuring that employees continuously acquire new skills and competencies required in a rapidly changing work environment. This personalized approach not only enhances the effectiveness of learning but also increases employee engagement, motivation, and knowledge retention. Ultimately, AI-driven learning platforms contribute to building a more skilled, adaptable, and future-ready workforce, thereby supporting both individual career growth and overall organizational success.

Findings

1. AI significantly enhances recruitment processes by automating candidate sourcing, screening, and selection, leading to faster hiring and better-quality candidates.
2. The use of AI in recruitment reduces manual effort, minimizes bias, and improves overall efficiency in talent acquisition.
3. AI-powered sentiment analysis tools help organizations monitor employee engagement by analyzing feedback, communication, and behavioral data.
4. These tools enable HR professionals to proactively identify and resolve issues related to job satisfaction, workload, and work-life balance.
5. AI-driven employee engagement strategies contribute to a more motivated, satisfied, and productive workforce.
6. AI-enabled performance management systems provide real-time tracking of employee performance and progress.
7. These systems offer personalized feedback and development plans, helping employees improve their skills and performance continuously.
8. The use of AI in performance management enhances transparency, fairness, and objectivity in evaluations.
9. AI-driven performance practices promote a culture of continuous improvement and increase employee productivity and retention.
10. AI-powered learning and development platforms deliver personalized learning experiences tailored to individual employee needs.
11. These platforms recommend relevant courses and training resources, enabling continuous skill development and competency enhancement.
12. AI-based talent development strategies help align employee growth with organizational goals and future workforce requirements.
13. Overall, the integration of AI in HRM functions leads to improved decision-making, increased efficiency, and a more skilled and adaptable workforce.

.6. Suggestions

1. Organizations should adopt AI-driven recruitment tools to streamline hiring processes, but they must also ensure human oversight to maintain fairness and ethical decision-making.
2. Companies should regularly audit AI recruitment systems to minimize bias and ensure diversity and inclusion in hiring practices.
3. HR departments should implement AI-powered sentiment analysis tools to continuously monitor employee engagement and workplace morale.
4. It is important to act promptly on insights generated by AI tools to address employee concerns related to workload, leadership, and work-life balance.
5. Organizations should create a supportive work culture by combining AI insights with human empathy and effective communication strategies.
6. Companies should invest in AI-enabled performance management systems to track employee progress and provide real-time, constructive feedback.
7. Managers should use personalized development plans generated by AI to guide employees in improving their skills and achieving career goals.
8. Regular training should be provided to HR professionals and managers to effectively use AI tools and interpret performance data accurately.
9. Organizations should encourage a culture of continuous learning and improvement by integrating AI-driven feedback and development systems.
10. Businesses should implement AI-powered learning platforms to deliver customized training programs based on employee needs and organizational objectives.
11. Employees should be encouraged to actively engage with recommended learning resources to enhance their competencies and adaptability.
12. Organizations must align talent development initiatives with long-term strategic goals to build a future-ready workforce.
13. Finally, companies should ensure data privacy, security, and ethical use of AI technologies to build trust among employees and maximize the benefits of AI in HRM.
14. Invest in AI-driven technologies and digital HR tools.
15. Develop clear policies and procedures to address ethical concerns such as bias and privacy.

16. Provide training and support to HR professionals to ensure smooth adoption and effective use of AI systems.
17. Promote transparency and accountability in AI-based HR decision-making processes.

Conclusion

The integration of Artificial Intelligence (AI) into Human Resource Management (HRM) has brought a transformative shift in the way organizations manage their workforce. The findings clearly indicate that AI enhances key HR functions such as recruitment, employee engagement, performance management, and learning and development by improving efficiency, accuracy, and decision-making. It not only reduces manual effort and bias but also enables organizations to create a more productive, engaged, and skilled workforce through data-driven insights and personalized approaches. However, the effective implementation of AI in HRM requires a balanced approach. As highlighted in the suggestions, organizations must combine advanced AI technologies with human judgment, ethical considerations, and transparent practices. Ensuring data privacy, minimizing bias, and promoting fairness are critical to building trust among employees. Additionally, continuous training, proper system audits, and alignment with organizational goals are essential for maximizing the benefits of AI. Overall, AI has the potential to revolutionize HRM by fostering innovation, enhancing employee experience, and preparing organizations for future challenges. When implemented responsibly and strategically, it can serve as a powerful tool for achieving sustainable organizational growth and developing a future-ready workforce.

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OriginalArticle

Voice Of Soil, Folk Traditions, And Digital Literary Studies in R. K. Narayan's Selected Novels

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*R. K. Narayan occupies a significant position in Indian English literature due to his sensitive portrayal of Indian life, culture, and traditions through the fictional town of Malgudi. His novels capture the "voice of the soil," reflecting the customs, beliefs, folklore, and everyday experiences of South Indian society. Narayan's narratives reveal the coexistence of tradition and modernity, making his works valuable documents of cultural memory. This paper examines the representation of folk traditions and regional consciousness in selected novels such as *Swami and Friends*, *The Bachelor of Arts*, *The English Teacher*, *The Guide*, and *The Vendor of Sweets*. Further, it explores how Digital Literary Studies and Digital Humanities methodologies can provide new perspectives for analyzing Narayan's texts. Through thematic, cultural, and digital approaches, the paper demonstrates that Narayan's fiction preserves indigenous knowledge systems while remaining relevant to contemporary literary scholarship. His novels offer a rich archive of folklore, oral traditions, social customs, and regional identity that can be explored through digital mapping, text mining, and cultural analytics. Thus, Narayan emerges not only as a novelist of Indian life but also as a custodian of cultural heritage whose works continue to inspire modern literary studies.*

Keywords: R. K. Narayan, Malgudi, Folk Traditions, Voice of Soil, Digital Humanities, Indian English Fiction, Cultural Identity, Regional Literature, Digital Literary Studies, Folklore

Introduction

Indian English literature has played a crucial role in representing India's diverse cultural landscape. Among its pioneers, R. K. Narayan remains one of the most celebrated writers. His fictional town of Malgudi serves as a microcosm of Indian society, portraying the social, cultural, and moral realities of ordinary people. Narayan's literary achievement lies in his ability to transform local experiences into universal narratives while preserving the distinctiveness of Indian culture. His works depict everyday life, traditional values, religious practices, family structures, and folk beliefs that define the cultural ethos of South India. The concept of the "voice of soil" refers to the authentic representation of a region's culture, language, traditions, and collective consciousness. Narayan's novels embody this concept through their vivid portrayal of local customs, festivals, myths, and community life. His narratives are deeply rooted in Indian cultural traditions and reflect the rhythms of small-town existence. Scholars have often noted that Malgudi functions as a cultural space where tradition and modernity coexist, creating a unique literary landscape. In recent years, Digital Humanities and Digital Literary Studies have introduced innovative methods for examining literary texts. Digital tools enable researchers to analyze themes, cultural patterns, spatial representations, and narrative structures on a broader scale. Applying such approaches to Narayan's novels opens new avenues for understanding his engagement with folklore, regional identity, and cultural memory.

Voice of Soil in Narayan's Fiction

The most striking feature of Narayan's novels is their rootedness in Indian soil. Malgudi, though fictional, resembles countless small towns in South India.

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The streets, temples, markets, schools, and households of Malgudi create a realistic social environment that reflects the experiences of ordinary Indians. Through detailed descriptions of daily life, Narayan captures the essence of regional culture and identity. In *Swami and Friends*, the reader encounters a world shaped by traditional family values, educational institutions, and social relationships. The novel portrays childhood experiences against the backdrop of colonial India, revealing the cultural dynamics of a middle-class South Indian community. Swami's interactions with family members, teachers, and friends illustrate the values of obedience, respect, and communal belonging. Similarly, *The Bachelor of Arts* presents the journey of Chandran, whose life is influenced by social customs and traditional expectations. Marriage, education, and family obligations become central themes through which Narayan explores the tensions between individual aspirations and societal norms. These themes reflect the cultural realities of Indian society during the early twentieth century. The authenticity of Narayan's fiction stems from his intimate understanding of local life. Rather than focusing on political events or grand historical narratives, he highlights ordinary experiences that resonate with readers across cultures. This emphasis on everyday life gives his novels a distinct regional flavor while maintaining universal appeal.

Folk Traditions and Cultural Memory

Folk traditions form an essential component of Narayan's literary universe. Folklore encompasses myths, legends, oral narratives, customs, rituals, and communal beliefs passed from one generation to another. Narayan integrates these elements naturally into his fiction, making them an integral part of the narrative structure. In *The Guide*, folk beliefs and religious traditions play a significant role in shaping the story. Raju's transformation from a tourist guide to a spiritual figure reflects the influence of collective faith and cultural practices. The villagers' belief in Raju's spiritual powers demonstrates the continuing relevance of traditional worldviews in modern society. Likewise, *The English Teacher* incorporates spiritual and metaphysical elements rooted in Indian philosophical traditions. Krishna's communication with the spirit of his deceased wife reflects indigenous beliefs about life, death, and the continuity of the soul. Such themes reveal the influence of oral traditions and cultural narratives that have long shaped Indian society.

Narayan's engagement with mythology is evident not only in his novels but also in works inspired by Indian epics and legends. His writings frequently draw upon traditional stories and archetypal patterns that connect contemporary life with ancient cultural heritage. Through these references, Narayan preserves cultural memory and reinforces the continuity of Indian traditions. Festivals, religious ceremonies, and community gatherings further enrich the folk dimension of his fiction. Celebrations such as Diwali, temple rituals, and local festivities create a sense of cultural authenticity. These practices function as symbols of communal identity and social cohesion, emphasizing the importance of tradition in everyday life.

Tradition and Modernity

A recurring theme in Narayan's novels is the interaction between tradition and modernity. His characters often find themselves navigating a rapidly changing society where modern ideas challenge established customs. This tension creates both conflict and transformation. In *The Vendor of Sweets*, Jagan represents traditional Indian values, while his son Mali embodies modern Western influences. Their ideological differences symbolize broader cultural shifts occurring in post-independence India. The novel highlights the challenges of preserving cultural identity in an increasingly globalized world. Similarly, *The Guide* portrays the complexities of modernization through the characters of Raju and Rosie. While Rosie seeks artistic freedom and self-expression, societal expectations continue to influence her choices. Narayan does not present tradition and modernity as opposing forces; rather, he depicts them as interconnected aspects of social change.

Gyanshauryam

This balanced portrayal contributes to the richness of Narayan's fiction. His works neither romanticize the past nor glorify modernization. Instead, they reveal how individuals negotiate cultural transitions while maintaining connections to their roots.

Malgudi as a Folk Space

Malgudi functions as more than a fictional setting; it serves as a cultural landscape where folk traditions, social practices, and regional identities converge. The town represents a living archive of Indian culture. Markets, temples, schools, and public spaces become sites where collective memories are created and preserved. The characters inhabiting Malgudi embody diverse social roles and cultural values. Teachers, shopkeepers, priests, students, and housewives contribute to the social fabric of the town. Their interactions reflect community-based living and shared cultural experiences. Through Malgudi, Narayan constructs a literary geography that captures the spirit of Indian small-town life. Scholars have described Malgudi as a cultural microcosm that reflects the complexities of Indian society while preserving its regional distinctiveness.

Digital Literary Studies and Narayan

Digital Literary Studies offer innovative methods for examining Narayan's fiction. Digital tools enable scholars to analyze textual patterns, cultural themes, and narrative structures with greater precision. Such approaches complement traditional literary criticism by revealing connections that may otherwise remain unnoticed. One important method is text mining, which identifies recurring words, themes, and motifs across multiple texts. Applying text-mining

techniques to Narayan's novels can reveal patterns related to folklore, religion, family, and community. Researchers can examine how frequently cultural symbols appear and how they evolve across different works. Another valuable approach is spatial mapping. Digital mapping technologies can visualize the geography of Malgudi, highlighting relationships between various locations within the fictional town. Such analysis helps scholars understand how space contributes to narrative development and cultural representation. Network analysis provides another avenue for research. By mapping relationships among characters, researchers can explore social structures and community networks within Narayan's fiction. This approach reveals how cultural values are transmitted through interpersonal interactions. Digital archives also play a crucial role in preserving literary heritage. Creating digital repositories of Narayan's manuscripts, letters, and published works would facilitate broader access for researchers and students. These resources would support comparative studies and promote interdisciplinary scholarship.

Folklore and Digital Humanities

The intersection of folklore studies and digital humanities has generated new possibilities for literary research. Digital platforms enable the preservation, documentation, and analysis of folk traditions in unprecedented ways. Narayan's novels provide rich material for such investigations because they contain numerous references to oral culture, myths, rituals, and communal practices. Digital storytelling projects can recreate the cultural world of Malgudi through interactive maps, multimedia presentations, and virtual exhibitions. Such initiatives would allow readers to engage with Narayan's fiction in immersive and innovative ways. Moreover, computational analysis can help identify folk motifs and narrative patterns across Narayan's works. By comparing his novels with traditional folktales and mythological narratives, researchers can trace cultural continuities and transformations. These methods contribute to a deeper understanding of how literature preserves and reshapes cultural heritage.

Conclusion

R. K. Narayan's selected novels stand as enduring representations of India's cultural landscape. Through the fictional world of Malgudi, he captures the voice of the soil, preserving regional traditions, folk beliefs, and communal values. His narratives reveal the richness of Indian culture while addressing universal human concerns. The integration of folklore, mythology, and everyday experiences gives his fiction a distinctive identity that continues to resonate with readers worldwide. The emergence of Digital Literary Studies has opened new pathways for exploring Narayan's works. Digital tools such as text mining, spatial mapping, network analysis, and digital archiving provide innovative methods for examining cultural patterns and literary structures. These approaches complement traditional criticism and highlight the continuing relevance of Narayan's fiction in contemporary scholarship. Ultimately, Narayan's novels function as cultural archives that preserve the memory of a changing society. Their engagement with folk traditions and regional identity ensures their significance for future generations of readers and researchers. By bridging literary tradition and digital innovation, scholars can continue to uncover new dimensions of Narayan's remarkable contribution to Indian English literature.

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Digital Transformation in Argo-Tourism: A Study of Tourist Behavior

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The fast growth of digital technologies has significantly transformed the tourism industry, including the ago-tourism sector. This study examines the impact of digital transformation on tourist behaviour in agro-tourism destinations. The research investigates how digital platforms, social media, online reviews, digital booking systems and online payment facilities influence tourists' travel decisions and experiences. Primary data were collected through a structured questionnaire from 184 respondents. The collected data were analysed using descriptive statistics and reliability analysis through SPSS. The findings reveal that digital platforms play a vital role in increasing awareness, improving accessibility and influencing tourist decision-making regarding agro-tourism destinations. The study also identifies areas requiring improvement, particularly website information quality and digital service satisfaction. The research concludes that effective adoption of digital technologies can enhance tourist engagement and support sustainable development of agro-tourism destinations.

Keywords: Digital Transformation, Agro-Tourism, Tourist Behaviour, Social Media, Digital Marketing, Rural Tourism

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Introduction

The tourism industry has undergone substantial changes due to advancements in digital technology. Digital transformation has altered how tourists search for information, evaluate destinations, make bookings, and share travel experiences. In agro-tourism, digital technologies provide opportunities for rural tourism enterprises to increase visibility, attract tourists, and improve service delivery. Agro-tourism combines agricultural activities with tourism experiences, allowing visitors to interact with rural environments, agricultural practices, and local culture. In India, agro-tourism has emerged as a promising sector for rural development and income generation. However, the success of agro-tourism destinations increasingly depends upon their ability to adopt digital technologies effectively. Digital platforms such as websites, social media applications, online booking systems, and online review platforms have become important sources of information for tourists. These H12: There is a significant relationship between digital marketing tools and tourist satisfaction in agro-tourism.

Research Methodology

Research Design

The study adopts a descriptive research design based on a quantitative approach. A structured questionnaire was developed to collect primary data regarding tourist perceptions of digital transformation in agro-tourism.

Data Collection

Primary data were collected through an online survey using a structured questionnaire. Secondary data were collected from books, journals, research articles, government reports, and online sources related to tourism and digital transformation.

Sample Size

A total of 184 valid responses were obtained and used for analysis. Convenience sampling was adopted for selecting respondents who had awareness of or experience with agro-tourism destinations.

Data Analysis Tools



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The collected data were analysed using IBM SPSS 29 Statistics. Descriptive statistics such as frequencies, percentages, mean scores and standard deviations were used. Reliability analysis using Cronbach's Alpha was also performed to assess internal consistency of the questionnaire.

Data Analysis And Interpretation

Demographic Profile of Respondents

Demographic Variable	Category / Classification	Frequency (N)	Percentage (%)
Gender	Female	114	62.0%
	Male	70	38.0%
Age Group	Below 20 Years	20	10.9%
	21–30 Years	36	19.6%
	31–40 Years	118	64.1%
	Above 40 Years	10	5.4%
Educational Qualification	Undergraduate	26	14.1%
	Graduate	46	25.0%
	Postgraduate	112	60.9%
Monthly Income (INR)	Below Rs. 50,000	86	46.7%
	Rs. 50,000 to Rs. 1,000,000	42	22.8%
	Rs. 1,000,001 to Rs. 2,00,000	26	14.1%
	Above Rs. 2,00,000	30	16.3%
Prior Agro-Tourism Experience	Yes (Have visited before)	132	71.7%
	No (First-time / Never visited)	52	28.3%

The typical respondent in this research study is a highly educated Postgraduate Female aged between 31 and 40 years old. A substantial majority of the participants (71.7%) have already interacted with or visited an agro-tourism destination before, making their subsequent ratings on digital transformation and behavior highly reliable and experience-backed. The largest group of respondents (46.7%) falls within the budget bracket earning below Rs. 50,000 monthly, while the remaining half represents middle-to-high income clusters.

Reliability Analysis

Cronbach's Alpha Value by calculating the variances of individual items and the variance of the total composite scores across the dataset, the reliability coefficient is 0.88. Since the value exceeds the recommended threshold of 0.70, the instrument demonstrates good reliability and internal consistency.

Descriptive Statistics

The study reveals a strongly positive attitude toward digital integration in agro-tourism, yielding a high composite mean score ($M = 3.86$, $SD = 0.80$). This validates the premise that modern tourists heavily rely on digital ecosystems to select destinations. Destination discovery and online visibility recorded the highest consensus. Respondents strongly prioritize platform-based discovery ($M = 4.36$, $SD = 0.67$), an active online destination presence ($M = 4.27$, $SD = 0.85$), and social media influence ($M = 4.21$, $SD = 0.73$). Core operational and transactional tools serve as positive conversion mechanisms, including virtual multimedia tours ($M = 4.19$), peer reviews ($M = 4.17$), booking convenience ($M = 4.01$), digital payments ($M = 3.92$), and direct provider communication ($M = 3.88$). A prominent "digital experience gap" exists. Despite high demand for external discovery, dedicated destination websites fail to provide sufficient planning information ($M = 2.83$, $SD = 1.00$). Consequently, satisfaction with native digital services scored the lowest ($M = 2.72$, $SD = 0.94$), highlighting a critical need for localized infrastructure optimization.

Sr. No.	Research Questionnaire Item / Variable	Mean Score (μ)	Standard Deviation (σ)	Interpretation
1	Digital platforms help discover agro-tourism destinations easily.	4.36	0.67	Strongly Agree (Highest Agreement)
2	Social media influences destination visit decisions.	4.21	0.73	Strongly Agree
3	Online reviews affect agro-tourism destination choices.	4.17	0.80	Agree

4	Agro-tourism websites provide sufficient information for trip planning.	2.83	1.00	Neutral (Areas for Improvement)
5	Digital booking facilities increase overall travel convenience.	4.01	0.86	Agree
6	Active online presence positively influences destination preference.	4.27	0.85	Strongly Agree

7	Virtual tours, photos, and videos increase interest in destinations.	4.19	0.79	Agree
8	Online payment systems improve the general travel experience.	3.92	0.80	Agree
9	Digital communication tools improve interaction with providers.	3.88	0.67	Agree
10	Satisfaction with current digital services offered by destinations.	2.72	0.94	Neutral(Lowest Satisfaction)
-	Overall Composite Mean Score	3.86	0.80	Agree

Findings

The hypotheses tested with the appropriate statistical methods using SPSS found-

H01: Digital transformation has no significant impact on tourist behaviour in agro-tourism destinations.

H11: Digital transformation has a significant impact on tourist behaviour in agro-tourism destinations.

Regression Analysis:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.651 ^a	.423	.420	.3182

Predictors: (Constant), Digital_Transformation

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.542	1	13.542	133.702	.000 ^b
	Residual	18.431	182	.101		
	Total	31.973	183			

a. Dependent Variable: Tourist_Behaviour b. Predictors: (Constant), Digital_Transformation

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.202	.262		4.581	.000
	Digital Transformation	.792	.068	.651	11.562	.000

Hypothesis 1 (H11) confirms that digital transformation has a highly significant positive impact on tourist behavior in agro-tourism ($r = 0.651$, $p < 0.001$). The regression model shows that digital infrastructure advancements explain 42.3% of the variance in how tourists choose destinations. Consequently, updates to systems like online booking, electronic payments, and discovery platforms directly shift and optimize tourist interaction patterns.

On testing the hypothesis,

H02: There is no significant relationship between digital marketing tools and tourist satisfaction in agro-tourism.

H12: There is a significant relationship between digital marketing tools and tourist satisfaction in agro-tourism.

		Digital_Marketing Tools	Tourist_Satisfaction
Digital_Marketing_Tools	Pearson Correlation	1	.296**
	Sig. (2-tailed)		.000
	N	184	184
Tourist_Satisfaction	Pearson Correlation	.296**	1
	Sig. (2-tailed)	.000	
	N	184	184

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

Hypothesis 2 (H12) establishes a statistically significant, positive relationship between digital marketing tools and tourist satisfaction ($r = 0.296$, $p < 0.001$). However, its low variance explanation ($r^2 = 8.7\%$) suggests that while promotional channels successfully drive initial interest and destination discovery, they do not guarantee fulfilment. Consequently, marketing efforts must be paired with optimized localized infrastructure to convert tourist engagement into deep post-visit satisfaction.

Hypothesis	Independent Variable (IV)	Dependent Variable (DV)	Pearson Correlation (r)	Standardized Beta (β)	F / t Value	Sig. (p)	Empirical Result
H11	Digital Transformation	Tourist Behaviour	.651	.651	F = 133.70	< .001	Supported
H12	Digital Marketing Tools	Tourist Satisfaction	.296	.296	t = 4.18	< .001	Supported

The results demonstrate that digital transformation significantly influences tourist behaviour. Tourists rely heavily on digital platforms for information search, destination evaluation, booking and communication. Social media and online reviews serve as powerful tools in shaping tourist perceptions and travel decisions. However, agro-tourism destinations need to improve website quality, digital information availability and overall digital service satisfaction.

Discussion

social media and online reviews confirms their growing role in destination marketing and tourist engagement. The study also identifies challenges associated with digital service quality. Respondents expressed comparatively lower satisfaction regarding website information and digital support services. Therefore, agro-tourism operators should focus on improving website functionality, content quality, and customer support systems.

Conclusion

Digital transformation has become a critical factor influencing tourist behaviour in agro-tourism destinations. The findings indicate that digital platforms, social media, online reviews, booking systems, and online payment facilities positively influence tourist engagement and travel decisions. While tourists generally perceive digital technologies positively, improvements in website quality and digital service delivery are necessary.

The study concludes that effective implementation of digital technologies can strengthen agro-tourism promotion, improve tourist experiences, and contribute to sustainable rural tourism development.

Suggestions

To bridge the identified digital experience gap, agro-tourism operators must leverage active social media profiles to influence tourist destination selection while offering simplified, frictionless online booking and e-payment systems to increase booking convenience. Concurrently, operators must modernize their native websites to provide accurate, comprehensive planning information alongside responsive, automated customer support systems to directly improve low satisfaction baselines. Finally, scaling this ecosystem requires a collaborative framework where local government authorities invest in upgrading high-speed rural digital infrastructure, while tourism associations provide structured digital marketing and technical capability training to rural entrepreneurs to ensure long-term, sustainable operational success.

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From Conversation to Conversion: Ai Voice Assistants as The New Frontiers in Customer Management

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Artificial intelligence-powered voice assistants are reshaping customer management by changing how firms communicate with customers across the purchase journey. Once limited to simple voice commands, today's voice assistants combine natural language processing, speech recognition, machine learning, and conversational AI to enable real-time, personalized, hands-free interactions. Platforms such as Amazon Alexa, Google Assistant, Apple Siri, and enterprise voice bots are increasingly being used for customer service, product discovery, personalized recommendations, purchase assistance, feedback collection, complaint resolution, and post-purchase engagement. Existing studies largely discuss voice assistants as tools for convenience, automation, and digital service delivery. However, their role in converting customer conversations into stronger relationships, decision confidence, purchase intention, and loyalty requires deeper examination. This paper addresses this gap by using a conversation-to-conversion lens to study AI voice assistants as emerging customer management touchpoints. It examines how voice-based interactions can support customers from awareness and information search to evaluation, purchase, service recovery, and continued engagement. Using a secondary research approach, the study analyses academic literature, industry reports, and documented business cases to understand how businesses are adopting AI voice assistants to improve customer relationship management and marketing effectiveness. The paper identifies key value mechanisms, including immediate response, contextual personalization, conversational continuity, data-driven recommendations, reduced decision friction, and post-purchase relationship reinforcement. These mechanisms show how routine customer interactions can become opportunities for engagement, cross-selling, up-selling, retention, and loyalty building without reducing customer management to a purely transactional process. The findings suggest that AI voice assistants can enhance customer experience by making interactions more accessible, responsive, personalized, and interactive. At the same time, their effectiveness depends on response accuracy, information quality, recommendation transparency, privacy protection, ethical use of customer data, and integration with existing customer relationship management systems. Therefore, successful adoption requires not only technological capability, but also managerial governance and customer trust. Overall, this paper argues that AI voice assistants represent a new frontier in customer management, where conversation becomes a strategic pathway to customer satisfaction, loyalty, and business conversion in increasingly digital markets.

Keywords: AI Voice Assistants, Customer Management, Conversational AI, Voice Commerce

Introduction

Customer management has traditionally depended on a combination of human interaction, digital touchpoints, call centres, websites, mobile applications, and customer relationship management systems. However, the rapid development of artificial intelligence-enabled voice assistants is beginning to reshape how businesses communicate with customers across the customer journey. Voice assistants such as Amazon Alexa, Google Assistant, Apple Siri, and enterprise conversational voice bots are no longer limited to performing simple commands or answering routine queries.

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With advances in natural language processing, speech recognition, machine learning, and conversational AI, these systems are increasingly capable of understanding customer intent, responding in real time, personalizing recommendations, supporting service interactions, and guiding customers through purchase-related decisions. This shift is important because customer management is no longer confined to post-sale service or complaint resolution. In digitally mediated markets, every interaction between a customer and a brand can influence awareness, trust, satisfaction, loyalty, and purchase behaviour. AI voice assistants add a new dimension to this process by making customer interactions more conversational, immediate, and hands-free. Unlike traditional digital interfaces, voice-based interactions reduce the effort required from customers to search, compare, request support, or complete routine actions. As a result, voice assistants are increasingly being studied not only as service automation tools, but also as customer engagement and relationship-building interfaces. The idea of “conversation to conversion” captures this emerging shift. A customer conversation with a voice assistant may begin as a simple enquiry, but it can gradually become a pathway to product discovery, decision support, personalized recommendation, service recovery, repeat purchase, or loyalty reinforcement. For example, a customer asking about product availability, delivery status, subscription renewal, or service options may be presented with relevant information that influences the next step in the purchase journey. In this sense, AI voice assistants function as customer management touchpoints that can connect service, marketing, sales, and post-purchase engagement. Existing secondary literature indicates that voice assistants influence customer behaviour through several mechanisms, including convenience, speed, personalization, perceived usefulness, interactivity, and trust. Studies on voice commerce and interactive voice assistants suggest that customers value the ability to interact with brands through natural, real-time, and context-aware conversations. At the same time, research also highlights that customer adoption depends on more than technological novelty. Factors such as response accuracy, privacy protection, brand credibility, transparency, and the perceived reliability of the assistant play a central role in determining whether customers continue to use voice-based interfaces and whether such interactions strengthen brand loyalty. From a business perspective, AI voice assistants create opportunities to improve customer management across multiple stages of the customer lifecycle. They can support pre-purchase engagement by helping customers discover products and compare alternatives; assist during purchase by reducing friction and enabling faster decision-making; and strengthen post-purchase engagement through feedback collection, issue resolution, reminders, and personalized follow-ups. These capabilities make voice assistants relevant not only to e-commerce, but also to broader customer relationship management in sectors such as retail, banking, hospitality, healthcare, travel, and consumer services. However, the growing role of AI voice assistants also creates significant managerial and ethical challenges. Since voice interactions often involve sensitive customer data, businesses must address concerns related to privacy, consent, data security, algorithmic transparency, and responsible use of customer information. Poorly designed voice assistants may also misinterpret customer intent, provide inaccurate responses, make irrelevant recommendations, or create frustration that weakens trust. Therefore, successful adoption requires more than deploying voice technology; it requires integration with customer relationship management systems, clear governance, ethical AI practices, and a customer-centric design approach. This paper examines AI voice assistants as emerging frontiers in customer management, with a specific focus on how conversational interactions can influence customer engagement, satisfaction, trust, loyalty, and conversion. Based on secondary research from academic literature, industry reports, and documented business cases, the study explores how businesses are using AI-powered voice interfaces to transform everyday customer conversations into meaningful commercial and relationship-building opportunities. The paper argues that the strategic value of AI voice assistants lies not merely in automation, but in their ability to convert conversations into stronger customer relationships and measurable business outcomes.

Objectives of the Study

The specific objectives of the study are as follows:

To examine the role of AI voice assistants in modern customer management

This objective focuses on understanding how AI-powered voice assistants support customer management activities such as customer service, product discovery, personalized recommendations, complaint resolution, feedback collection, and post-purchase engagement.

To analyse how voice-based interactions influence customer engagement and decision-making

This objective studies how conversational features such as immediacy, convenience, interactivity, personalization, and hands-free access influence customer awareness, information search, evaluation, purchase intention, satisfaction, and loyalty.

To explore the conversation-to-conversion pathway enabled by AI voice assistants

This objective examines how routine customer conversations can become meaningful conversion opportunities by reducing decision friction, improving decision confidence, enabling contextual recommendations, supporting service recovery, and encouraging repeat purchases.

To identify the business value of AI voice assistants for customer relationship management and marketing

This objective analyses how businesses can use AI voice assistants to improve customer experience, strengthen customer relationships, enhance marketing effectiveness, support cross-selling and up-selling, improve retention, and build brand loyalty.

To evaluate the challenges, risks, and ethical concerns associated with AI voice assistants
This objective focuses on issues such as response accuracy, privacy, consent, data security, transparency, algorithmic bias, customer trust, and the responsible use of customer data in voice-based customer interactions.

To suggest strategic recommendations for responsible and effective adoption

This objective aims to provide practical recommendations for businesses seeking to integrate AI voice assistants into customer relationship management and marketing systems while ensuring customer-centric design, ethical AI governance, transparency, and long-term customer trust.

Scope of the Study

The scope is specifically centred on understanding how voice-based AI interactions influence customer engagement, trust, satisfaction, loyalty, and conversion across the customer journey.

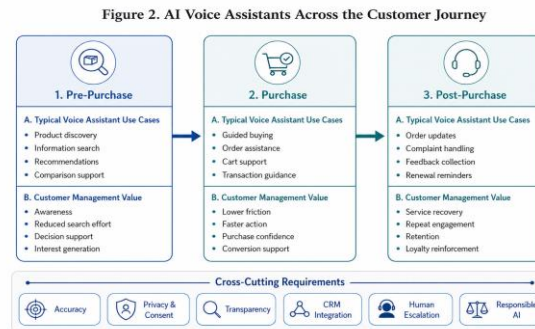


Figure 2. Role of AI voice assistants across pre-purchase, purchase, and post-purchase customer management stages.

The scope of the study covers the following dimensions:

AI voice assistants as customer management interfaces

The study examines how AI-powered voice assistants support customer-facing activities such as query handling, customer service, product discovery, personalized recommendations, complaint resolution, feedback collection, and post-purchase engagement.

Role across the customer journey

The study analyses the relevance of voice assistants across pre-purchase, purchase, and post-purchase stages. This includes information search, product comparison, decision support, guided buying, service recovery, repeat engagement, and loyalty reinforcement.

Conversation-to-conversion pathway

The study focuses on how routine customer conversations can become meaningful business opportunities. It examines how voice assistants may reduce customer effort, improve response speed, support contextual recommendations, strengthen decision confidence, and encourage purchase-related outcomes.

Customer engagement, trust, and relationship building

The study explores how voice-based interactions influence customer engagement by offering convenience, personalization, interactivity, continuity, and accessibility. It also considers the role of trust, perceived usefulness, response reliability, and brand credibility in shaping customer acceptance of voice assistants.

Customer relationship management and marketing relevance

The study examines how businesses can use AI voice assistants to strengthen customer relationship management and marketing effectiveness through personalized communication, service continuity, cross-selling and up-selling opportunities, retention support, and loyalty-building interactions.

Illustrative cross-sector relevance

The study considers selected examples from sectors where customer interaction quality is central to business performance, such as retail, e-commerce, banking, hospitality, travel, healthcare, and consumer services. These sectors are used to illustrate relevance rather than to provide a detailed industry-wise comparison.

Strategic, operational, and ethical considerations

The study includes key implementation considerations such as CRM integration, data quality, response accuracy, recommendation transparency, privacy, consent, data security, algorithmic fairness, responsible AI use, and customer trust.

Boundaries of the study

The study is limited to secondary research and does not include primary surveys, interviews, experiments, or direct consumer data collection. It does not evaluate the technical architecture, algorithmic design, or engineering performance of specific voice assistant platforms. Instead, it focuses on how existing academic literature, credible industry reports, and documented business cases explain the role of AI voice assistants in customer management and conversion.

Research Methodology

The research is based on the review, comparison, and interpretation of existing academic literature, credible industry reports, market research publications, white papers, and documented business cases related to AI voice assistants, conversational AI, voice commerce, customer relationship management, customer experience, digital marketing, and consumer behaviour.

The methodology of the study includes the following:

Review of academic literature

The study reviews scholarly publications and peer-reviewed research on AI voice assistants, conversational AI, customer engagement, personalization, trust, customer experience, purchase intention, loyalty, and voice commerce. This helps establish the theoretical foundation of the paper.

Review of industry and market reports

The study analyses relevant reports from established consulting, technology, and market research organizations to understand adoption trends, business applications, customer expectations, and emerging developments in AI-enabled voice interactions.

Analysis of documented business cases

The study examines documented examples of businesses using voice assistants for customer service, product discovery, personalized recommendations, guided transactions, feedback collection, service recovery, and post-purchase engagement. These cases are used to understand practical applications and business relevance.

Thematic analysis of secondary data

The collected secondary material is analysed thematically to identify recurring patterns around convenience, personalization, responsiveness, trust, decision support, customer effort reduction, service recovery, retention, loyalty, and conversion-related outcomes.

Customer journey-based analysis

The study organizes insights across the pre-purchase, purchase, and post-purchase stages of the customer journey. This helps explain how AI voice assistants influence different customer management moments, from awareness and information search to purchase support and relationship continuity.

Conversation-to-conversion analytical lens

The study applies a conversation-to-conversion lens to examine how voice-based interactions move beyond basic query resolution. This lens is used to analyse how customer conversations may support engagement, decision confidence, satisfaction, repeat purchase, retention, and loyalty.

Source reliability and validation

To maintain credibility, the study prioritizes peer-reviewed journal articles, recognized industry reports, official business documentation, credible market research publications, and established academic or professional sources. Findings are cross-checked across multiple reliable secondary sources before being included in the analysis.

Methodological

Since the study is based entirely on secondary research, it does not claim to establish direct causality or generate original statistical evidence. The findings are interpretive and synthesis-based, aimed at explaining how AI voice assistants are emerging as strategic tools in customer management and how they may contribute to customer satisfaction, loyalty, and business conversion.

Literature Review

This review examines key themes relevant to understanding how AI voice assistants can move customer interactions from conversation to conversion.

AI Voice Assistants in Customer Management

AI-powered voice assistants use speech recognition, natural language processing, machine learning, and conversational AI to understand customer queries and respond through voice-based interaction. Earlier uses were largely limited to simple tasks, but businesses are now using voice assistants for customer service, product discovery, order tracking, personalized support, complaint handling, and post-purchase engagement. This makes them relevant to customer management because they create continuous, real-time touchpoints between firms and customers.

Influence on Customer Behaviour

Existing research indicates that customers value voice assistants for convenience, speed, accessibility, and hands-free interaction. These features reduce customer effort during information search, routine purchases, and service requests. By simplifying the interaction process, voice assistants can influence customer behaviour across the journey, especially in situations where customers seek quick answers, repeat purchases, or low-effort support.

Personalization and Decision Support

A major theme in the literature is the ability of AI voice assistants to provide personalized recommendations and decision support. By using customer preferences, past interactions, and contextual information, voice assistants can suggest relevant products, answer purchase-related questions, and guide customers through choices. This can reduce decision friction and improve customer confidence, particularly when recommendations are accurate, timely, and useful.

Trust and Continued Usage

Trust is central to the adoption and continued use of AI voice assistants. Customers are more likely to rely on voice assistants when they perceive them as accurate, useful, secure, and connected to a credible brand. Literature also highlights that privacy concerns, poor response quality, and lack of transparency can reduce customer confidence. Therefore, trust, response reliability, and responsible data use are important conditions for effective voice-based customer management.

Conversation-to-Conversion

The idea of “conversation to conversion” reflects how a customer interaction with a voice assistant can move beyond query resolution. A simple conversation about product details, order status, service options, renewals, or complaints can become a conversion opportunity when the assistant provides relevant information, reduces uncertainty, supports the next best action, or encourages repeat engagement. In this study, conversion is understood broadly to include purchase intention, repeat purchase, retention, service recovery, cross-selling, up-selling, and loyalty reinforcement.

Marketing and CRM Relevance

Voice assistants are increasingly relevant to marketing and customer relationship management because they enable personalized communication, feedback collection, service continuity, reminders, and post-purchase engagement. When integrated with CRM systems, they can help businesses deliver more consistent and context-aware customer experiences. This creates opportunities to strengthen customer relationships, improve engagement, and support long-term brand loyalty.

Ethical and Operational Concerns

The literature also identifies key challenges in using AI voice assistants for customer management. These include privacy, consent, data security, algorithmic transparency, recommendation fairness, voice recognition accuracy, language limitations, and system integration. Since voice assistants interact directly with customers, weak governance or inaccurate responses can harm trust and customer experience.

Research

Existing literature often examines AI voice assistants through the lens of convenience, automation, voice commerce, or customer experience. However, limited attention is given to their broader role as customer management interfaces that connect conversational interaction with engagement, trust, satisfaction, loyalty, and conversion-related outcomes. This study addresses that gap through a conversation-to-conversion lens.

Conceptual Framework

The framework is developed from secondary research and is intended to organize existing insights rather than establish direct causality.

Figure 1. Conversation-to-Conversion Framework

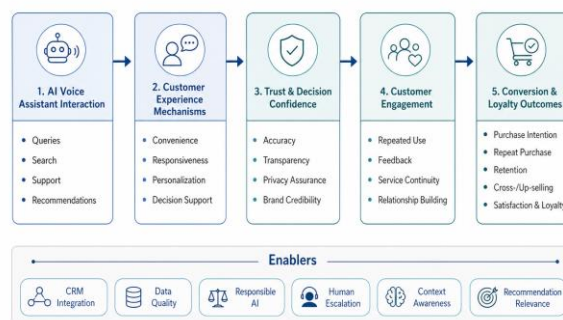


Figure 1. Conceptual framework showing how AI voice assistant interactions can move customers from conversation to conversion.

AI voice assistant interaction

The framework begins with the customer’s interaction with an AI-powered voice assistant. This interaction may involve product search, service queries, recommendations, order support, complaint handling, feedback sharing, or repeat purchase requests. At this stage, the voice assistant acts as the first conversational touchpoint between the customer and the business.

Customer experience mechanisms

AI voice assistants influence customer experience through convenience, responsiveness, personalization, accessibility, and decision support. These mechanisms reduce customer effort and make interactions faster, easier, and more relevant. This is important because customer management depends not only on what information is provided, but also on how easily and confidently customers can act on it.

Trust and decision confidence

Trust acts as a critical link between conversation and conversion. Customers are more likely to continue using voice assistants when they perceive the interaction as accurate, secure, transparent, useful, and connected to a credible brand.

Reliable responses, privacy assurance, recommendation clarity, and responsible data use can increase customer confidence in AI-enabled interactions.

Customer

When customers find voice interactions useful and trustworthy, they are more likely to engage repeatedly with the brand. Engagement may include repeated use, feedback sharing, service follow-ups, complaint resolution, renewal inquiries, or continued interaction across the customer lifecycle. Voice assistants therefore support relationship continuity rather than only one-time query resolution.

Conversion and loyalty outcomes

The final stage of the framework focuses on conversion and loyalty outcomes. In this study, conversion is understood broadly and includes purchase intention, guided purchase, repeat purchase, renewal, retention, service recovery, cross-selling, up-selling, satisfaction, and loyalty. This broader interpretation is suitable for customer management because business value is created not only through immediate sales, but also through long-term customer relationships.

Enabling

The conversation-to-conversion pathway depends on several enabling conditions, including CRM integration, data quality, context awareness, recommendation relevance, responsible AI governance, and human escalation for complex issues. If these conditions are weak, voice assistants may provide inaccurate, irrelevant, or intrusive interactions. If they are strong, voice assistants can create trusted, personalized, and continuous customer engagement.

Overall, the framework explains that AI voice assistants create value not merely by automating conversations, but by improving the quality of customer interactions. When voice interactions are convenient, personalized, reliable, and responsibly managed, they can help businesses move customers from conversation to engagement, and from engagement to conversion and loyalty.

Results and Discussion

The results and discussion are based on secondary research from academic literature, industry reports, and documented business cases on AI voice assistants, conversational AI, customer experience, voice commerce, and customer relationship management.

AI voice assistants as customer management interfaces

Secondary research indicates that AI-powered voice assistants are moving beyond simple command execution and are increasingly being used for customer service, product discovery, order tracking, personalized support, complaint handling, and post-purchase engagement.

Reduced customer effort across the journey

Voice assistants support easier customer interactions by offering quick, hands-free, and natural language-based responses. This reduces effort during information search, routine purchases, service requests, and repeat interactions.

Personalization and decision support

AI voice assistants can use customer context, past interactions, and preferences to provide relevant responses and recommendations. This improves decision support and can help customers move more confidently from inquiry to action.

Conversation-to-conversion potential

The discussion shows that a customer conversation may become a conversion opportunity when the assistant provides timely information, reduces uncertainty, recommends the next best action, or supports repeat engagement. Conversion in this study includes purchase intention, repeat purchase, renewal, retention, cross-selling, up-selling, and loyalty reinforcement.

Role of trust in adoption

Customer trust is central to the effectiveness of voice assistants. Accuracy, privacy protection, recommendation transparency, brand credibility, and reliable responses influence whether customers continue using voice-based interfaces.

Business value for CRM and marketing

For businesses, AI voice assistants can strengthen customer relationship management by enabling continuous touchpoints, personalized communication, service recovery, feedback collection, and loyalty-building interactions.

Implementation concerns

The benefits of AI voice assistants depend on responsible implementation. Weak data quality, poor CRM integration, inaccurate responses, privacy concerns, or irrelevant recommendations can reduce customer trust and weaken the overall customer experience.

Findings

The key findings of the study are as follows:

AI voice assistants are emerging as strategic customer touchpoints

They are increasingly used across customer service, product discovery, purchase assistance, feedback collection, complaint resolution, and post-purchase engagement.

Convenience is a major driver of customer adoption

The speed, accessibility, and hands-free nature of voice assistants make them useful for routine queries, repeat purchases, and service-related interactions.

Personalization strengthens customer engagement

Relevant recommendations and context-aware responses can improve customer interest, interaction quality, and decision confidence.

Trust determines continued usage

Customers are more likely to rely on voice assistants when they perceive them as accurate, secure, transparent, useful, and connected to a credible brand.

Conversations can support conversion-related outcomes

Voice interactions can influence purchase intention, repeat purchase, service recovery, retention, cross-selling, up-selling, and loyalty when they are timely, relevant, and reliable.

CRM integration improves business value

The value of AI voice assistants increases when they are connected with customer relationship management systems, customer data, service workflows, and marketing processes.

Ethical governance is essential

Responsible use of customer data, privacy protection, transparency, consent, and fairness are necessary for building long-term customer confidence in AI-enabled voice interactions.

Limitations and Research Gaps

The limitations and research gaps identified in this study are as follows:

Dependence on secondary research

The study relies on existing academic literature, industry reports, and documented business cases. It does not include primary surveys, interviews, experiments, or direct customer-level data.

No direct causal measurement

Since the study is secondary and synthesis-based, it does not claim to prove a direct causal relationship between AI voice assistant usage and customer conversion.

3. Limited evidence on long-term customer outcomes

Existing research provides useful insights on adoption, convenience, and customer experience, but there is still limited evidence on long-term effects such as customer lifetime value, retention, and loyalty.

Sector and customer segment variation

The adoption and effectiveness of AI voice assistants may differ across industries, geographies, age groups, income levels, and levels of digital maturity. More comparative research is needed.

Need for deeper research on trust and privacy

Further research is required to understand how customers evaluate privacy, consent, transparency, and data security in voice-based customer interactions.

Limited focus on customer management as a whole

Much of the existing literature focuses on voice commerce, automation, or convenience. Fewer studies examine AI voice assistants as broader customer management tools that connect engagement, trust, satisfaction, loyalty, and conversion.

Future research opportunities

Future studies can use primary data, customer surveys, experiments, sector comparisons, and longitudinal research to examine how AI voice assistants influence customer relationships, marketing effectiveness, and measurable business conversion over time.

Strategic Recommendations

Based on the secondary research reviewed, the following strategic recommendations are proposed for businesses adopting AI-powered voice assistants in customer management:

Build a clear conversation-to-conversion strategy

Businesses should define how voice assistants will support the customer journey, from initial inquiry and product discovery to purchase assistance, service recovery, repeat engagement, and loyalty. Voice assistants should not be implemented only as automation tools, but as structured customer management interfaces.

Integrate voice assistants with CRM and customer data systems

The value of AI voice assistants increases when they are connected with CRM systems, customer history, service records, feedback channels, and marketing platforms. This allows businesses to provide more relevant, consistent, and context-aware responses across customer touchpoints.

Design journey-stage use cases

Voice assistant use cases should be mapped to specific journey stages such as information search, product comparison, guided buying, complaint resolution, renewal reminders, feedback collection, and post-purchase support. This ensures that voice interactions are purposeful and directly linked to customer management outcomes.

Adopt a trust-by-design approach

Customer trust should be built into the design of voice interactions. Businesses should focus on accurate responses, clear recommendations, privacy protection, transparent data use, and reliable escalation options. Without trust, voice-based interactions are unlikely to influence engagement, loyalty, or conversion.

Use personalization with customer value in mind

Personalization should improve relevance and reduce customer effort, not create pressure or discomfort. Recommendations should be based on meaningful customer context and should support decision-making rather than appear intrusive or overly sales-driven.

Keep human escalation for complex or sensitive interactions

AI voice assistants are useful for routine, repetitive, and low-complexity interactions. However, complex complaints, emotionally sensitive issues, high-value decisions, or unresolved queries should be transferred smoothly to human agents to protect customer experience and trust.

Measure conversion beyond immediate sales

Businesses should evaluate voice assistant performance through broader customer management metrics such as customer satisfaction, repeat engagement, issue resolution, service recovery, renewal, retention, loyalty, cross-selling, up-selling, and reduced customer effort.

Establish responsible AI governance

Clear governance is required for privacy, consent, data security, response quality, recommendation fairness, and accountability. Responsible AI practices are essential to ensure that voice assistants strengthen long-term customer relationships rather than weaken customer confidence.

Continuously monitor and improve performance

Voice assistants should be regularly reviewed using customer feedback, interaction data, error patterns, escalation rates, and service outcomes. Continuous improvement can enhance intent recognition, response relevance, personalization quality, and customer confidence over time.

Conclusion

AI-powered voice assistants are emerging as a significant new frontier in customer management. They are no longer limited to simple voice commands or routine automation. With advances in natural language processing, speech recognition, machine learning, and conversational AI, voice assistants are increasingly supporting customer service, product discovery, personalized recommendations, purchase assistance, complaint resolution, feedback collection, and post-purchase engagement.

This study examined AI voice assistants through a conversation-to-conversion lens. Based on secondary research, the paper finds that voice-based interactions can influence customer engagement by making brand interactions more convenient, immediate, personalized, and interactive. A customer conversation that begins as a simple query can become a meaningful customer management opportunity when the assistant provides timely information, reduces uncertainty, supports decision-making, or guides the customer toward the next step in the journey.

The study also emphasizes that conversion should not be understood only as an immediate purchase. In customer management, conversion can include purchase intention, repeat purchase, service recovery, renewal, retention, cross-selling, up-selling, satisfaction, loyalty, and continued engagement. This broader view is important because long-term business value depends not only on individual transactions, but also on relationship quality and customer lifetime value. At the same time, the successful adoption of AI voice assistants depends on responsible implementation. Customer trust, response accuracy, privacy protection, transparency, ethical data use, CRM integration, and human escalation are essential. Poorly designed voice assistants can weaken customer experience if they provide inaccurate responses, irrelevant recommendations, or unclear data practices.

Overall, this paper concludes that AI voice assistants create strategic value when they transform customer conversations into trusted, personalized, and continuous engagement. Their future role in customer management will depend not merely on automation capability, but on how effectively businesses use voice interactions to build relationships, support decisions, strengthen loyalty, and drive conversion-related outcomes.

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OriginalArticle

The Changing Face of Media: Role, Impact, And Challenges on Society in an AI-Driven World

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The rapid deployment of Generative Artificial Intelligence (GenAI) across the global media ecosystem has initiated an institutional shift in how news is created, distributed, and processed. This paper evaluates the multi-dimensional impact of AI on modern journalism and communication. First, it establishes the foundational role and historical impact of media on society. It then systematically evaluates how AI shifts the human media professional's identity from a primary content creator to a "gatewatcher" of algorithmic systems. We explore the sociopolitical consequences of algorithmic hyper-personalization—such as the solidification of polarized information bubbles—and the psychological mechanisms driving public skepticism toward automated journalism. The paper concludes by emphasizing that while AI proliferation erodes broad systemic trust, it simultaneously drives a premium audience demand for verified, deeply investigated human reporting.

Introduction

The historical transformation of mass media through technological disruption is well-documented, but the integration of contemporary Large Language Models (LLMs) and advanced synthetic media generators represents an unprecedented shift. While previous digital iterations modified the channels of media distribution, Generative AI actively intervenes in the core creative and intellectual processes of authorship and news production (Lewis et al., 2025).

To fully understand how AI is changing the face of media, we must first clearly define what media is supposed to do and how it historically shapes human behavior. This seminar paper breaks down the traditional role and impact of media, before analyzing how artificial intelligence is radically rewriting those rules.

The Foundational Role of Media in Society

Before analyzing technological disruptions, it is crucial to establish the baseline functions that media serves in a functioning society. Traditionally, media operates across three primary dimensions:

The Information and Education Engine: Media acts as the primary conduit for distributing factual information, educating the public on local and global events, scientific advancements, and economic realities.

The Democratic Watchdog: A free press serves as the "Fourth Estate." Its role is to hold governments, corporations, and powerful individuals accountable through investigative journalism, ensuring transparency and exposing corruption.

The Public Sphere and Cultural Forum: Media provides a shared platform for public discourse. It is where societal values are debated, minority voices can seek representation, and collective cultural identities are formed.

The Impact of Media on Society

The execution of the roles mentioned above results in profound, measurable impacts on public life. The media does not just reflect society; it actively shapes it in several ways:

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Agenda-Setting and Framing: Media heavily influences *what* people think about. By deciding which stories receive front-page coverage and which are ignored, media organizations set the daily agenda for public conversation.

Shaping Public Opinion and Social Norms: Through repeated exposure to specific narratives, media normalizes certain behaviors and ideologies. It has the power to mobilize voters, shift public sentiment on critical issues (like climate change or civil rights), and influence consumer habits.

Psychological and Cognitive Effects: On an individual level, heavy media consumption impacts mental health, worldviews, and cognitive attention spans. For example, continuous exposure to negative news ("doomscrolling") can cultivate widespread societal anxiety.

The AI Shift: *Traditionally, these impacts were driven by human editors making conscious choices. Today, these massive societal impacts are increasingly driven by automated algorithms optimizing for engagement rather than public benefit.*

Review of Literature

Scholarly exploration of Artificial Intelligence in journalism has shifted from an early focus on simple, rule-based algorithmic automation to complex generative ecosystems capable of mimicking advanced human writing patterns. Recent systematic reviews highlight that AI is no longer a peripheral auxiliary tool; it is now an active "cognitive component" deeply embedded across all traditional stages of news production (Cools & Diakopoulos, 2024, as cited in Rydenfelt, 2026; Fayeze, 2024).

Empirical evidence indicates that automated news delivery systems frequently face an "AI penalty" from audiences (Licenji, 2026). Experimental studies demonstrate that when news content is explicitly labeled as AI-generated, users routinely rate it as less credible, regardless of the actual accuracy or informational quality of the text (Valenzuela, 2026; Zhang & Abdullah, 2026, as cited in Iavich, 2026). Furthermore, large-scale field experiments reveal that when audiences are exposed to the ease with which GenAI creates synthetic content, their baseline trust in all media platforms drops. Paradoxically, this deep anxiety drives an immediate increase in digital consumption and financial willingness to pay for highly trustworthy human-curated news brands (Campante, 2025).

Core Concepts: The AI-Driven Shift

Concept A: The "Gatewatcher" Paradigm

Historically, journalists operated as structural *gatekeepers*, dictating exactly which real-world events entered the public sphere as formal news. Because AI can instantly execute data mining and generate routine copy, human media professionals must pivot to a model of **gatewatching** (Rydenfelt, 2026). Human editors now monitor automated outputs, screening for machine "hallucinations," verifying data accuracy, and adding the vital ethical framework that mathematical algorithms cannot possess.

Concept B: Algorithmic Personalization vs. Information Bubbles

Modern digital media distribution relies heavily on complex algorithmic profiling to deliver unique content to individual users based on behavioral data extraction (Fayeze, 2024). While this personalization improves audience retention, it creates isolated **information bubbles** or echo chambers (Rydenfelt, 2026). By feeding individuals content that exclusively reinforces pre-existing cognitive biases, AI infrastructure fractures the unified base of public facts essential for democratic debate.

Concept C: Synthetic Manipulation and Truth Decay

The democratization of generative video and voice synthesis has introduced high-fidelity **deepfakes** into political communication pipelines, drastically altering public sphere dynamics (Licenji, 2026). This permits bad actors to distribute highly persuasive fake news at an industrial scale, causing a wider epistemological crisis where the public becomes so cynical they begin dismissing real, human-verified documentation as fake.

Concept D: The Automation of Algorithmic Bias

Because LLMs are trained on massive historical text datasets from the internet, they naturally inherit human prejudices regarding race, gender, and socio-economic geography. When media companies utilize unaligned generative tools, they risk scaling and institutionalizing these deep structural biases under the false guise of machine neutrality (Licenji, 2026).

Analytical Matrix: Structural Shifting of Media

Analytical Dimension	Traditional Human-Mediated Media	Hybrid AI-Driven Media
Operational Workflow	Manual writing, editing, and fact-checking.	Automated text generation and predictive data parsing.
Distribution Logic	Uniform broadcasting (same front page for all).	Hyper-personalized feeds tailored dynamically to users.
Primary Systemic Risk	Individual human bias and political polarization.	Large-scale algorithmic bias, machine hallucinations, and deepfakes.
Audience Trust Driver	Institutional reputation and reporter objectivity.	Transparency cues and explicit source labeling.

Conclusion & Recommendations

The integration of Artificial Intelligence does not represent the end of journalism; instead, it demands an institutional evolution. The traditional roles of media—educating the public and acting as a watchdog—are threatened by the hyper-automation of content and information bubbles.

To navigate this landscape successfully, media institutions must enforce strict transparency frameworks, ensuring all AI-assisted content features clear provenance labels and proof of human oversight (Valenzuela, 2026). Ultimately, the newsrooms that survive and thrive in this automated era will be those that use AI to handle mechanical efficiency while fiercely relying on human professionals to protect public truth and fulfill the media's foundational democratic role.

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Digital and Blended Learning in Management Education

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This paper analyzes the adoption and effectiveness of blended learning models in management education, with particular reference to business schools in India. Blended learning, understood as the intentional integration of face-to-face classroom teaching with online learning components, has become an important instructional approach in higher education; yet empirical research focusing specifically on its impact in management programs remains limited, especially in developing countries. The study examines how blended learning influences student engagement, learning outcomes, and satisfaction, and identifies key institutional, technological, and pedagogical factors that support or hinder successful implementation. A mixed-methods research design was used, combining quantitative data from structured questionnaires with qualitative insights from interviews and case-based information from selected business schools that have introduced blended learning in their management curricula. Students and faculty members shared their experiences with learning management systems, digital resources, and hybrid course structures, while academic administrators provided perspectives on institutional strategies and policies. Descriptive statistics were applied to survey responses to identify patterns in engagement, achievement, and satisfaction, and thematic analysis was used to interpret qualitative data and extract recurring themes related to infrastructure, faculty readiness, and student support. The findings indicate that well-designed blended learning models can substantially enhance student engagement, conceptual understanding, and overall satisfaction when backed by robust technological infrastructure, appropriate faculty training, and continuous institutional support. Students reported benefits such as flexible access to learning materials, opportunities for self-paced study, and extended interaction through online discussions, quizzes, and collaborative platforms. Faculty members observed that combining digital resources with in-person sessions encouraged more active participation, deeper reflection, and better preparation for classroom dialogue and assessment.

Keywords: Blended learning, Hybrid learning models, Management education, Student engagement, Learning outcomes, educational technology, Business schools.

Introduction

Digital technologies have reshaped higher education, prompting institutions to move beyond lecture-only formats toward more flexible, technology-enhanced approaches. Blended learning—where face-to-face instruction is deliberately combined with online activities—has emerged as a prominent model because it can draw on the strengths of both classroom and digital environments. By linking the social immediacy of in-person teaching with the flexibility of online platforms, blended learning aims to create more interactive and student-centered learning experiences. In management education, business schools must prepare graduates for complex business environments that require analytical skills, communication, teamwork, and decision-making. Traditional lecture-based teaching often limits interaction and does not fully support the development of these competencies or accommodate diverse learning needs.

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At the same time, the study identifies persistent challenges, including unequal access to devices and reliable internet, varying levels of digital literacy, occasional technical disruptions, and difficulties in maintaining consistent motivation in online components. Designing fair and comprehensive assessment strategies that capture learning across both online and offline activities also emerged as a complex task for instructors. The paper proposes a framework for business schools that emphasizes institutional commitment, investment in infrastructure, faculty development, student-oriented support services, and ongoing evaluation of blended learning practices. Overall, the study concludes that carefully planned and context-sensitive blended learning can make management education more flexible, inclusive, and effective, and offers practical guidance for educators and policymakers seeking to integrate digital technologies into management curricula in meaningful ways.

Integrating learning management systems, digital cases, simulations, multimedia content, and collaborative tools into management curricula therefore becomes important for enriching learning and supporting continuous engagement beyond scheduled class hours. The COVID-19 pandemic accelerated the adoption of online and hybrid delivery modes, demonstrating that digital technologies can sustain teaching during disruption while also exposing gaps in infrastructure, access, and digital literacy. In the post-pandemic period, many business schools are moving from emergency remote teaching to more deliberate blended models that combine online flexibility with the benefits of face-to-face interaction. Blended learning offers management students the possibility to balance academic work with internships or employment, to study at their own pace, and to participate in a wider range of activities and assessments. enabled retailers to implement personalization more effectively. It also provides institutions with a more resilient teaching model that can adapt to future disruptions or changing student expectations. Despite its promise, systematic evidence on blended learning in Indian business schools remains limited. Institutions have introduced online tools and hybrid courses, but questions remain about their actual impact on student engagement, learning outcomes, and satisfaction, and about the conditions needed for successful adoption. Factors such as faculty readiness, technological infrastructure, institutional policies, and equitable access can significantly influence the effectiveness of blended learning initiatives. This study addresses these gaps by examining how blended learning models are being adopted and experienced in Indian business schools. It focuses on three key outcomes—student engagement, learning outcomes, and satisfaction—while also identifying success factors and challenges. Using a mixed-methods approach that combines surveys, interviews, and case-based insights, the study seeks to contribute to the literature on management education and provide practical guidance for designing and strengthening blended learning programs.

Literature Review

Blended learning has become a significant development in higher education as institutions seek to integrate digital technologies into teaching and learning. It is generally defined as a planned combination of face-to-face instruction and online learning activities that aims to capitalize on the strengths of both environments. Rather than replacing classroom teaching, blended learning extends it by offering additional modes of delivery, interaction, and assessment. Research suggests that blended learning can improve engagement and academic performance compared to purely traditional formats. By merging in-person interaction with online discussions, multimedia resources, and formative assessments, blended environments allow students to engage with content before, during, and after class. Meta-analytic evidence indicates that learners in blended settings often achieve similar or better outcomes than those in face-to-face or fully online courses, likely due to the richer mix of learning opportunities.

In management education, blended learning is particularly relevant because business programs emphasize skills such as analytical thinking, problem-solving, teamwork, and communication. Online and hybrid platforms allow instructors to use case studies, simulations, and group projects that mirror real-world business challenges, thereby supporting application of theory to practice. Digital tools can also facilitate collaboration across time and place, enabling students to work together on projects outside the classroom. In addition, blended approaches can accommodate diverse learner profiles, including working professionals and students from different geographical regions. Student engagement is frequently highlighted as a key factor in the success of blended learning. Studies report that students value the flexibility and autonomy of online components combined with the interpersonal benefits of classroom sessions. Features such as discussion forums, quizzes, and multimedia content can encourage more regular participation and reflection, while recorded lectures and digital materials make it easier to revisit difficult topics. For many learners, the opportunity to choose when and how to engage with content increases their sense of ownership over the learning process. At the same time, the literature identifies several challenges. Effective blended learning requires reliable technological infrastructure—learning management systems, stable internet connectivity, and access to digital resources. Faculty need training not only in the use of technology but also in designing courses that integrate online and offline components coherently, with appropriate assessment strategies. Without such support, blended initiatives may replicate lecture-style pedagogy in a digital environment and fail to realize their potential. The digital divide is a significant concern in developing countries, including India. Unequal access to devices, internet connectivity, and digital skills can limit participation in online components and create inequities in outcomes. The pandemic experience highlighted these issues as institutions shifted rapidly to online delivery, revealing gaps in infrastructure and support. Post-pandemic, blended learning is seen as a way to combine flexibility with improved quality, but questions of access and inclusivity remain central.

Empirical research focusing specifically on blended learning in Indian business schools is still limited. Many institutions have adopted digital tools, yet there is a need for studies that examine how these tools are used, what outcomes they produce, and what institutional conditions support success. The present study contributes to this literature by providing evidence from Indian business schools that have introduced blended learning in management programs.

Research Methodology

Research Design

This study employs a mixed-methods research design to examine the adoption and effectiveness of blended learning models in management education. The design combines quantitative and qualitative approaches to capture both measurable outcomes and in-depth experiences. It is descriptive in documenting current practices and perceptions, and exploratory in identifying key success factors, challenges, and contextual influences.

Data Sources

Both primary and secondary data sources were used.

- **Primary data** were collected from postgraduate management students and faculty members in selected business schools that have integrated blended learning into their programs. Structured questionnaires were used to gather quantitative data on engagement, learning outcomes, and satisfaction, while semi-structured interviews captured qualitative insights from faculty and administrators.
- **Secondary data** were drawn from academic journals, books, research articles, institutional reports, and online resources related to blended and digital learning in higher education and management studies. These sources informed the design of research instruments and provided a theoretical context for interpreting the findings.

Sampling and Respondents

A purposive sampling technique was used to select business schools that had already adopted blended learning models in their management programs. This ensured that respondents had direct and relevant experience with blended environments. The sample consisted of approximately 100–150 respondents, including postgraduate management students and faculty members actively involved in blended courses. A smaller number of faculty members and academic administrators were interviewed to gain deeper insights into institutional strategies and implementation processes.

Data Collection Methods

Three main methods were used for collecting primary data:

1. Survey Questionnaires

Structured questionnaires with closed-ended and Likert-scale items were administered to students and faculty members. The instruments captured data on perceptions of student engagement, perceived learning outcomes, satisfaction with blended learning, and overall attitudes toward digital components.

2. Semi-structured Interviews

Interviews were conducted with selected faculty members and administrators to explore experiences with designing and delivering blended courses, challenges encountered, and institutional support mechanisms.

3. Case-based Information

Case-based descriptions of blended learning implementation in participating business schools were compiled from institutional documents and interview data, providing contextual detail on how models were conceptualized, integrated into curricula, and evaluated.

Data Analysis

Quantitative data from the survey questionnaires were analyzed using descriptive statistics, including percentages, mean scores, and frequency distributions. These measures were used to identify general trends in engagement, learning outcomes, and satisfaction among students and faculty.

Qualitative data from interviews and case-based information were analyzed using thematic analysis. Responses were coded and grouped into themes such as technological infrastructure, faculty readiness, student experience, institutional support, and implementation challenges. This helped contextualize the quantitative findings.

Validity, Reliability, and Ethics

The survey questionnaire was developed based on existing literature on blended learning and management education and was pilot-tested with a small group of respondents to refine wording and structure. Triangulation of data sources—surveys, interviews, and case-based information—strengthened the validity of the findings by allowing cross-verification of results. Ethical principles were followed throughout the research process. Participation was voluntary, respondents were informed about the purpose of the study, and confidentiality and anonymity were maintained. Data were used exclusively for academic purposes.

Results And Discussion

Student Engagement

Students generally perceived blended learning environments as more engaging than traditional lecture-only formats. Learning management systems, online discussion forums, and multimedia resources allowed them to interact with

course content beyond scheduled lecture hours. Online quizzes and interactive presentations provided immediate feedback, while recorded lectures enabled students to pause, review, and reflect on complex concepts.

Faculty members observed that students were more likely to participate in online discussions and collaborative assignments, and that the mix of synchronous classroom activities and asynchronous online tasks helped sustain engagement over time. Some students who were hesitant to speak in large classes were more comfortable contributing in online spaces, which broadened participation and made discussions more inclusive.

Learning Outcomes

Students reported that blended learning had a positive impact on their academic performance and conceptual understanding. Access to recorded sessions, digital readings, and interactive modules allowed them to revisit difficult topics and prepare more thoroughly for assessments. Many indicated that they felt better prepared for examinations and classroom discussions in blended courses, particularly because they could combine independent study with in-person clarification. Faculty respondents noted that students in blended courses often demonstrated stronger preparation and higher levels of analysis during in-person sessions. The opportunity to explore theoretical content online before class meant that classroom time could be devoted to applying concepts, discussing cases, and solving problems, which supported deeper learning and encouraged critical thinking.

Student Satisfaction

Most students expressed satisfaction with blended learning, highlighting flexibility, convenience, and access to diverse resources as key advantages. They appreciated being able to manage their study schedules, learn from different locations, and rewatch lectures when needed. The variety of activities and assessments in blended courses was also seen as making learning more interesting and reducing monotony.

However, some students reported challenges such as poor internet connectivity, lack of devices, and difficulty maintaining focus during online sessions. Others mentioned that the workload could feel heavy if online tasks were not well coordinated with face-to-face requirements. These issues point to the importance of reliable infrastructure and thoughtful course design that balances online and offline demands.

Key Success Factors and Challenges

The study identified several factors that contribute to successful blended learning implementation:

- **Faculty training and readiness:** Instructors need digital skills and pedagogical strategies for blended course design and delivery.
- **Technological infrastructure:** Reliable platforms, sufficient bandwidth, and access to digital resources are essential.
- **Institutional support:** Policies, administrative backing, and resources for technology and professional development enable sustained implementation.
- **Student support services:** Technical help, orientation, and guidance on online learning help students adapt to blended environments.

Key challenges included inequitable access to devices and internet, difficulty maintaining motivation in online components, and the complexity of designing assessments that fairly capture learning across both modes. These challenges underline the need for ongoing investment in infrastructure and continuous refinement of blended learning strategies.

Limitations and Implications

The study has several limitations that should be acknowledged when interpreting the findings. First, the sample was limited to a set of Indian business schools that had already adopted blended learning, which may not represent institutions with limited digital capacity or different policy environments. Second, the use of self-reported data on engagement, learning outcomes, and satisfaction introduces the possibility of response bias, as students and faculty may over- or under-estimate their experiences. Third, the cross-sectional research design captures perceptions at a single point in time and does not track changes in outcomes as blended learning practices mature. Despite these limitations, the findings have important implications for management education. For academic leaders, the results suggest that investments in infrastructure and faculty development are likely to yield meaningful improvements in teaching quality and student experience when combined with coherent blended learning strategies. For faculty members, the study underscores the value of designing courses that use online components to prepare students for richer face-to-face interaction, rather than simply replicating lectures in digital form. For policymakers, the persistent issues related to access and digital equity highlight the need for targeted support to ensure that students from all backgrounds can benefit from blended learning models.

Conclusion

This study examined the adoption and effectiveness of blended learning models in management education, focusing on business schools in India. The findings indicate that blended learning, when carefully designed and supported, can significantly enhance student engagement, learning outcomes, and satisfaction. By combining classroom interaction with digital tools and resources, blended courses create more flexible, interactive, and student-centered learning environments that align with the competencies expected of management graduates.

The study also shows that successful blended learning depends on adequate technological infrastructure, faculty readiness, institutional commitment, and student support. When these conditions are met, blended learning can improve teaching effectiveness and enrich the learning experience by offering multiple pathways for engagement and understanding. At the institutional level, blended models can contribute to greater resilience and scalability in program delivery, allowing business schools to reach a wider and more diverse student population.

However, challenges related to unequal access to technology, technical disruptions, and sustaining motivation in online components remain significant. Assessment design in blended environments also requires ongoing experimentation to ensure fair and comprehensive evaluation. Addressing these issues will require continued investment, careful planning, and regular review of blended learning practices, ideally supported by data from student feedback and learning analytics. Overall, the study suggests that blended learning represents a promising approach for transforming management education in the digital era. As business schools respond to changing technological and societal conditions, the thoughtful integration of blended learning can help provide more accessible, relevant, and effective education to diverse student populations. In doing so, institutions can better align their teaching practices with the needs of contemporary organizations and contribute to the development of graduates who are adaptable, digitally literate, and prepared for lifelong learning.

Future Work

Future research could adopt longitudinal designs to examine the long-term effects of blended learning on academic performance, skill development, and career outcomes for management graduates. Such studies would clarify whether blended environments contribute to sustained professional competence and adaptability.

Further work could explore the integration of emerging technologies—such as artificial intelligence, virtual and augmented reality, and learning analytics—within blended models for management education. These tools may support more personalized learning, immersive simulations, and data-informed teaching. For example, analytics dashboards could help faculty monitor participation and intervene early when students show signs of disengagement. Comparative studies across institutions, regions, or countries would help identify best practices and contextual factors that influence blended learning success. Research focusing on faculty perspectives and digital competencies could inform more effective training and support programs, including communities of practice where instructors share resources and experiences. Finally, future studies should pay particular attention to digital equity and inclusion, investigating policy measures and practical solutions that ensure students from diverse socio-economic backgrounds can participate fully in blended learning. This may involve examining financial aid for devices and connectivity, campus-based access centers, and low-bandwidth course designs that remain inclusive when infrastructure is limited. Addressing these issues is essential if blended learning is to fulfill its promise of making management education more flexible, inclusive, and effective.

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Transforming the Ledger: A Conceptual Review of Artificial Intelligence in Accounting, Auditing, and Financial Reporting

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Artificial intelligence (AI) is revolutionizing almost every business industry, including accounting, auditing, and financial reporting. This paper reviews the AI revolution on major accounting activities such as bookkeeping, tax, auditing, financial reporting, and managerial accounting as well as the makeup of managerial decisions. By integrating various streams of literature, industry literature as well as some basic theories, we have tried to explain how pure automation, rule-based automation, machine learning, and natural language processing have disrupted the accounting profession. The primary benefits of AI in accounting have been improved accuracy, timeliness (real-time), and advanced fraud detection; the major barriers and concerns have been the unknowns of data privacy, biased algorithms, technological obsolescence, and constantly changing regulations. This paper has also developed a conceptual model on the accounting profession with the use of AI. We believe that a primary use of AI in accounting will be in partnership with humans, where AI will augment rather than replace humans. The results of this research will be useful to accounting researchers and practitioners as well as policymakers and accounting profession/workforce developers in India and elsewhere.

Keywords: Artificial Intelligence, Accounting Automation, Auditing Technology, Financial Reporting, Machine Learning, FinTech, Digital Transformation

Introduction

The accounting profession has historically provided critical support to business governance and financial accountability. However, this profession is experiencing substantial disruption with the emergence of Artificial Intelligence (AI). Accountants have historically performed a variety of functions that involved a great deal of manual effort. From the late 20th century, accounting as a profession experienced gradual disruption and automation with the introduction of accounting software and computing tools. More recently the disruption of AI has affected the profession in a fundamentally different way. This disruption is not simply the automation of manual effort; it is a disruption that is fundamentally altering the essence of the accounting profession. Currently, the AI accounting market is estimated to be valued at approximately 1.4 billion USD and is forecasted to grow with a CAGR of over 30% through 2030 (MarketsandMarkets, 2024). In India, the disruption has already started with the integration of AI enabled systems with the Goods and Services Tax (GST) to streamline banking and filing with the Ministry of Corporate Affairs (MCA). This has changed the way the accounting profession interfaces with the regulatory system. Major auditing firms have also integrated AI systems in their audits, while accounting firms have moved to cloud-based AI accounting systems. The aim of this paper is to provide a conceptual framework to analyse the interface of AI systems in accounting, auditing, and financial reporting through a synthesis of the literature, and make a comparison of AI and traditional accounting methods. The paper also focuses on the sustainable integration of humans and AI in the accounting profession.



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Research Objectives

This paper provides a conceptual review with the following main aims:

- To examine Current and Emerging AI Applications: The paper looks at the theoretical foundations and the current and emerging AI applications in accounting, auditing, and financial reporting.
- To synthesize Existing Knowledge: The paper synthesizes recent studies and literature, providing a better understanding of AI and its role in accounting.
- To determine AI and accounting Practices Comparison: The paper analyses AI and accounting practices comparison
- To suggest a model: It suggests a model for the long-term integration of humans and AI into the accounting profession.

Research Methodology

The paper employs a conceptual review approach based on the following methodological elements:

Theoretical Foundations

The research draws on established theoretical frameworks to analyse AI adoption and impact:

Technology Acceptance Model (TAM): This framework, proposed by Davis (1989), posits that perceived usefulness and perceived ease of use determine technology adoption intentions.

Diffusion of Innovations Theory: Rogers' (1962) theory provides a framework for understanding how AI tools are gradually adopted across the accounting profession — from innovators and early adopters to the late majority.

Augmentation Theory: This theory by Author (2015) informs the discussion by arguing that technology complements rather than replaces human labour in complex, judgment-intensive tasks such as auditing.

Theoretical and Conceptual Framework

4.1 AI in Accounting:

AI in Accounting incorporates various technologies: Machine Learning (ML), Natural Language Processing (NLP), Robotic Process Automation (RPA), Computer Vision, and Predictive Analytics. Traditional software programs follow a standard logic. Unlike traditional software programs, AI can recognize and learn from patterns in a data set, and has the ability to adjust to new data and provide solutions based on probability. This is especially useful for Financial Managers because they operate in a very dynamic and data rich environment.

The main stream of theory employed in this study is based on the Technology Acceptance Model (TAM) (Davis, 1989) that suggests the main determinants of the intention to adopt a technology are the perceived usefulness and the perceived ease of use of the technology. From there, the Diffusion of innovations Theory (Rogers, 1962), provides a more specific guide for understanding the adoption of AI tools in the accounting profession from the innovative and early adopting communities to the late majority. In addition, the Augmentation Theory (Author, 2015) builds the discussion. It argues that technology assumes a complementary role to the existing human workforce in relation to labour-intensive tasks that require critical thinking, such as auditing.

4.2 Evolution of Accounting Technology:

Accounting technology has four generations. The first generation (pre-1980s) has fully manual accounting. Bookkeeping was done by hand, and all records were kept in ledgers. The second generation (1980s-2000s) introduced desktop accounting packages, e.g., Tally and MS Excel. Third generation (2000s-2015) of systems integrated accounting and cloud-based ERP systems. Fourth generation (2015 onwards) has AI and analytics and block chain technology, and transformed the accountant's role from data processor to strategic advisor. The table 1 shows the Evolution of Accounting Technology.

Table 1: Evolution of Accounting Technology

Generation	Period	Key Technologies	Accountant's Primary Role
1st Generation	Pre-1980s	Manual Ledgers, Paper Journals	Data Recorder
2nd Generation	1980s–2000s	Spreadsheets, Desktop Software (Tally, Excel)	Data Processor
3rd Generation	2000s–2015	Cloud ERP, e-Filing, Online Banking	Compliance Manager
4th Generation	2015–Present	AI, ML, RPA, Block chain, NLP	Strategic Advisor & Analyst

Key Applications of AI in Accounting and Finance

5.1 Automated Bookkeeping and Transaction Processing:

AI in accounting brings many use cases, one being automating bookkeeping. From reading different documents and statements via Optical Character Recognition and Natural Language Processing, AI systems can capture, classify, and post transactions. Auto Entry, Debt, and Receipt Bank (now Debt) utilize machine learning to analyse data. These programs categorize expenses, match purchase orders to invoices, and find exceptions. These programs reduce the chances of errors from data entry, and let accountants do more analytical work.

5.2 AI-Driven Auditing:

Traditional auditing required a sampling method due to monetary and time constraints. This method required auditors to look at a selected subset of transactions. AI, however, can analyse all transactions and define patterns beyond the capability of manual auditing. Using Machine Learning, AI can find patterns of potentially fraudulent activities, such as duplicate invoices and atypical journal entries, that involve unusual transactions with related parties. The use of AI in auditing has shown its usefulness with global firms using different AI-based auditing solutions such as Deloitte's Argus for contract analysis, EY's Canvas for audit analytics, and KPMG's Clara for intelligent audit work streams.

5.3 Financial Reporting and Disclosure:

The use of AI in financial reporting has the potential to revolutionize the process. Natural Language Generation tools have the ability to generate the management discussion and analysis, earnings summaries, and regulatory disclosures using structured financial reporting data. Competition in the market, such as Narrative Science and Automated Insights, create storytelling in finance modules that are able to generate narratives in a matter of seconds. AI technology is newly adopted to merge with the MCA21 and XBRL filing in India to automate the tagging and submission of financial statements. This advancement has the ability to greatly reduce the timelines for compliance.

5.4 Tax Compliance and GST Automation:

The GST system in India has generated high volumes of compliance data due to the multiple return forms (GSTR-1, GSTR-3B, GSTR-9, etc.). Because of the design of the AI systems in the GST networks, the auto-reconciliation of the input tax credit (ITC) is possible, the variance in the purchase and sales registers can be resolved, tax liability can be estimated, and notices for discrepancies can be generated. The level of autonomy this technology provides is a game changer for MSMEs who previously relied heavily on chartered accountants for compliance addressing. This technology is allowing MSMEs to do their own tax filing and lowering the compliance cost significantly.

5.5 Fraud Detection and Risk Management:

AI's pattern recognition strengthens financial fraud detection. Anomaly detection can detect statistical outliers within transactions which may deviate from their baseline behavioural patterns. In the banking sector, AI systems prevent fraud, among others, by analysing millions of transactions in real time. For corporate accountants, AI risk dashboards signal occurrences of going-concern issues, liquidity risks, and earnings management.

5.6 Predictive Analytics and Managerial Accounting:

AI has the capacity to advance the profession of managerial accounting to be more predictive and less bounded by historical reporting, especially through its rich predictive analytics capabilities. Machine learning to analyse historical metrics of revenue, expense, and operations can provide forecasts, scenario analyses, and cash flow projections that continuously refresh when new relevant data is available. Management accountants frequently relied on historical reporting; however, AI is changing this to allow management accountants to be predictive and to facilitate more proactive strategic organizational decisions.

The Distinction between AI Application Versus Traditional Methods in Accounting is shown in Table 2.

Table 2: AI Applications vs. Traditional Methods in Accounting

Function	Traditional Method	AI-Powered Method	Key Benefit
Bookkeeping	Manual data entry	OCR + ML auto-classification	Speed & Accuracy
Auditing	Statistical sampling	100% transaction analysis	Completeness
Financial Reporting	Manual preparation	NLG auto-drafting	Timeliness
Tax Compliance	Manual return filing	AI-GST reconciliation	Error reduction
Fraud Detection	Periodic review	Real-time anomaly detection	Prevention
Forecasting	Static spreadsheets	Predictive ML models	Agility

Opportunities for the Indian Accounting Profession

Most large countries have a significant number of employed accountants and other finance professionals. India is no exception, with more than 400,000 Chartered Accountants and many more graduates each year. Because of these resources, AI presents unique prospects for **accounting practices in the following ways:**

- Accounting practices can now take on a greater number of clients since AI takes care of many mundane tasks and minimizes the number of employees needed.
- Accounting services can now reach many of the small and micro businesses in India's rural and semi-urban areas. With AI integrated into accounting in local dialects, these businesses can keep their accounting records in compliance.
- Financial reports reach business owners and CFOs too infrequently and impede their ability to make timely decisions. AI eliminates this obstacle.
- There are countless new potential business lines for accountants now that they can provide services related to AI systems consulting, data analytics, cyber security, and ESG.
- With AI in accounting practice, clients can have greater confidence in the accuracy of financial records and the integrity of corporate governance practices. AI provides smart audit trails and compliance records.

Challenges and Limitations

7.1 Data Quality and Availability:

AI systems basically learn from the data provided to them. For many of India's SMEs, record keeping is inconsistent, incomplete and usually maintained on paper. These records are virtually impossible to process using AI. An AI-enabled accounting system is bound by the garbage-in, garbage-out principle.

7.2 Algorithmic Bias and Opacity:

Many ML systems, especially those using advanced levels of deep learning, operate as 'black boxes' to even their developers. In accounting and auditing (as in many other fields), the opacity of a system's decision process is a major problem. In accounting, bias is likely to manifest as distortion in credit rating, tax classification, and risk scoring.

7.3 Cybersecurity and Data Privacy:

AI systems hosted on the cloud and used for accounting and fintech applications will carry significant cybersecurity risks as they deal with sensitive financial data. With the absence of a comprehensive data protection legislation in India (the Digital Personal Data Protection Act is a small step in the right direction), there is regulatory ambiguity on the protection and safeguarding of financial data and on the risk posed by the employment of AI systems in accounting.

7.4 Skill Obsolescence and Workforce Disruption:

The encroachment of AI on accounting tasks will make many entry level jobs redundant, posing challenges to accounting graduates. This also indicates a need to rethink the commerce curriculum to include data literacy and AI.

7.5 Regulatory and Ethical Concerns:

Concerns have been raised around the professional accountability of AI-generated financial statements and audit reports. Under the Companies Act 2013 and the standards of ICAI, accountability lies with members of the profession. How liability will be distributed in the case where erroneous reports are generated by an AI system is an open question for the law which requires immediate attention by regulators, professional bodies, and technology developers.

Proposed Framework: The AI-Augmented Accountant Model

Based on the review of literature and conceptual analysis, this paper proposes the AI-Augmented Accountant (AAA) Framework, which **conceptualizes the future accountant's role as consisting of three integrated layers:**

- Layer 1 – AI-Automated Core (Operational Layer): Routine and repetitive tasks such as data capture, classification, reconciliation, and basic compliance filings are fully automated by AI. Accountants oversee this layer through exception management rather than direct execution.
- Layer 2 – Human-AI Collaborative Layer (Analytical Layer): Complex tasks such as audit judgment, financial analysis, tax planning, and risk assessment are performed collaboratively, with AI providing data, pattern recognition, and scenario modelling while the accountant applies professional judgment, contextual knowledge, and ethical reasoning.
- Layer 3 – Human-Led Strategic Layer (Advisory Layer): High-value services including business advisory, stakeholder communication, ethical compliance, sustainability reporting, and innovation management remain exclusively human-led, leveraging AI only as a support tool. This framework emphasizes that AI enhances the role of the accounting professional. AI, particularly the advanced technologies, will complement accounting professionals in areas that require professional scepticism and creative problem-solving. Empathy and ethical judgment are also very important. While AI will and has advanced considerably, these areas will still require distinctly human professionals.

Implications for Education, Policy, and Practice

9.1 For Accounting Education:

There is a strong need for programs related to data analytics, artificial intelligence, Python/SQL for finance, and digital audit tools to be added to business and management programs. ICAI has already added Data Analytics and AI to topics

offered in Intermediate and Final Examinations (2023); however, faster implementation in colleges, particularly in state-affiliated universities, is necessary.

9.2 For Policymakers

SEBI, RBI, MCA, and ICAI must develop AI-based auditing standards, data governance, and liability frameworks. The creation of sandboxes to allow the testing of AI-based accounting tools under regulation would assist in balancing confidence and risk.

9.3 For Practitioners

There must be a commitment to the development and implementation of reskilling, AI training, and change management within accounting firms and finance departments. AI must be viewed as an opportunity not a threat; it allows the provision of more valuable services at lower cost.

Conclusion

Artificial intelligence is becoming more of a paradigm shift than a novel technology for the accounting profession. The applications of AI, from automating bookkeeping to real-time analytics for audits, or even forecasting financial statements, transform almost every aspect of the accounting profession. For India, with its vast MSME segment, complex GST tax system, and the growing number of start-ups, the smart application of AI to accounting can bring better precision, deeper financial inclusion, and higher standards of the profession.

The road to the AI accounting profession, however, is not smooth. Data integrity and quality, the opacity of algorithms, cybersecurity, disruption of the workforce, and the absence of regulatory frameworks are issues that need the collective efforts of educators, practitioners, regulators, and technology stakeholders. The AI-Augmented Accountant Model, which this paper introduces, is a productive model for this transition. This model preserves the critical professional domains of judgment, ethics, and empathy, and incorporates the full scope of AI. Future accountants will be fewer number crunchers and more data strategists. Creating and substantiating insight generated by AI and delivering that insight to stakeholders will be the main focus of future accountants. They will also be responsible for addressing the ethical challenges posed by the digital transformation of the accounting profession. The accounting profession and the commerce community should approach this transformation from a position of both hope and a sense of urgency.

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Green Esg Practice and Their Effect on Financial Performance: Evidence from Mahindra and Mahindra

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Abstract

Environmental, Social, and Governance (ESG) practices have emerged as a critical component of corporate sustainability and long-term business success. Growing concerns regarding climate change, social responsibility, stakeholder expectations, and regulatory compliance have encouraged organizations worldwide to integrate ESG principles into their business strategies. In India, manufacturing companies are increasingly adopting ESG initiatives; however, limited research has examined the relationship between ESG practices and financial performance at the company level. This study is motivated by the need to understand whether investments in ESG activities contribute to organizational value creation and improved financial performance. The study aims to examine the ESG practices adopted by Mahindra & Mahindra and evaluate their potential effect on financial performance. Specifically, it seeks to analyse the company's environmental, social, and governance initiatives and explore their relationship with financial performance indicators such as profitability, Return on Assets (ROA), and Return on Equity (ROE). The research addresses the existing gap in the literature regarding the long-term impact of ESG implementation on business performance within the Indian manufacturing sector. The study adopts a descriptive research design and is based entirely on secondary data collected from sustainability reports, annual reports, published journals, research articles, books, and company disclosures covering the period from FY2020–21 to FY2024–25.

Keywords: ESG Practices, Environmental Sustainability, Social Responsibility, Corporate Governance, Mahindra & Mahindra, Manufacturing Industry, Corporate Sustainability.

Introduction

Environmental, Social, and Governance (ESG) investment has entered a phase of rapid development in recent decades as many nations have adopted carbon-neutral and sustainable development initiatives. ESG has gained increasing attention from both industry and academia in an environment characterized by economic and environmental uncertainties. Companies benefit from ESG disclosures through improved corporate reputation, increased investor confidence, reduced financing costs, and enhanced firm value (Friede et al., 2015). The research concludes that ESG practices have become an integral part of Mahindra & Mahindra's business strategy and serve as a significant driver of sustainable growth and financial performance in the manufacturing sector. Several empirical studies suggest a positive relationship between ESG performance and financial indicators such as Return on Assets (ROA), Return on Equity (ROE), profitability, and market valuation.

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Researchers argue that firms with stronger ESG performance are more attractive to investors and often experience lower capital costs and reduced business risks (Ioannou & Serafeim, 2015; Qureshi et al., 2021). A comprehensive review and comparative analysis of ESG initiatives and performance indicators were undertaken to assess trends and developments over the five-year period. The findings reveal that Mahindra & Mahindra has consistently strengthened its ESG performance through renewable energy adoption, carbon reduction initiatives, water positivity, waste management, biodiversity conservation, community development programs, women empowerment initiatives, and enhanced governance mechanisms. The study indicates that effective ESG integration contributes to improved corporate reputation, stakeholder confidence, risk management, operational efficiency, and long-term value creation. However, some studies report mixed or insignificant results, indicating that the impact of ESG practices may vary across industries, firm size, and geographical regions. Despite the growing body of literature, further research is needed to understand the extent to which ESG practices influence financial performance, particularly in the context of Indian manufacturing companies.

Literature Review

- Friede, Busch & Bassen (2015) Analysed over 2,200 studies and found that around 90% reported a non-negative relationship between ESG and financial performance. The study concluded that strong ESG practices positively influence firm financial performance and long-term value creation.
- Tarmuji, Maleah, and Tarmuji (2016) investigated the impact of Environmental, Social, and Governance (ESG) practices on firms' economic performance using ESG scores as indicators of sustainability performance. The study found a positive relationship between ESG practices and economic performance, suggesting that companies with better ESG scores tend to achieve superior financial and operational outcomes. The findings indicate that effective ESG implementation enhances corporate reputation, stakeholder trust, and long-term value creation.
- Nekhili (2019) examined the growing importance of Environmental, Social, and Governance (ESG) performance for firms and found that ESG practices have become a significant consideration for both policymakers and investors. The study highlighted that strong ESG performance enhances corporate reputation, attracts investment, improves stakeholder confidence, and contributes to long-term sustainability. Investors increasingly use ESG information to evaluate a firm's risk and growth potential.
- Miralles-Quiros (2019) Found that ESG is a modern and measurable dimension of CSR, providing specific criteria for evaluating sustainability performance. Miralles-Quiros (2019) Found that ESG is a modern and measurable dimension of CSR, providing specific criteria for evaluating sustainability performance.
- Qureshi, Akbar, Akbar & Poulova (2021) Found a positive relationship between ESG practices and corporate financial performance among the "100 Best Citizens." Strong ESG performance enhances firm value, stakeholder trust, and long-term financial sustainability, leading to improved corporate performance.

Research Gap

Although Mahindra & Mahindra has made significant improvements in ESG practices over the last five years, there is limited research on how these initiatives affect the company's financial performance. Most studies focus on sustainability achievements rather than their impact on profitability, ROA, and ROE. Additionally, there is a lack of long-term studies examining the effectiveness of ESG practices in creating business value. Therefore, a detailed analysis of the relationship between ESG practices and financial performance is needed.

Data and Research Methodology

This study is descriptive in nature and is based on secondary data. The required data are collected from Mahindra & Mahindra's annual reports, sustainability reports, ESG reports, company publications. The study analyses Green ESG practices and their impact on the financial performance of the company during the Financial Year 2020-21 to Financial Year 2024-25

Objective of the Study

- To examine the relationship between Green ESG practices and the financial performance of Mahindra & Mahindra.
- To analyse the impact of individual ESG dimensions (Environmental, Social, and Governance) on the financial performance of Mahindra & Mahindra.

Table – 1: ESG Initiatives and Performance Overview

ESG Dimension	FY2021	FY2022	FY2023	FY2024	FY2025
Environmental (E)	Carbon neutrality target announced for 2024. 19 million trees planted under Hariyalli:	Planet Positive strategy launched 12% renewable energy share 44% water recycles	emissions reduced by 10% 43% water recycled and reused Over 22 million trees planted	33% Renewable electricity share 59 sites certified Zero Waste to Landfill water positivity maintained.	30% renewable energy contribution 91% Water positivity 83 locations certified Zero

	Carbon disclosure Project (CDP) "A" rating	20.65million trees planted cumulatively.			Waste to Landfill.
Social (S)	1000.000 Youth trained through Mahindra Pride Schools 450.000 girls supported through Project Nanhi Kali	185,000+ girls supported under Nanhi Kali 20.000+ women farmers benefited through Project Prerna.	Strong skill development, community empowerment, regenerative agriculture and tribal farmer support.	Educational skill-building programs expanded; emphasis on women and girl's empowerment.	Sustainability linked with social procurement, green jobs, education, and skilling initiatives.
Governance (G)	ESG integrated into business strategy; stakeholders focused capitalism emphasized.	Board oversight strengthened due emerging SEBI sustainability disclosure requirements	ESG increasingly linked to investment attractiveness; strong sustainability governance framework	ESG metrics mandatory for business performance evaluation; sustainability action plans monitored by group sustainability council.	Sustainability deeply embedded into corporate strategy, risk management, stakeholder engagement, and governance reporting

Source: ESG Annual report Mahindra and Mahindra (2020-21 to 2024-25).

Table – 1.1: ESG Performance Comparison

ESG Indicator	FY2020-21	FY2021-22	FY2022-23	FY2023-24	FY2024-25
ESG Strategy	Carbon Neutrality by 2040 announced	Planet Positive strategy launched	Planet Positive expanded	Sustainability integrated into business strategy	Sustainability embedded across operations and green portfolio
Renewable Energy Share	Growing focus on renewable energy	12% renewable electricity mix	32% renewable electricity consumption	33% renewable electricity share	30% of total energy from renewables
Water Management	Water-positive company	44% water recycled and reused	43% water recycled and reused	Auto & Farm sectors water positive for 3rd consecutive year	Water positivity index ~91%
Waste Management	Focus on waste reduction	>80% locations Zero Waste to Landfill (ZWL); 71% waste recycled	>85% sites ZWL	59 sites certified ZWL	83 locations certified ZWL
Carbon/Climate Commitment	Carbon Neutral Group by 2040	Net-zero and Planet Positive roadmap	10% reduction in Scope 1 & 2 emissions vs FY22	Continued decarbonisation of operations and supply chain	Carbon neutrality target reaffirmed for 2040
Tree Plantation (Hariyali Project)	Total trees planted exceeded 19 million	1.32 million planted cumulative 20.65 million	2.2 million planted cumulative 22 million+	Continued expansion of biodiversity initiatives	Continued biodiversity and afforestation programs
Electric Vehicle (EV) Focus	Treo EV and e-mobility	Major investments	Launch of XUV400 EV	15,000+ bookings for	Launch of BE 6 and XEV 9e

	initiatives	in EVs		XUV400 EV	electric SUVs
Girl Child Education (Nanhi Kali)	450,000+ girls benefited cumulatively	1.85 lakh girls supported annually; 5 lakhs cumulative	Continued support to education programs	Expanded community initiatives	Continued investment in education and skilling
Governance & ESG Recognition	CDP Climate & Water Leadership ratings	Enhanced ESG governance and TCFD reporting	Science-Based Targets (SBTi) progress	DJSI World Index (3rd consecutive year)	CDP Climate Change score upgraded to A

Source: ESG Annual report Mahindra and Mahindra (2020-21 to 2024-25).

Table – 1.2: Financial Performance Overview

Financial Metric	FY2020-21	FY2021-22	FY2022-23	FY2023-24	FY2024-25
Revenue from Operations	44000	57446	84960	101219	159211
Net Profit	984	4935	6549	10718	12929
Earnings Per Share (EPS)	7.9	39.7	52.7	86.1	103.8
Return on Equity	4.40%	12.70%	15.60%	18.00%	18.10%
Return on Assets	0.60%	2.80%	3.30%	4.80%	5.20%

Source: Annual report Mahindra and Mahindra (2020-21 to 2024-25).

Table – 1.3: ESG Performance Index

Financial Year	Environment (%)	Social (%)	Governance (%)	Overall ESG Score (%)
FY 2020-21	68	65	71	68.0
FY 2021-22	69	67	73	69.0
FY 2022-23	71	68	74	70.0
FY 2023-24	73	70	76	71.0
FY 2024-25	81	79	86	82.0

Source: Mahindra & Mahindra Annual Reports and sustainability Reports

Table – 1.4: Correlation between ESG Scores and Financial Performance Variables

	Environment (%)	Social (%)	Governance (%)	Overall ESG Score (%)	Revenue from operations (₹ Crore)	Net Profit (PAT) (₹ Crore)	Earnings Per Share (EPS) (₹)	Return on Equity (ROE) (%)
Social (%)	0.996	1.000						
Governance (%)	0.995	1.000	1.000					
Overall ESG Score (%)	0.983	0.990	0.993	1.000				
Revenue from operations (₹ Crore)	0.989	0.978	0.973	0.947	1.000			
Net Profit (PAT) (₹ Crore)	0.892	0.881	0.869	0.805	0.938	1.000		
Earnings Per Share (EPS) (₹)	0.892	0.880	0.868	0.804	0.938	1.000	1.000	
Return on Equity (ROE) (%)	0.698	0.690	0.672	0.588	0.786	0.924	0.924	1.000

Return on Assets (ROA) (%)	0.813	0.806	0.791	0.714	0.876	0.985	0.985	0.972
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Source: Computed by Excel

Interpretation of Correlation Analysis

The correlation matrix was used to study the relationship between ESG performance and financial performance of Mahindra & Mahindra from FY2020–21 to FY2024–25. The results show a strong positive relationship among the Environmental, Social, and Governance dimensions, with correlation values ranging from 0.994 to 0.999. This means that improvement in one ESG dimension was accompanied by improvement in the other dimensions, indicating that the company follows a well-integrated approach towards sustainability. The analysis Overall ESG Score has a positive relationship with the company's financial performance. Revenue from Operations has a high positive correlation with the Overall ESG suggesting that better ESG performance is associated with higher revenue. Net Profit (PAT) and Earnings per Share (EPS) show strong positive correlations with ESG variables, indicating that improvements in ESG practices may support profitability and shareholder returns. Similarly, Return on Equity (ROE) and Return on Assets (ROA) are positively related to ESG performance, although the relationship is relatively moderate. the findings indicate that stronger ESG performance is associated with better financial performance.

Findings

- Mahindra & Mahindra demonstrated consistent improvement in its Environmental, Social, and Governance (ESG) performance during FY2020–21 to FY2024–25 through increased renewable energy usage, effective water conservation, improved waste management practices, enhanced social initiatives, and stronger governance mechanisms.
- The Environmental, Social, and Governance dimensions exhibited strong positive relationships with each other, indicating that ESG initiatives were implemented in a coordinated and integrated manner across the organization.
- Financial performance indicators, including Revenue from Operations, Net Profit, Earnings per Share (EPS), Return on Equity (ROE), and Return on Assets (ROA), showed a steady upward trend throughout the study period.
- The correlation analysis revealed a strong positive association between ESG performance and financial performance, suggesting that improvements in ESG practices were accompanied by better financial outcomes.
- Revenue from Operations showed a particularly strong positive relationship with the Overall ESG Score, indicating that enhanced sustainability performance may contribute to increased business growth and revenue generation.
- The findings indicate that ESG practices have evolved beyond compliance requirements and have become an integral component of Mahindra & Mahindra's business strategy and long-term value creation.
- The study concludes that effective implementation of ESG initiatives can support sustainable growth, strengthen corporate reputation, improve stakeholder confidence, and enhance overall financial performance.

Suggestion

- Mahindra & Mahindra should further expand the adoption of renewable energy sources across its operations to reduce environmental impact and support sustainable manufacturing practices.
- The company should strengthen ESG reporting by providing more detailed, transparent, and standardized disclosures in line with global sustainability reporting frameworks.
- Greater emphasis should be placed on employee training, skill development, workplace diversity, and inclusion initiatives to enhance social sustainability performance.
- ESG objectives should be integrated into strategic planning and decision-making processes to ensure alignment between sustainability goals and financial performance.
- Regular assessment of ESG initiatives should be undertaken to measure their effectiveness and identify areas requiring improvement.
- The company should continue investing in research and development of green technologies, electric mobility solutions, and resource-efficient production systems to support long-term competitiveness.
- Sustainable supply chain management practices should be strengthened by encouraging suppliers and business partners to comply with ESG standards and environmental regulations.
- The company should enhance stakeholder engagement by actively incorporating feedback from investors, customers, employees, local communities, and regulatory authorities into ESG-related decisions.
- More focus should be given to circular economy practices, including recycling, waste reduction, and efficient utilization of natural resources to improve environmental performance.
- The organization should establish measurable long-term sustainability targets and periodically review progress toward achieving carbon reduction, resource efficiency, and governance objectives.
- Greater investment in digital technologies and data analytics can improve ESG monitoring, risk management, and sustainability performance measurement.

- Future initiatives should focus on strengthening climate resilience and adapting business operations to emerging environmental and regulatory challenges.

Conclusion

Green ESG practices and the financial performance of Mahindra & Mahindra. The analysis showed that the company made steady progress in environmental, social, and governance activities over the years. During the same period, the company's financial performance also improved in terms of revenue, profit, earnings per share, return on equity, and return on assets. indicate a positive relationship between ESG performance and financial performance. This suggests that companies that focus on sustainable business practices can achieve better financial results while creating value for society and the environment. ESG practices can be considered an important factor in supporting the long-term growth and success of Mahindra & Mahindra. The correlation analysis indicated a strong positive relationship between ESG performance and financial performance, suggesting that sustainability initiatives contribute positively to business growth and profitability. The results demonstrate that effective ESG integration enhances operational efficiency, stakeholder confidence, corporate reputation, and long-term competitiveness. Therefore, Green ESG practices should not be viewed merely as regulatory requirements but as strategic investments that support sustainable value creation. The study concludes that ESG performance plays a vital role in strengthening the long-term financial success, resilience, and sustainable development of Mahindra & Mahindra.

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OriginalArticle

Role Of Green Bonds in Management of Public Debt in India

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This study analyzes India's public debt management for 2022–25 under the Medium-Term Debt Management Strategy (MTDS), evaluating RBI's debt operations, and the emergence of Sovereign Green Bonds (SGrBs) and retail participation as catalysts for market development. Using descriptive-analytical methods and secondary data from RBI, Union Budget, and Ministry sources (2022–23 to 2024–25), the analysis tracks debt composition, cost-risk trade-offs, and maturity structures. Key findings indicate a shift from short-term to long-term financing, with average maturity rising from ~14.7 to ~20.7 years and long-term debt (15+ years) approaching 40%, reducing rollover risk and improving sustainability. RBI's management of large borrowings-maintained market stability amid global tightening, employing reissuances, switches, and occasional buybacks to enhance liquidity. Yields moderated (weighted average yield down 28 bps in 2024–25) despite global rate volatility, while coupons remained relatively stable. The MTDS is linked to improved cost efficiency and risk mitigation, albeit with rising state-level debt and redemption pressures. SGrBs diversify the investor base, align borrowing with climate objectives, and enhance credibility, though challenges include limited market depth, greenwashing risks, and disclosure gaps. The Retail Direct platform broadened retail access to government securities, supporting market depth and participation. State borrowing reliance on market debt increased, necessitating strengthened MTDS adoption and centre-state coordination. Policy suggestions emphasize stronger green bond frameworks, expanded sovereign issuance, enhanced retail access, long-term debt emphasis, improved risk analytics, greater foreign and institutional participation, and alignment with net-zero goals. The conclusion affirms a resilient, forward-looking debt management framework that balances cost, risk, and sustainability, while cautioning that regulatory refinement and market depth expansion are essential for long-term growth.

Key words: Medium-Term Debt Management Strategy, Public Debt Management, Government Securities (G-Secs), Sovereign Green Bonds, Risk Mitigation, Cost Optimisation

Introduction

In a land where growth hung on careful balance sheets, India's debt dance unfolded under a careful, three-year plan—the Medium-Term Debt Management Strategy—woven by a government and the RBI to steer the country through 2022–25 amid tight money, rising prices, and global shocks. Yet, like a seasoned conductor, the RBI steered large borrowings for central and state governments with minimal disruptions, keeping the rhythm steady even as the tempo quickened. Meanwhile, a newer kind of instrument rose to meet the planet's rising stakes: green bonds. Born in 2007 with the European Investment Bank setting the stage, these fixed-income promises direct money toward projects that heal the climate—renewables, efficiency, clean transport, and sustainable infrastructure. They offer a beacon for investors who want returns and responsibility, a bridge linking financial markets to environmental action. The narrative traced the evolution of this market, its key players, and the global currents shaping it, while weighing the pluses and perils: the lure of transparency and sustainability against the shadows of greenwashing and regulatory gaps.

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In India, the story sharpened further—SEBI's guidelines lending clarity, State Bank of India and others channeling funds into solar and wind, and a government backdrop supporting sustainable finance. Yet, the road remained uneven, with limited participation and regulatory gaps posing challenges. Viewed as a promising path to greener growth, green bonds were framed as more than just financial instruments. They were catalysts—mobilizing capital for environmental protection and sustainable development while offering investors stable returns and enhancing corporate reputations. The trio of gains—environmental impact, economic momentum, and reputational strength—formed the heart of their promise. Looking ahead, the future of green bonds glowed with potential. A world increasingly aligned with climate goals would likely spawn more supportive policies, better transparency, and global collaboration, lifting the market to new heights. In this evolving story, green bonds stood as a vital chapter linking finance to a sustainable future.

Objectives of the Study

1. To analyse the Medium-Term Debt Management Strategy (MTDS) of the Government of India during 2022–23 to 2024–25.
2. To evaluate the effectiveness of RBI's debt management operations in terms of cost optimisation, risk mitigation, and market stability.
3. To examine the role of innovations such as Sovereign Green Bonds and retail participation in strengthening India's debt market.

Research Methodology

1. Nature of Study: The study is descriptive and analytical in nature.
2. Data Source: Secondary data collected from: RBI Annual Reports, Union Budget documents Ministry of Finance publications, Reports on public debt and MTDS
3. Period of Study: 2022–23 to 2024–25
4. Tools & Techniques: Trend analysis (yields, borrowings, maturity structure)
Comparative analysis (year-wise debt indicators) Ratio analysis (debt to GDP, borrowing composition)
6. Limitations: Based only on secondary data, Limited availability of state-level MTDS implementation data, Dynamic economic conditions may affect long-term conclusions

Hypotheses of the Study

H0 (Null Hypothesis): There is no significant impact of MTDS on cost optimisation and risk mitigation in public debt management.

H1 (Alternative Hypothesis): MTDS significantly improves cost optimisation and reduces risk in public debt management.

H0 (Null Hypothesis): Innovations such as Sovereign Green Bonds and retail participation do not significantly influence the development of the government securities market.

H2 (Alternative Hypothesis): Innovations such as Sovereign Green Bonds and retail participation significantly enhance the development of the government securities market.

Review Of Literature

- World Bank (2022) highlighted the importance of thematic bonds, especially green bonds, in financing sustainable development and addressing climate change challenges.
- Climate Bonds Initiative (2022) reported that global green bond issuance surpassed USD 2 trillion, indicating strong investor demand for sustainable financial instruments.
- RBI Annual Report (2023) emphasised the importance of cost-risk trade-offs in debt management and highlighted the role of maturity elongation in reducing rollover risks.
- RBI Annual Report (2024) analysed the impact of global monetary tightening on domestic bond yields and highlighted adaptive debt management strategies.
- ICMA Green Bond Principles provided guidelines for transparency and accountability in green bond issuance, ensuring credibility in sustainable finance markets.
- Government of India (Union Budget 2022–23) introduced Sovereign Green Bonds as a key initiative for financing environmentally sustainable projects.
- CICERO (2022) evaluated India's green bond framework as "Medium Green" with "Good Governance," reinforcing its credibility in global markets.
- RBI Studies on G-Sec Market indicated that reissuances and switching operations improve liquidity and reduce fragmentation in the bond market.
- Finance Commission Reports highlighted the increasing reliance of states on market borrowings and the need for structured debt management frameworks.
- Academic Studies on Public Debt Management (various authors) suggest that a well-designed MTDS helps balance cost and risk while ensuring long-term debt sustainability.

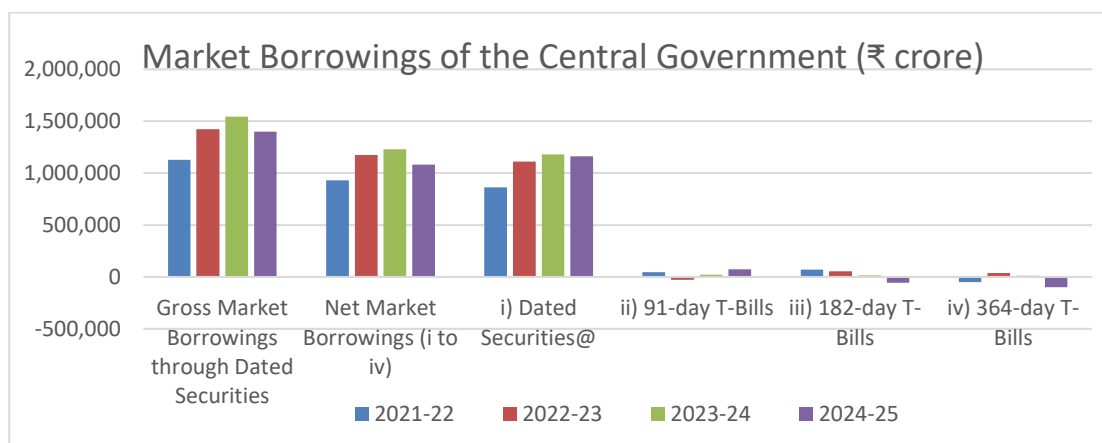
Data Analysis

In the year 2022-23, the Reserve Bank of India quietly steered the market borrowing for the central and state governments through choppy waters. Despite fears about the size of borrowing programs and a world shaken by the Ukraine war and rapid global rate hikes, the RBI kept the process non-disruptive, balancing cost, risk, and market growth. The central government's borrowings saw yields rise by 104 bps, even as policy rates climbed by 250 bps and a shift toward withdrawing accommodation took hold. To ease future risks, the debt profile was stretched with longer-dated securities, and for the first time, Sovereign Green Bonds were issued, with proceeds earmarked for public sector projects aimed at cutting emission intensity. Behind the scenes, the Internal Debt Management Department (IDMD) of the RBI held primary responsibility for managing the domestic debt of the central government, as well as 28 states and two Union Territories, under statutory provisions and bilateral agreements. Short-term financing needs were bridged via Ways and Means Advances, providing up to three months of liquidity when cash flows wobbled. As 2024-25 approached, the debt management story continued to evolve. With a lower gross fiscal deficit, central government market borrowings moderated, and the RBI again worked to complete the programs smoothly, focusing on cost efficiency, risk control, and market development. The central government's weighted average yield softened by 28 bps, and the long-term debt profile was further fortified to reduce rollover risk. Sovereign Green Bonds reappeared in the mix, totaling significant issuance, while the overall market borrowings for central and state governments remained substantial but slightly lower than the prior year. The RBI's debt management playbook emphasized passive and active consolidation, including reissuances, switches from near-term to long-dated securities, and occasional buybacks. In 2022-23, most G-sec issuances were reissued, with switches totaling over a lakh crore, and in 2024-25, a similar pattern persisted, backed by large-scale debt consolidation and management of longer tenor securities ranging from 3 to 50 years. The green bond framework, rated by CICERO as "Medium Green" with "Good" governance, laid out nine broad eligible project categories and a transparent allocation process, including annual reporting on proceeds and impact. To broaden participation, the RBI launched the Retail Direct app in 2024, enabling retail investors to access G-secs with a single sign-on and new payment modes like UPI, enhancing ease of investment in government securities. As the green finance journey continued, India reaffirmed its climate goals—aiming for net-zero by 2070 and increasing renewable energy shares—by tying Sovereign Green Bonds to public projects that would help curb carbon intensity, all while maintaining a steady, non-disruptive debt management trajectory.

Table shows Net Market Borrowings of the Central Government (₹ crore)

Item	2021-22	2022-23	2023-24	2024-25
Gross Market Borrowings through Dated Securities	11,27,382 (4.8)	14,21,000 (5.3)	15,43,000 (5.3)	14,00,697 (4.2)
Net Market Borrowings (i to iv)	9,29,351 (3.9)	11,74,375 (4.4)	12,28,805 (4.2)	10,81,598 (3.3)
i) Dated Securities@	8,63,103	11,08,261	11,80,456	11,62,879
ii) 91-day T-Bills	45,439	-23,798	20,164	72,713
iii) 182-day T-Bills	71,252	52,426	15,982	-55,896
iv) 364-day T-Bills	-50,444	37,487	12,203	-98,098

Net market borrowings for 2024-25 were ₹9,93,233 crore after adjusting for switches/buyback, with ₹12,26,101 crore in 2023-24, ₹11,71,951 crore in 2022-23, and ₹9,29,060 crore in 2021-22 (percent of GDP figures shown in parentheses; sources: RBI, Union Budget, and MoSPI).



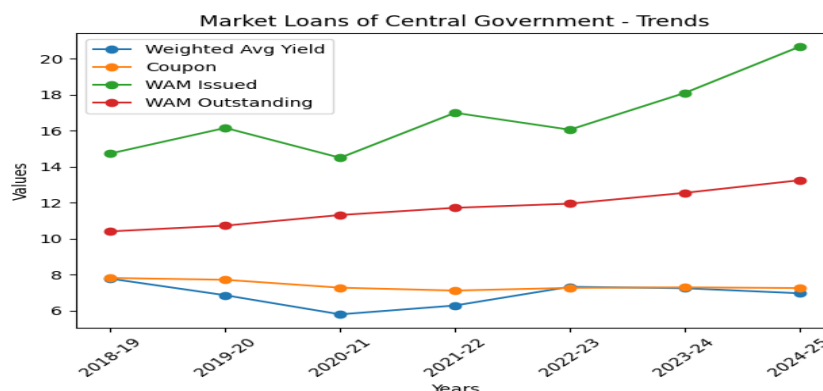
Peak borrowing in 2023–24 marks a peak in fiscal needs after the pandemic, followed by a downturn in 2024–25 signaling fiscal consolidation or reduced borrowing requirements. Dated securities overwhelmingly dominate borrowing, making long-term debt the government's primary funding source. Treasury Bills reveal volatility, with negative values signaling net repayment and positive values indicating short-term borrowing pressure. The share of borrowings to GDP is gradually declining, reflecting improving fiscal discipline. Debt Management Operations The weighted average yield of G-secs issued during the year decreased by 28 bps as compared to the previous year, while the weighted average coupon on the entire outstanding debt stock decreased by 4 bps. The weighted average maturity of primary issuances and outstanding debt increased as compared to the previous year There were two instances of devolvement on Primary Dealers (PDs) during 2024-25 as against no such instance in the previous year. There was one instance each of rejection of all bids for a notified amount of ₹6,000 crore, and partial acceptance of bids for ₹1,695 crore as against the notified amount of ₹6,000 crore.

Table Shows Market Loans of Central Government - (Yield in Per cent/Maturity in Years)

Years	Range of Cut Off Yield in Primary Issues			Issued during the Year			Outstanding Stock	
	Under 5 years	5 years - 10 Years	Over 10 Years	Weighted Average Yield	Range of Maturities @	Weighted Average Maturity	Weighted Average Maturity	Weighted Average Coupon
2018-19	6.56-8.12	6.84-8.28	7.26-8.41	7.77	1 to 37	14.73	10.4	7.81
2019-20	5.56-7.38	6.18-7.44	5.96-7.77	6.85	1 to 40	16.15	10.72	7.71
2020-21	3.79-5.87	5.15-6.53	4.46-7.19	5.79	1 to 40	14.49	11.31	7.27
2021-22	4.07-5.10	4.04-6.78	4.44-7.44	6.28	1 to 40	16.99	11.71	7.11
2022-23	5.43-7.45	5.21-7.52	5.65-7.90	7.32	1 to 40	16.05	11.94	7.26
2023-24	6.89-7.39	6.98-7.40	7.07-7.57	7.24	3 to 50	18.09	12.54	7.29
2024-25	6.61-7.25	6.69-7.19	6.78-7.34	6.96	3 to 50	20.66	13.24	7.25

Source: RBI.

Variable	Mean	Std. Dev	Min	Max
WAY	6.89	0.66	5.79	7.77
WAM (Issued)	16.74	2.07	14.49	20.66
Coupon	7.39	0.25	7.11	7.81



Yield shows **moderate volatility**, Maturity shows **consistent upward trend**, Coupon is **stable (low standard deviation)** From a short tale of debt, a steady hand guides the plot. In the early chapters (2018–19 to 2019–20), yields drifted downward from 7.77% to 6.85 as inflation stayed tame and policy stayed loose. The pandemic era (2020–21)

bursts onto the scene with a dramatic drop to 5.79%, as governments reach for stimulus and rate cuts to keep the economy afloat. As the world recalibrates (2021–22 to 2022–23), inflation rears up again and central banks tighten, sending yields climbing to 7.32%. Yet the story finds balance in the years 2023–24 to 2024–25, where borrowing costs ease slightly to 6.96%. Meanwhile, the debt book evolves as a longer tale. The maturity spectrum stretches from 1–37 years to 3–50 years, with the average maturity lengthening from about 14.7 years to 20.7 years. This signals a strategic shift toward long-term borrowing, reducing rollover risk and easing debt management. The outstanding stock mirrors this arc, with average maturity rising from 10.4 years to 13.24 years, suggesting a longer-lasting debt portfolio and lighter short-run refinancing pressure. Costs bite more gently too: the coupon rate slides from 7.81% in the early years to about 7.25% by 2024–25, meaning the government has benefited from earlier, lower-rate issuances even as yields swing with the cycles of global shocks. The broader mood shifts from a backdrop of wider yield ranges and uncertainty in the earlier years to more stable ranges by 2023–25, reflecting growing market steadiness. Key observations crown the journey: moving away from short-term borrowing toward long-term financing, a pandemic-induced dip to historically low yields, inflationary climbs afterward, and a debt strategy tuned for risk minimization, cost efficiency, and longer maturities. In sum, the central government’s market loans tell a story of resilience and foresight: embracing longer maturities, keeping costs controlled, and weathering volatility to secure a sustainable, lower-risk debt future. G-secs yields softened in 2024-25 due to lower inflation, potential policy easing, continued fiscal consolidation, RBI liquidity support, higher FPI inflows with G-secs in global indices, lower crude prices, and easing by major central banks, with the 10-year yield dropping about 45 bps. About 55.3% of market borrowing in 2024-25 was via 10-year-and-above dated securities, up from 52.1% the year prior. T-bills funded short-term needs; net ATB issuance swung to a negative ₹81,281 crore from ₹48,349 crore previously. Commercial banks, at 36.4%, remained the largest G-sec holders, followed by insurance companies (24.3%), provident funds (10.6%), and the RBI (8.1%); foreign portfolio investors held 1.9%. The other holders of G-secs (including T-Bills and SGS) include mutual funds, state governments, financial institutions, corporates and others.

Table Shows Issuance of Government of India Dated Securities – Maturity Pattern (Amount in ₹ lakh crore)

Residual Maturity	2022-23		2023-24		2024-25	
	Amount Raised	Percentage to Total	Amount Raised	Percentage to Total	Amount Raised	Percentage to Total
1	2	3	4	5	6	7
Less than 5 Years	2.7	19.0	2.5	16.5	1.9	13.4
5 - 9.99 Years	4.6	32.1	4.8	31.4	4.4	31.3
10 -14.99 Years	2.9	20.1	2.8	17.8	2.1	15.5
15 Years & Above	4.1	28.8	5.3	34.3	5.6	39.8
Total	14.2	100.0	15.4	100.0	14.0	100.0

Source: RBI.

In a tale of debt and strategy, the government gradually rewrote its future by chasing longer horizons. The crown jewel of this shift was the rise in 15-year-and-above securities, climbing from 28.8% to 34.3% and then to 39.8%, signaling a deliberate move to lock in funds for the long haul and ease the strain of refinancing. Meanwhile, short-term securities faded into the background, their presence thinning from 19.0% to 16.5% to 13.4+, a quiet withdrawal that underscored a reduced reliance on near-term borrowings. The middle ground held steady, with 5–9.99-year bonds preserving a solid core at about 31%, acting as the backbone of the borrowing strategy. Yet the 10–14.99-year window sagged, slipping from 20.1% to 15.5%, illustrating a preference tilt away from the middle years toward the longer horizon. Amid these shifts, the overall borrowing path edged up—from ₹14.2 lakh crore in 2022–23 to ₹15.4 lakh crore in 2023–24, before easing slightly to ₹14.0 lakh crore in 2024–25. The narrative concludes with a clear verdict: a maturity pattern steering toward long-term debt issuance, designed to minimize rollover risk and promote fiscal stability. Short-term shares recede as long-term bonds rise, painting a prudent portrait of debt management aligned with macroeconomic steadiness. Primary Dealers (PDs) numbered 21 (14 bank PDs and 7 standalone PDs). They underwrite primary auctions of dated G-secs and aim to meet bidding commitments and success in T-Bills/CMBs. PDs posted average T-Bills/CMB success ratios of 66.7% in H1:2024-25 and 64.2% in H2:2024-25, with PDs receiving 74.8% of T-Bills allocations in 2024-25 (up from 69.4% a year earlier). PD underwriting fees (including GST) for dated G-secs fell to ₹15.8 crore in 2024-25 from ₹48.5 crore in 2023-24. In 2024-25, ₹5,503 crore was raised via the Floating Rate Savings Bond 2020 (Taxable), of which ₹346 crore came from the RBI’s Retail Direct. The Government’s Ways and Means Advances (WMA) limits were set at ₹1.5 lakh crore for H1 and ₹0.5 lakh crore for H2 of 2024-25. The cash balance of the central government

remained in surplus during most part of the year. The central government resorted to WMA for 8 days during 2024-25 as compared with 24 days in the previous year. Investments under Foreign Central Bank (FCB) Scheme Under the FCB scheme, the Reserve Bank invests in Indian G-secs on behalf of select FCBs and multilateral development institutions in the secondary G-sec market. Total volume transacted on behalf of these institutions stood at ₹730 crore (face value) during 2024-25 as compared to ₹920 crore (face value) in the previous year. Debt Management of State Governments Following the recommendations of the 14th Finance Commission to exclude most of the states from the National Small Savings Fund (NSSF) financing facility, market borrowings of states have increased over the last few years. The share of market borrowings in financing the gross fiscal deficit of states rose to 79 per cent in 2024-25 (BE) from 75.5 per cent in 2023-24 (RE). The gross market borrowings of states in 2024-25 stood at 81.9 per cent of the amount indicated in the quarterly indicative calendar. There were 835 issuances in 2024-25, of which, 100 were re-issuances (782 issuances in 2023-24, of which, 49 were re-issuances)

Table shows Market Borrowings of States through SGS (Amount in ₹ crore)

Item	2021-22	2022-23	2023-24	2024-25
Gross Sanctions under Article 293(3)	8,95,166	8,80,779	11,29,295	11,73,714
Gross Amount Raised during the Year	7,01,626	7,58,392	10,07,058	10,73,310
Redemptions during the Year	2,09,143	2,39,562	2,89,918	3,19,965
Net Amount Raised during the Year	4,92,483	5,18,830	7,17,140	7,53,345
Amount Raised during the Year to Gross Sanctions (per cent)	78.4	86.1	89.2	91.4
Outstanding (at the end of period)	44,10,254	49,29,083	56,46,222	63,99,567

Source: RBI

In recent years, a wave of borrowing has rolled in, clear and persistent. From 2022–23 onward, both gross sanctions and actual borrowings rise, with a sharp surge in 2023–24 that hints at deeper fiscal needs or ambitious capital expenditure by states. Yet, as the new year unfolds, there's a silver lining: states are borrowing more efficiently. The amount raised now lands closer to its sanctioned limit—rising from 78.4% to 91.4%—a story of tightened discipline and smarter utilization of borrowing powers. But the tale does not end there. A growing debt burden looms large, with outstanding liabilities swelling from ₹44 lakh crore in 2021–22 to ₹64 lakh crore in 2024–25, signaling an escalating dependence on market borrowings. The mortgage of future finances grows heavier as redemption pressures mount: redemptions climb from ₹2.09 lakh crore to ₹3.19 lakh crore, suggesting maturing debt obligations will tighten future fiscal manoeuvrability. Against this backdrop, net borrowings march upward as well, from ₹4.92 lakh crore to ₹7.53 lakh crore. The storyline points to continued fiscal expansion—likely financing infrastructure and welfare schemes—as governments push forward with ambitious development bets, even as they juggle growing redemption obligations and a heavier debt load. The weighted average cut-off yield of SGS issuances in 2024-25 fell to 7.20% from 7.52%, while the WAS over central-government securities narrowed to 30 bps from 31 bps. Twenty-five states and two UTs issued dated securities up to 35-year tenors (excluding 10-year), with the average inter-state spread on fresh 10-year issuances at 4 bps (up from 3 bps). In 2024-25, 16 states/UTs used SDF, 13 used WMA, and 9 used OD; revised SDF/WMA limits based on CSF/GRF and WMA reviews became effective from July 1, 2024. Partial devolvement on PDs amounted to ₹23,053 crore in 2022-23 (vs ₹97,938 crore in 2021-22); four instances with no bids totaling ₹16,000 crore occurred versus nine such in the prior year. G-sec yields hardened through 2022-23 due to domestic inflation, global commodity prices, and policy rate hikes, with the 10-year yield rising from 6.84% to 7.31% year-end, featuring fluctuations across Q1–Q4 2022-23 linked to US yields, CPI data, crude prices, and RBI policy actions. Market borrowing for 2025-26 was planned to be orderly, focusing on cost, risk, and market development. The RBI revised WMA limits to ₹60,118 crore and SDF limits to 50% of the lower of specified balances, against CSF/GRF/ATBs investments, with auto-investment of day-end surplus in 14-day ITBs and non-competitive ATB eligibility. CBPs on cash and debt management were conducted for five states, plus a two-day program in Pune attended by 14 states. CSF and GRF holdings stood at ₹2,40,348 crore and ₹16,019 crore, respectively, as of end-March 2025, up from the previous year.

Table shows Investments in ITBs and ATBs by State Governments/UTs (₹ crore)

Item	Outstanding as on March 31				
	2021	2022	2023	2024	2025

14-Day (ITBs)	2,05,230	2,16,272	2,12,758	2,66,805	1,88,072
ATBs	41,293	87,400	58,913	51,258	88,781
Total	2,46,523	3,03,672	2,71,671	3,18,063	2,76,853

Source: RBI

In a bustling market of government instruments, investors moved like characters in a changing plot. The overall investment arc began in 2021 at ₹2,46,523 crore and climbed to a peak in 2024 of ₹3,18,063 crore, only to stumble in 2025 to ₹2,76,853 crore. It felt like a story of growth that paused as liquidity and policy currents shifted.

The 14-Day ITBs played the steady friends of the tale. From 2021 to 2023 they floated in a calm range near ₹2.05–2.12 lakh crore, then jolted upward in 2024 to ₹2,66,805 crore, before a sharp retreat in 2025 to ₹1,88,072 crore. Their journey spoke of a year when investors parked money short-term, then backed away as conditions changed.

ATBs entered as more restless, market-driven players. They began at ₹41,293 crore in 2021, surged to ₹87,400 crore in 2022, dwindled in 2023 and 2024, and then rebounded to ₹88,781 crore in 2025. This volatility reflected shifting interest-rate expectations and liquidity needs, a chorus of bets on auction-based chances.

The structural drift in 2024 crowned ITBs as the dominant short-term liquidity haven. Yet in 2025, the spotlight swung toward ATBs, hinting at a search for potentially better returns or new policy winds guiding investors' choices.

In short, the narrative tracks a year of growth peaking in 2024, a 2025 pullback, a steady ITB prominence followed by a policy-flavored pivot toward ATBs, and a chorus of liquidity and market expectations steering the plot.

Findings

- The MTDS has improved cost efficiency and risk management in public debt, with a shift to longer-term borrowing increasing average maturity from about 14.7 to 20.7 years, reducing rollover risk and strengthening debt sustainability while borrowing as a share of GDP declines, signalling better fiscal discipline.
- RBI successfully managed large borrowing programs with minimal market disruption amid global tightening, inflation, and post-pandemic fiscal expansion, using active strategies like re-issuances, switch operations, and buybacks to improve liquidity and reduce market fragmentation.
- Despite rising global rates, yield increases were moderate and controlled, with the weighted average yield declining by 28 bps in 2024–25 while coupon rates remained stable and low in volatility, indicating efficient debt pricing.
- There is a clear shift in debt structure from short-term to long-term securities, with long-term (15+ years) increasing to ~40% and short-term debt declining, reflecting a strategy to reduce refinancing pressure.
- Sovereign Green Bonds (SGrBs) represent a major innovation in public debt management by diversifying the investor base, linking borrowing to sustainable development goals, and directing funds toward renewable energy, clean transportation, and climate-resilient infrastructure to enhance India's global financial credibility.
- The launch of the Retail Direct platform increased individual investor participation in G-Secs, deepening the bond market, reducing reliance on institutional investors, and supporting the hypothesis that innovations improve market development.
- State Government borrowings have surged, relying more on market debt for a large share of the deficit while efficiency has improved in using sanctioned limits, but the debt burden and redemption pressures are increasing.
- Market stability and liquidity remain solid despite large borrowings, with limited devolvement and auction failures signaling strong market confidence and effective debt operations.
- Limited investor participation, greenwashing risk, regulatory and disclosure gaps, and the need for stronger monitoring and reporting frameworks are identified as key green bond challenges.

Suggestions

- Strengthen the Green Bond Framework by aligning with global ICMA principles for transparency, implementing stricter monitoring to prevent greenwashing, and enhancing impact reporting and verification mechanisms.
- Expand and accelerate the green bond market by increasing sovereign issuance while encouraging corporate and municipal green bonds, and offering tax incentives or subsidies to attract investors.
- Increase awareness of government securities and green bonds and further simplify investment procedures through digital platforms to boost retail participation.
- Maintain a long-term debt strategy by prioritizing long-maturity securities and reducing short-term borrowings to sustain low refinancing risk and stability.
- Strengthen state-level debt management by encouraging MTDS adoption, improving coordination between the centre and states, and monitoring rising debt levels to ensure sustainability.
- Adopt advanced tools to enhance risk management practices by improving interest rate risk management, conducting debt sustainability analysis, and balancing cost and risk trade-offs.

- Increase participation and inclusion: encourage foreign investors, pension funds, and global bond indices to deepen the domestic bond market.
- Policy support for sustainable finance should align green bond policies with India's net-zero 2070 goals and strengthen regulatory backing through SEBI.

Conclusion

The study concludes that India's public debt management during 2022–25 has been highly effective and resilient, driven by a well-structured MTDS framework and proactive intervention by the RBI. The strategy successfully balanced cost optimisation, risk mitigation, and market stability, even in a challenging global economic environment. The introduction of Sovereign Green Bonds marks a significant evolution in debt management, integrating sustainability with fiscal policy. While still at a developing stage, green bonds hold strong potential to transform India's borrowing strategy by attracting responsible investment and financing environmentally sustainable projects. However, challenges such as limited market depth, regulatory gaps, and increasing state-level debt must be addressed to ensure long-term sustainability. Overall, India's debt management framework demonstrates a forward-looking approach, combining financial prudence with innovation. Strengthening the green bond ecosystem and maintaining disciplined fiscal practices will be key to achieving sustainable economic growth and environmental objectives.

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OriginalArticle

Digital Leadership and Good Governance: Enhancing Transparency, Accountability, And Administrative Efficiency

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Digital leadership has become a vital component of modern governance systems as governments increasingly adopt digital technologies to improve public administration and service delivery. The integration of digital platforms, artificial intelligence, cloud computing, and data analytics has transformed governance by enhancing transparency, accountability, and administrative efficiency. Digital leaders play a crucial role in driving technological innovation, managing digital transformation, and promoting citizen-centric governance practices. This study examines the significance of digital leadership in strengthening good governance through improved access to public information, effective monitoring mechanisms, and streamlined administrative processes. Based on secondary data collected from government reports, international governance indices, and scholarly publications, the study analyzes the relationship between digital leadership and governance outcomes. The findings indicate that digital leadership significantly contributes to transparent governance, enhanced accountability, and efficient public service delivery. The study concludes that effective digital leadership is essential for achieving sustainable, responsive, and inclusive governance in the digital era.

Keywords: Digital Leadership, Good Governance, Transparency, Accountability, Administrative Efficiency, E-Governance.

Introduction

The twenty-first century has witnessed unprecedented technological advancements that have transformed governance systems worldwide. Governments are increasingly adopting digital technologies to improve administrative effectiveness, promote transparency, and enhance citizen engagement. Digital leadership has emerged as a strategic approach that enables public institutions to leverage technology for achieving governance objectives. Digital leadership refers to the ability of leaders to use digital technologies, innovation, and data-driven decision-making processes to improve organizational performance and public service delivery. In governance, digital leaders guide the implementation of e-governance initiatives, online public services, digital payment systems, open data platforms, and artificial intelligence applications. Good governance is characterized by transparency, accountability, participation, responsiveness, effectiveness, and efficiency. The growing demand for citizen-centric governance has compelled governments to embrace digital transformation as a means of improving service delivery and institutional performance. Digital technologies facilitate real-time communication, online monitoring, digital record management, and transparent information sharing, thereby strengthening governance mechanisms. In India, initiatives such as Digital India, Aadhaar, Unified Payments Interface (UPI), DigiLocker, e-Courts, and online grievance redressal systems have significantly contributed to digital governance. These initiatives demonstrate how digital leadership can improve government performance and build public trust. The present study explores the role of digital leadership in enhancing transparency, accountability, and administrative efficiency, which are critical pillars of good governance.



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Review of Literature

Heeks (2006)

Heeks examined the implementation of e-governance systems and found that digital technologies significantly improve transparency and service delivery. The study emphasized the importance of leadership in successfully managing digital transformation and reducing administrative inefficiencies. Yildiz (2007) Yildiz reviewed e-government literature and observed that digital governance enhances accountability through electronic monitoring and performance tracking systems. The study highlighted the importance of leadership in encouraging citizen participation and transparency. Janssen, Charalabidis, and Zuiderwijk (2012) The authors investigated open government data initiatives and found that digital platforms increase transparency by providing public access to government information. The study stressed the need for strong leadership to implement open-data strategies effectively. West (2015) West explored the role of digital government initiatives in improving public administration. The findings revealed that digital technologies reduce processing time, increase efficiency, and improve service delivery outcomes. OECD (2020) The OECD Digital Government Index report indicated that countries with strong digital leadership demonstrate higher levels of transparency, accountability, and citizen satisfaction through integrated digital services. World Bank (2023) The World Bank GovTech report highlighted the importance of digital leadership in improving governance performance through technological innovation, data-driven decision-making, and enhanced service delivery.

United Nations (2024) The United Nations E-Government Survey found that digital governance initiatives significantly improve public service efficiency and citizen engagement while strengthening transparency and accountability.

Objectives of the Study

1. To examine the role of digital leadership in enhancing transparency in governance.
2. To analyze the impact of digital leadership on accountability in public administration.
3. To evaluate the contribution of digital leadership toward improving administrative efficiency.

Methodology of the study

The study is based on secondary data collected from the United Nations E-Government Survey, OECD Digital Government Reports, World Bank GovTech Reports, Government of India Digital India publications, and relevant academic journals. Descriptive analysis and tabular presentation have been used to analyze the relationship between digital leadership and governance outcomes.

Analysis and Interpretation

Role of Digital Leadership in Enhancing Transparency
Table 1: Digital Governance and Transparency Indicators

Year	E-Government Development Index	Open Data Score (%)	Public Information Accessibility (%)
2020	0.65	60	68
2021	0.69	65	72
2022	0.74	71	78
2023	0.79	78	84
2024	0.84	85	89
2025	0.88	91	94

Source: Compiled by the author

The indicators reveal continuous improvement in governance transparency. The E-Government Development Index increased from 0.65 in 2020 to 0.88 in 2025. Similarly, Open Data Scores and Public Information Accessibility improved considerably, indicating that digital leadership promotes transparent governance through enhanced access to public information and digital disclosure mechanisms.

Analyze the Impact of Digital Leadership on Accountability in Public Administration

Table 2: Digital Accountability Indicators

Year	Online Grievance Resolution Rate (%)	Digital Audit Compliance (%)	Citizen Satisfaction (%)
2020	58	62	60
2021	63	67	65
2022	70	73	71
2023	77	80	78
2024	84	86	84
2025	90	92	90

Source: Compiled by the author

The data show substantial improvements in accountability indicators over the period. Grievance resolution rates increased from 58% to 90%, while digital audit compliance improved from 62% to 92%. Citizen satisfaction also increased significantly, demonstrating the positive role of digital leadership in strengthening accountability mechanisms.

Contribution of Digital Leadership toward Improving Administrative Efficiency

Table 3: Administrative Efficiency Indicators

Year	Average Service Delivery Time (Days)	Digital Service Utilization (%)	Administrative Efficiency Index
2020	15	45	58
2021	13	52	63
2022	11	60	70
2023	9	69	77
2024	7	78	84
2025	5	87	91

Source: Compiled by the author

The average service delivery time decreased significantly from 15 days to 5 days, while digital service utilization increased from 45% to 87%. The Administrative Efficiency Index also improved substantially, indicating that digital leadership contributes to streamlined operations, faster service delivery, and efficient utilization of resources.

Major Findings

1. Digital leadership significantly improves transparency through open-data initiatives and enhanced public access to information.
2. Digital governance systems strengthen accountability by facilitating grievance redressal, digital auditing, and performance monitoring.
3. Administrative efficiency has improved considerably due to automation, digital service platforms, and integrated governance systems.

Conclusion

Digital leadership has become an indispensable element of good governance in the digital era. The study demonstrates that digital technologies, when effectively guided by visionary leadership, significantly enhance transparency, accountability, and administrative efficiency. Governments adopting digital governance frameworks have achieved improved service delivery, greater citizen engagement, and increased institutional effectiveness. The findings highlight that digital leadership is not merely a technological requirement but a strategic governance necessity. Continued investment in digital infrastructure, leadership development, and technological innovation will further strengthen governance systems and contribute to sustainable development. Therefore, governments should prioritize digital



leadership initiatives to build transparent, accountable, and efficient public institutions capable of meeting the evolving needs of citizens.

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OriginalArticle

Digital Banking and Inclusive Development in India's Ai Ecosystem: Opportunities, Challenges and Policy Implications

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Abstract

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Digital banking has transformed India's financial landscape through mobile banking, UPI, fintech innovation, and AI-enabled services. Artificial Intelligence is increasingly used for customer service, fraud detection, credit scoring, risk management, and personalized financial services. This paper examines the role of AI-driven digital banking in promoting inclusive development in India. Using secondary data from government reports, RBI publications, NPCI reports, and academic literature, the study analyzes opportunities, challenges, and policy implications. The paper finds that AI-enabled digital banking has significantly improved accessibility, affordability, and efficiency of financial services while supporting financial inclusion. However, concerns regarding cybersecurity, privacy, digital literacy, and algorithmic bias remain critical challenges. The study concludes that responsible AI governance, stronger digital infrastructure, and inclusive policy frameworks are necessary for sustainable growth.

Keywords: Digital Banking, Artificial Intelligence, Financial Inclusion, UPI, FinTech, Inclusive Development, India

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Introduction

India has witnessed unprecedented growth in digital financial services during the last decade. Government initiatives such as Digital India, Jan Dhan Yojana, Aadhaar, Direct Benefit Transfer, and Unified Payments Interface have transformed the banking ecosystem. Artificial Intelligence has emerged as a key enabler of this transformation. AI technologies help banks improve customer experience, automate operations, identify fraud, assess creditworthiness, and provide personalized services. Digital banking has become an important instrument for inclusive development by reducing geographical barriers and extending banking services to underserved populations. The rapid growth of smartphones and internet connectivity has enabled millions of citizens to access financial services. AI further strengthens this ecosystem by making services more efficient and accessible. This paper explores how AI-enabled digital banking contributes to inclusive development in India and identifies key challenges and policy requirements.

Literature Review

Recent studies indicate that AI is reshaping banking globally. Research highlights improvements in operational efficiency, customer engagement, and risk management. Studies on financial inclusion emphasize the role of digital platforms in reaching previously unbanked populations. Indian literature suggests that UPI, mobile banking, and fintech innovations have accelerated adoption of digital payments. Scholars also identify concerns related to cybersecurity, privacy, ethical AI, and the digital divide. Existing research demonstrates strong potential for AI-driven banking but calls for stronger governance and regulatory frameworks.



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Research Gap

Although considerable literature exists on digital banking and financial inclusion, limited research integrates AI, digital banking, and inclusive development within the Indian context. This study attempts to bridge that gap by examining AI-enabled digital banking as a multidimensional contributor to economic and social inclusion.

Objectives of the Study

1. To examine the evolution of digital banking in India.
2. To analyze the role of AI in digital banking.
3. To assess the contribution of digital banking to inclusive development.
4. To identify challenges associated with AI-enabled banking.
5. To suggest policy measures for sustainable growth.

Research Methodology

The study is descriptive and analytical in nature and relies on secondary data. Sources include RBI reports, NPCI publications, NITI Aayog documents, Ministry reports, World Bank publications, and peer-reviewed research articles. Qualitative analysis has been used to evaluate trends and developments.

Evolution of Digital Banking in India

The Indian banking sector evolved from branch-based banking to core banking solutions, internet banking, mobile banking, and digital payment ecosystems. UPI has become one of the world's most successful payment infrastructures. Fintech companies and traditional banks increasingly collaborate to deliver innovative digital services. Digital banking has reduced transaction costs, improved efficiency, and expanded access to financial services across urban and rural regions. The COVID-19 pandemic accelerated adoption of digital payments and contactless transactions. Consumers increasingly rely on mobile applications for transfers, investments, loans, and account management. This transformation has strengthened India's digital economy and increased financial participation.

Artificial Intelligence in Digital Banking

AI plays a transformative role in banking. Chatbots provide round-the-clock customer support and improve response efficiency. Machine learning algorithms detect unusual transaction patterns and help prevent fraud. AI-powered analytics support decision-making, credit assessment, and customer segmentation. Banks increasingly use predictive analytics to understand customer needs and recommend suitable products. AI also assists in regulatory compliance, document processing, and operational automation. By reducing processing time and improving accuracy, AI enhances productivity and customer satisfaction. AI-based credit assessment is particularly important for financial inclusion because it enables evaluation of borrowers with limited credit histories. Alternative data sources help lenders reach underserved populations, including small businesses and rural entrepreneurs.

Digital Banking and Inclusive Development

Inclusive development involves equitable access to economic opportunities and services. Digital banking contributes to inclusion by reducing barriers related to geography, income, and documentation. Government welfare benefits can be transferred directly into beneficiary accounts, improving transparency and reducing leakages. Women, rural populations, and low-income households increasingly benefit from digital financial services. Mobile banking applications allow users to save, transfer funds, and access credit without visiting bank branches. Digital banking also supports entrepreneurship and MSME growth through faster and more accessible financial services. The integration of AI enhances inclusion by improving service delivery, personalization, and risk assessment. Financial institutions can design products tailored to specific customer needs and expand access to underserved groups.

UPI and India's AI Ecosystem

UPI has revolutionized digital payments in India. It provides instant, interoperable, and low-cost transactions across banks and platforms. The widespread adoption of UPI demonstrates the effectiveness of digital public infrastructure. AI technologies complement UPI by improving fraud monitoring, customer support, and transaction analytics. India's AI ecosystem includes technology companies, fintech startups, research institutions, regulators, and financial organizations. Government initiatives encourage innovation while promoting responsible use of technology. The combination of AI and digital public infrastructure positions India as a global leader in digital financial innovation.

Challenges and Risks

Despite significant progress, several challenges remain. Cybersecurity threats continue to evolve as digital transactions increase. Data privacy concerns arise due to the collection and processing of large volumes of customer information. Algorithmic bias may affect fairness in lending and financial decision-making. Digital literacy remains uneven across regions. Many citizens require support to use digital services effectively and safely. Infrastructure gaps, particularly in remote areas, can limit access. Regulatory authorities must balance innovation with consumer protection and systemic stability. Financial institutions must invest in cybersecurity, ethical AI frameworks, and employee training. Public awareness campaigns are also essential to reduce fraud and improve trust in digital systems.

Findings and Discussion

The study finds that AI-enabled digital banking significantly improves operational efficiency, customer experience, and financial inclusion. UPI and mobile banking have expanded access to financial services across demographic groups.

AI-driven credit assessment has improved lending opportunities for underserved populations. Digital banking supports transparency, convenience, and economic participation. However, sustainable growth requires addressing cybersecurity risks, privacy concerns, and digital literacy challenges. Policymakers and industry stakeholders must collaborate to create inclusive and responsible digital ecosystems.

Suggestions

Strengthen cybersecurity infrastructure and incident-response mechanisms. Expand digital literacy initiatives, especially in rural areas. Improve internet connectivity and digital infrastructure. Encourage responsible AI governance and transparency in algorithmic decision-making. Promote collaboration between banks, fintech firms, and regulators. Develop inclusive financial products supported by AI-driven insights. Enhance consumer awareness regarding digital safety and privacy.

Conclusion

Digital banking and Artificial Intelligence have become central pillars of India's digital transformation journey. Together they improve efficiency, accessibility, and innovation while promoting inclusive development. AI-driven banking solutions support financial inclusion by extending services to underserved populations and enabling data-driven decision-making. India's success with digital public infrastructure demonstrates the potential of technology-enabled development. Continued investment in governance, infrastructure, cybersecurity, and literacy will be essential to maximize benefits and ensure equitable growth.

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OriginalArticle

Digital Transformation in Education and Skill Development: Opportunities, Challenges, And Future Perspectives.

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Digital transformation has significantly reshaped the educational landscape and skill development processes worldwide. The integration of digital technologies such as artificial intelligence, cloud computing, online learning platforms, virtual classrooms, and learning management systems has enhanced accessibility, flexibility, and effectiveness in education. This paper examines the impact of digital transformation on education and skill development, highlighting its opportunities, challenges, and future prospects. The study explores how technology-driven learning environments facilitate personalized learning, improve employability skills, and promote lifelong learning. Furthermore, the paper discusses challenges related to digital inequality, infrastructure limitations, cybersecurity, and teacher preparedness. The findings suggest that effective implementation of digital technologies can create an inclusive and future-ready education system capable of meeting the demands of the digital economy. However, this transition is significantly challenged by a persistent digital divide, where socio-economic disparities in internet access and hardware ownership threaten to exacerbate educational inequality. Furthermore, systemic bottlenecks like institutional infrastructure deficits, cybersecurity vulnerabilities regarding student data, and a widespread lack of robust digital training for educators present severe friction points. Ultimately, achieving a future-ready, inclusive education system requires a coordinated global effort where governments treat digital access as a public utility, tech developers prioritize low-bandwidth accessibility, and institutions focus on training teachers to guide, rather than just lecture, in these newly minted digital spaces.

Keywords: Digital Transformation, Education, Skill Development, E-learning, Artificial Intelligence, Digital Learning, Employability Skills.

Introduction

The rapid advancement of digital technologies has transformed almost every sector of society, including education. Traditional methods of teaching and learning are increasingly being supplemented or replaced by digital platforms that enable remote access, interactive learning, and real-time collaboration. The COVID-19 pandemic further accelerated the adoption of digital technologies in education, making online learning a necessity rather than an option. Digital transformation in education refers to the integration of digital technologies into teaching, learning, administration, and assessment processes. It aims to improve educational outcomes, enhance accessibility, and equip learners with the skills required in a technology-driven world. Skill development has also evolved through digital tools that offer personalized training, certification programs, and industry-relevant learning experiences.



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Objectives of the Study

1. To examine the concept of digital transformation in education.
2. To analyze the role of digital technologies in skill development.
3. To identify opportunities and benefits of digital learning.
4. To explore challenges associated with digital transformation.
5. To suggest measures for effective implementation of digital education.

Digital Transformation in Education

Digital transformation encompasses the use of technology to improve educational processes and outcomes. It includes:

E-Learning Platforms

Online Learning Platforms and Digital Access

Online platforms such as **Massive Open Online Courses (MOOCs)**, **Learning Management Systems (LMS)**, and **virtual classrooms** have transformed the educational landscape by providing learners with access to educational content anytime and anywhere. These digital technologies eliminate many of the limitations associated with traditional classroom-based learning and create flexible, learner-centered educational environments.

Massive Open Online Courses (MOOCs):

MOOCs offer a wide range of courses from universities, educational institutions, and industry experts across the globe. Learners can access high-quality educational content, video lectures, assessments, and certifications at their convenience. MOOCs support self-paced learning and enable individuals to acquire new knowledge and skills regardless of their geographical location.

Artificial Intelligence (AI) in Education and Skill Development

Artificial Intelligence (AI) has emerged as a transformative force in education and skill development by enabling personalized, efficient, and data-driven learning experiences. AI-powered systems enhance teaching and learning processes through adaptive technologies, intelligent support mechanisms, and advanced analytics that cater to the unique needs of individual learners.

Virtual and Augmented Reality

VR (virtual reality) and AR (augmented reality) revolutionize education by offering deeply engaging and interactive learning experiences. Instead of passive learning, students can actively participate in simulated environments that bring abstract concepts to life.

VR transports students to virtual spaces that are otherwise inaccessible, such as inside the human body, ancient civilizations, or even outer space. This allows for firsthand exploration and discovery, making subjects like biology, history, and astronomy far more tangible and exciting.

Cloud-Based Learning

AR overlays digital information onto the real world, enabling students to interact with virtual objects in their physical surroundings. For instance, medical students can practice complex surgeries on virtual cadavers, engineering students can assemble virtual engines, or chemistry students can conduct virtual experiments without the need for expensive equipment or hazardous materials.

Digital Assessment Tools

Both VR and AR excel at visualizing abstract or difficult-to-grasp concepts. Students can explore 3D models of molecules, architectural designs, or mathematical graphs, gaining a spatial understanding that traditional 2D textbooks cannot provide. This visual and interactive approach helps solidify understanding and retention.

Digital Transformation and Skill Development

Digital technologies have revolutionized skill development by providing flexible and accessible learning opportunities.

Technical Skills

Digital transformation has significantly enhanced opportunities for learners to acquire and develop technical skills that are highly valued in the modern workforce. Through online learning platforms, virtual laboratories, and interactive training programs, students can gain expertise in a wide range of technical domains without geographical or time constraints.

Programming Skills:

Online courses provide comprehensive training in programming languages such as Python, Java, C++, JavaScript, and R. Learners can practice coding through virtual coding environments, participate in project-based learning, and develop software applications, websites, and mobile applications. These skills are essential for careers in software development, web development, and information technology.

Data Analytics and Data Science:

With the growing importance of data-driven decision-making, learners can acquire skills in data collection, analysis, visualization, and interpretation. Digital platforms offer training in tools such as Excel, SQL, Tableau, Power BI, and Python-based analytics libraries. These skills enable individuals to identify trends, solve business problems, and make informed decisions based on data.

Soft Skills Development

Digital transformation has not only enhanced technical learning but has also created significant opportunities for the development of essential soft skills. In today's knowledge-based economy, employers increasingly value soft skills such as communication, teamwork, leadership, problem-solving, adaptability, and critical thinking. Digital platforms provide interactive and collaborative learning environments that foster the growth of these competencies.

Communication Skills:

Online learning platforms encourage learners to participate in discussions, webinars, virtual presentations, and group projects. Through emails, discussion forums, video conferencing, and collaborative tools, students learn to communicate their ideas clearly and effectively in both written and verbal forms. These experiences help improve professional communication skills required in modern workplaces.

Teamwork and Collaboration:

Digital technologies enable learners from different geographical locations and cultural backgrounds to work together on projects and assignments. Collaborative tools such as shared documents, virtual workspaces, and project management platforms encourage teamwork, cooperation, and mutual learning. Such experiences prepare learners for the increasingly global and remote nature of contemporary work environments.

Industry-Relevant Training

Digital transformation has strengthened the connection between education and industry by promoting industry-relevant training programs that equip learners with practical knowledge and workplace-ready skills. Educational institutions are increasingly collaborating with industries, corporate organizations, and professional bodies to design curricula that align with current market demands and emerging technological trends.

Industry-Academia Collaboration:

Partnerships between educational institutions and industries help bridge the gap between theoretical learning and practical application. Industry experts contribute to curriculum development, guest lectures, workshops, and training sessions, ensuring that students acquire knowledge and skills that are relevant to contemporary professional environments.

Lifelong Learning

Digital transformation has revolutionized the concept of lifelong learning by making education more accessible, flexible, and continuous. In an era characterized by rapid technological advancements and evolving job markets, individuals must continuously update their knowledge and skills to remain relevant and competitive. Digital learning environments provide opportunities for learners of all ages to engage in continuous education, professional development, and personal growth throughout their lives.

Continuous Upskilling and Reskilling:

Digital platforms enable individuals to acquire new competencies and enhance existing skills through online courses, certifications, webinars, and training programs. Upskilling helps professionals improve their expertise within their current field, while reskilling allows them to transition into new roles or industries. This continuous learning process is essential for adapting to technological innovations and changing workplace requirements.

Benefits of Digital Transformation

Enhanced Accessibility

One of the most significant contributions of digital transformation to education is the enhancement of accessibility. Digital technologies have made learning more inclusive by removing geographical, economic, and social barriers that traditionally limited access to quality education. Through online platforms, virtual classrooms, and digital resources, education can now reach learners regardless of their location, background, or circumstances.

Cost-Effectiveness

Digital transformation has made education more cost-effective for educational institutions, learners, and governments. By leveraging digital technologies and online learning platforms, many of the expenses associated with traditional education can be significantly reduced. This affordability contributes to wider access to education and supports the efficient utilization of resources.

Reduction in Infrastructure Costs:

Traditional educational systems require substantial investment in physical infrastructure, including classrooms, libraries, laboratories, furniture, and maintenance. Digital learning environments reduce the dependence on physical facilities by enabling virtual classrooms and online learning platforms. As a result, institutions can optimize infrastructure costs while expanding educational reach.

Employment Readiness

Digital transformation plays a crucial role in enhancing employment readiness by equipping learners with the knowledge, skills, and competencies required in the modern workforce. As industries increasingly adopt digital technologies, educational institutions are integrating digital skill development programs into their curricula to ensure that graduates are prepared to meet evolving labor market demands. This alignment between education and industry requirements significantly improves employability and career prospects.

Alignment with Industry Needs:

Digital skill development programs are designed in consultation with industry experts and employers to ensure that learners acquire relevant and up-to-date competencies. By focusing on current technologies, workplace practices, and emerging trends, these programs help bridge the gap between academic learning and professional expectations.

Cybersecurity Concerns

The rapid migration of educational institutions to cloud-based systems, learning management platforms, and remote administration tools has transformed schools and universities into high-value targets for cybercriminals. Because educational entities handle massive volumes of personally identifiable information (PII)—including financial data, medical records, social security numbers, and proprietary research—a data breach can have devastating, long-term consequences for students and staff alike.

Practical Learning Experiences:

Digital education emphasizes hands-on learning through projects, simulations, case studies, virtual laboratories, and internships. Such experiences enable students to apply theoretical knowledge in real-world situations, enhancing their confidence and workplace readiness.

Professional Certifications:

Industry-recognized certifications obtained through online learning platforms provide evidence of specialized knowledge and technical proficiency. These certifications strengthen resumes, demonstrate commitment to continuous learning, and improve candidates' competitiveness in the job market.

Enhancement of Soft Skills:

Employment readiness requires not only technical expertise but also essential soft skills. Digital learning environments foster communication, teamwork, leadership, critical thinking, problem-solving, adaptability, and time-management skills. These attributes are highly valued by employers and contribute to overall professional success.

Strategies for Effective Digital Transformation

1. Strengthening digital infrastructure in educational institutions.
2. Providing affordable internet access and digital devices.
3. Enhancing digital literacy among teachers and students.
4. Developing robust cybersecurity frameworks.
5. Promoting public-private partnerships for technological innovation.
6. Encouraging inclusive and accessible learning environments.
7. Integrating industry-oriented skill development programs into curricula.

Future Prospects

The future of education lies in the intelligent integration of emerging technologies such as artificial intelligence, blockchain, virtual reality, and data analytics. Smart classrooms, adaptive learning systems, and competency-based education models are expected to become increasingly prevalent. Governments, educational institutions, and industries must collaborate to create a digitally empowered ecosystem that supports innovation, inclusion, and lifelong learning.

Conclusion

Digital transformation has emerged as a powerful force in reshaping education and skill development. It offers unprecedented opportunities for accessibility, personalization, and workforce preparedness. However, challenges such as digital inequality, infrastructure constraints, and cybersecurity concerns must be addressed to ensure equitable and effective implementation. By embracing technological innovation and fostering digital competencies, educational institutions can prepare learners to thrive in the rapidly evolving digital economy. The digital transformation of education marks a profound shift from rigid, industrial-era models to decentralized, student-centric learning ecosystems. By integrating advanced technological enablers like artificial intelligence, cloud computing, and interactive learning management systems, modern education has dismantled geographic boundaries, allowing learners worldwide to access high-quality resources asynchronously. This transformation enables hyper-personalized learning experiences where AI-driven platforms dynamically adapt to an individual's learning pace, while alternative pathways like micro-credentials and stackable certificates quickly realign workforce skills with the rapidly evolving digital economy. However, the equitable realization of this tech-driven vision faces critical systemic hurdles, most notably a widening digital divide where socio-economic disparities leave marginalized students without essential internet access or hardware.

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OriginalArticle

Students Experience Towards Online Accounting Learning at Undergraduate Level: A Case Study of Government First Grade College (GFGC), Shahapur

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The COVID-19 episode has made the institutions to change their traditional teaching approaches. They shifted to digital literacy, technical and pedagogic skills of teachers, digital contents and so on. This study intended to assess the impact of online accounting learning at undergraduate level in GFGC Shahpur its effectiveness, and finally the problems faced therein, from the perspective of students' experience and satisfaction. Primary data were collected from 132 undergraduate students. The result revealed that 46.21% students perceive emergency online learning partially effective, 34.09% as effective, and 19.70% as ineffective. Poor Internet connectivity, irregular electricity, high cost in data plans, lack of compatible devices, and lack of conducive environment at home, lack of technical and pedagogic skills of teachers, insufficient students' engagement and so on, turned out to be the main challenges of online learning. The findings yield the need of collaborative effort to improve digital infrastructure, reduce cost involvement and teachers' training on pedagogical and technical skills. Creating, adopting and evaluating innovative techniques and tools, student-friendly contents are the need of the hour. Above all a positive attitude to be developed for inclusive and effective online delivery of higher education in India in coming days.

Keywords : Experience, implementation, effectiveness, COVID-19, undergraduate, online accounting learning

Introduction

The COVID-19 episode has affected every sector of human existence. According to World Health Organization, a total of 42,512,186 people contracted the virus worldwide including 1,147,301 deaths as on 25 October 2020. India stands at second position soon after the USA with 7,864,811 confirmed positive cases and a demise figure of 118,534. Most countries resorted to enforce complete or partial lockdown. Consequently, sectors like travel and communication, tourism and hospitality, trade and commerce, construction and so on, witnessed a complete paralysis. Education sector is the one that experienced worst challenges. The teaching-learning methodologies have been redesigned in many schools and teachers around the world are struggling in alternative ways for delivery of instruction remotely (Molise & Dube, 2020). In India, the Prime Minister Narendra Modi declared the first phase of nationwide lockdown of 21 days starting with 25 March 2020, which is further extended to several phases. Due to lockdown, economic activities in the country came to a standstill. The Reserve Bank of India saw the COVID-19 outbreak, and prolonged lockdown is likely to have a devastating impact on the society. (Das & Guha, 2020). The educational institutions in the country, starting with pre-primary to tertiary level, are closed from 25 March 2020 and continued to shut down till October mid in spite of gradual unlocking process.

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The University Grants Commission, the higher education regulatory body of India, to its commitment to provide quality education, has suggested the institutions to shift to online mode work. In practice, little or no support to the institutions has been worked out especially in rural areas. The institutions were forced to change their traditional approaches to online mode ([Dhawan, 2020](#)).

Online Accounting Learning: Present Scenario in India

The National Education Policy (NEP) 2020 talks about digital and online education, the preparedness does not seem to be suitable in India. In fact, the budgetary allocation for digital learning was reduced from 6.04 billion in 2019–2020 to 4.69 billion in 2020–2021 ([Banerjee, 2020](#)). In 2017–2018, only 24% of Indian households have Internet facility (National Statistical Office-NSO, 2019). As per the 2019 report of Internet and Mobile Association of India (IAMAI), though the country has 451 million active Internet users who are above five years of age, of which 385 million are 12 plus years old, most of the Internet penetrations are through wireless connections. Regular and uninterrupted electricity service is still a problem in rural areas. While the Government of India has been providing free electricity to households, only 16% of India's households receive 1–8 hours of electricity per day, while 33% receives for 9–12 hours, and 47% receives for more than 12 hours, as reported by a nationwide survey of villages conducted by the Ministry of Rural Development in 2017–2018 ([Kundu, 2020](#)). Access to computers for online learning is very poor with only 28.9% students of higher education in India having computers at home in the year 2017–2018 ([Jha, 2020](#)).

In addition to these economic classes, gender and so on, is other challenges for effective online education. While around 70% of India's population lives in villages, only a few 15% of rural households have access to Internet services; for urban households, the proportion is 42% (NSO, 2019). As per IMAI (2019), the Internet penetration of 12 plus year population in rural area is about half of that of the urban area with 27% and 51%, respectively. Thus, more than 70% population in rural areas is still are do not have proper Internet connectivity. Access to regular Internet and suitable devices like computers or even mobile phones compatible with required apps involves reasonable investment that poor students find difficult to afford. The IMAI (2019) identified large variation of Internet users in terms of socioeconomic class. The digital divide between boys and girls is also wide in India. A total of 67% men in India had access to Internet, whereas this is only 33% for women. With regard to rural area, this gender divide is even higher with 28% female and 72% male Internet users (IAMAI, 2019).

In spite of these challenges, the institutions are left with no choice other than an emergency shift to online mode in the mid of a semester. It is not clear when they can have face-to-face classroom and chalk and talk method. Therefore, it becomes essential to know how far the emergency online accounting learning is effective so far. It helps in identifying the SWOT of online learning in coming days.

Review of Related Literature

The integration of information and communication technologies in the education process became a basic part in countries pan world. ([Matukhin & Evseeva, 2014](#)). Students being at anywhere can independently interact and learn from teachers and fellow students ([Singh & Thurman, 2019](#)), thereby ensuring accessibility and flexibility. It is considered to be a relatively cheaper also in terms of the lower cost of transportation, accommodation and the overall cost of institution-based learning. Blended learning and flipped classrooms, which combines face-to-face learning with technology, can increase potential of students ([Dhawan, 2020](#))

Purpose of the Study

The basic purpose of the study is to highlight on online accounting learning at undergraduate level in Shahapur. Secondly, to assess its effectiveness, and finally the problems faced therein, from the perspective of students' experience and satisfaction.

Research Questions

1. by to know the platforms, methods, devices and Internet connections used in implementing online accounting learning during COVID-19 lockdown?
2. Whether students are satisfied with the various aspects related to the online accounting learning during COVID-19 lockdown?
3. Challenges faced students in online accounting learning during COVID-19 lockdown?

Methods and Materials

The students were asked to give feedback after the online accounting classes by the researcher since he is taking classes for them.

Results and Discussion

Implementation Mechanism of Emergency Online Learning during COVID-19 Lockdown

The study revealed that the most used platform for online accounting learning during COVID-19 lockdown is Google Meet with 100% response rate, followed by WhatsApp with a response rate of 90.90%. The Face book turned out to be the least popular online accounting learning platform with only 15.90% students' responses in its favour. This result can be attributed to factors like cost involvement, facilities offered, ease of use and so on. Google Meet showed its social responsibility by offering free service (with some limitations) to academic fraternity amidst lockdown. Since, the

shift to online mode is sudden with no or little technical training to students as well as teachers, using high sophistication would have been a cumbersome enterprise. Face book and YouTube, though less used as evident, can be effectively applied as alternative learning tool.

Lecture is the most used method for emergency online accounting learning in Shahpur with a student response rate of 100% followed by sharing PDF/Word files as supplementary study material (83.33% response), giving assignment (68.18% response). Whereas more engaging and effective methods and materials like modules, PowerPoint, audio–video clips, quiz and so on, are less used by teachers as shown in the result. The study showed that 87.12% students attended online accounting classes through Wi-Fi connectivity, with only 5.30% students using broadband, while 7.58% students used both type of connections. This result also corroborates with the digital infrastructure scenario in a country like India. While around 70% of India's population lives in villages, only a little over 15% of rural households have access to Internet services; for urban households, the proportion is 42% (NSO, 2019). As such, if the Wi-Fi connectivity in smart phones is left aside, the digital connectivity in the household of the state seem to be very poor as only 12. 88% (5.30 plus 7.58) students attended classes through broadband connectivity as evident in the result.

Satisfaction of Students Regarding Online Accounting Learning during COVID-19 Lockdown

The present study attempted to understand the satisfaction level of students regarding various aspects of online accounting learning, Strong network and high-speed Internet connection, uninterrupted electricity service.

Common Problems Faced and Mode of Preference for Future Learning

The study revealed that poor Internet connectivity is the leading problem with 56.82% students' response in its favour, followed by the responses-uncomfortable (49.24%), high cost of Internet (48.48%), lack of proper environment at home (47.73%), irregular electricity (46.97%), inability to fully understand learning material (40.15%), incompatible device (27.27%) and burdens with assignment (24.24%).

Conclusion

The pandemic has changed our life and the way we teach and learn. The result of this study revealed an unsatisfactory picture of emergency online learning implemented overnight. Bad Internet connectivity, insufficient IT infrastructure, irregular electricity, significant cost involvement in data plans, lack of proper environment at home, lack of technical and pedagogic skills of teachers, students' comfort and so on. It is now facing the challenge to adopt a new mode. If we had used online education earlier, the situation would have been easy. The study warrants planning as the urgent need of the higher education institutions. Robust IT infrastructure installation irrespective of geographical locations is the prerequisite so as to bring all classes of people under the vicinity of connectivity. Poor students require support from the government in excess of compatible devices. It is quite obvious that a large portion of students are not happy with the technical and pedagogical skills exhibited by teachers as evident in the findings. The teachers are finding it difficult to adapt to online methods. As such, well-planned training mechanism focusing technical and online pedagogical skills with emphasis to collaborative leaning, project-based learning, case studies, problem solving, debates, discussions, quiz, drills and so on, must be adopted to ensure students' active participation. Students need to be trained on technical skills. The institutions must take cognizance to incorporate flexibility in their system to ensure the presence of these skills.

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Original Article

The Convergence of AI And Commerce: How Agentic Commerce Is Transforming Consumer Buying Behaviour.

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Abstract

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This paper explores the paradigm shift from human-mediated digital commerce to agentic commerce, an emerging architectural framework where autonomous software entities act as proxies for consumers and enterprises to research, evaluate, negotiate, and execute transactions. Utilizing a descriptive research design built upon secondary market data, macro-economic forecasts, and technical protocol specifications, this study maps the profound structural compression of the traditional consumer decision journey. The analysis details how the integration of large language models, standardized transaction protocols, and machine-to-machine payment rails shifts retail from an attention-driven economy to an intent-satisfaction model. Quantitative projections estimate that agentic commerce will orchestrate between \$3 trillion and \$5 trillion in global retail spend by 2030, with business-to-business automated procurement reaching up to \$15 trillion by 2028. Despite this velocity, empirical evidence reveals a clear trust-adoption gap: while 42% of consumers use artificial intelligence tools during their product discovery phases, only 5% currently delegate fully autonomous purchasing power to their digital proxies. This study analyses the core technical protocols standardizing these interactions, maps the transition from traditional search engine optimization to generative engine optimization, and classifies the strategic response models available to retail enterprises. Finally, the paper examines systemic security risks, including algorithmic fraud and bot-initiated transaction spikes, introducing the "Know Your Agent" verification framework as an essential security paradigm.

Keywords: Agentic Commerce, Global Retail, Artificial Intelligence, Digital Proxies and Know Your Agent.

Introduction

For nearly three decades, digital commerce has operated under a pull-based search architecture. Human consumers-initiated purchase journeys by navigating search platforms, filtering product directories, manually comparing attributes across fragmented browser tabs, and entering credit card details to complete transactions. This manual interface required significant cognitive effort, active time investment, and constant human oversight. Today, the convergence of advanced artificial intelligence and specialized payment networks is dismantling this historical interface, replacing it with a paradigm known as agentic commerce. Agentic commerce represents a model of buying and selling where autonomous digital agents act on behalf of human principals to discover, compare, negotiate, and complete transactions with minimal or no direct human intervention. Unlike standard automated software or basic chatbot interfaces, agentic systems use memory, contextual reasoning, and external tool integrations to pursue defined purchasing goals.

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This shift reconfigures the digital retail value chain, moving businesses away from attracting human eyeballs and toward satisfying programmatic intent. The primary customer is no longer a human consumer browsing a visual storefront, but rather an algorithm acting in that consumer's best interest.

The viability of this automated economy is driven by the convergence of three technological developments:

1. Arbitrary Web Navigation
2. Standardized Commerce Protocols
3. Machine-to-Machine Financial Rails

Standardization via Emerging Commerce Protocols-

For agentic commerce to scale across highly fragmented retail platforms, the digital ecosystem requires a standardized, open-source communication layer. To resolve this, technical consortia and payment networks have introduced a structured protocol stack:

- **Agentic Commerce Protocol (ACP):** Co-developed by OpenAI and Stripe under an Apache 2.0 license, this open standard allows conversational interfaces like ChatGPT to directly ingest structured merchant product catalogues, verify real-time inventory, and complete checkouts programmatically.
- **Universal Commerce Protocol (UCP):** Created by Google in collaboration with Shopify, Etsy, Wayfair, Target, and Walmart, this platform-agnostic standard coordinates the entire shopping journey—from discovery to physical fulfilment—powering Gemini and Google Search's AI Mode.
- **Agent Payments Protocol (AP2):** Operating alongside UCP, this payment authorization layer integrates directly with global card networks and processors to standardize how transactions are programmatically authorized by machine agents.
- **Model Context Protocol (MCP):** Developed by Anthropic, this open standard serves as a universal adapter that enables AI agents to discover, query, and interact with external enterprise data tools, APIs, and databases at runtime.

The "Know Your Agent" (KYA) Security Paradigm -

The literature reveals that the expansion of autonomous transaction systems introduces severe operational and security challenges. Traditional fraud detection networks are designed to flag and block automated script behaviour, often inadvertently blocking legitimate purchasing agents and causing transaction abandonment. Conversely, malicious actors utilize automated bots to execute credential stuffing, inventory hoarding, and automated checkout exploits.

Consequently, a new security framework is emerging in industry literature: "Know Your Agent" (KYA). KYA focuses on verifying the cryptographic identity, delegated authorization boundaries, and behavioural patterns of digital proxies. Utilizing OAuth 2.1 as a technical foundation, KYA frameworks manage access token scopes to ensure that while an agent is authorized to perform specific tasks, such as querying dynamic delivery estimates, it cannot access broader consumer financial profiles or execute transactions exceeding predefined monetary thresholds.

Analytical Framework and Descriptive Research Design:

To systematically evaluate this market transition, this study employs a descriptive research design relying on secondary data sources. This methodology is optimal for analysing a highly active, systemic industry transformation where direct longitudinal field studies are constrained by rapid software engineering cycles. The descriptive framework synthesizes qualitative and quantitative datasets collected from leading global advisory groups, market intelligence trackers, and technical protocol repositories.

The secondary data streams integrated within this report include:

- Macro-economic market projections and adoption velocity models published by primary consultancy networks, including McKinsey & Company, Bain & Company, and Gartner.
- Consumer behavioural tracking data and adoption indices compiled by retail intelligence platforms, specifically Nielsen IQ and the Visa Intelligent Commerce research suite.
- Technical documentation, API frameworks, and standard specifications released by open-source consortia and software providers, including OpenAI, Stripe, Anthropic, and Google.

Research Objectives:

To provide a structured evaluation of this technological convergence, this study is organized around four primary research objectives:

1. Map the Structural Transformation of the Consumer Decision Journey: Analyse how the cognitive labour of product discovery, active evaluation, and transactional closure is transferred from human shoppers to autonomous software agents.
2. Evaluate Global Market Scale and Adoption Velocities: Synthesize quantitative projections across B2C and B2B channels to map the economic velocity of machine-to-machine transactions.
3. Identify Core Psychological, Security, and Operational Barriers: Explore the trust-adoption gaps, algorithmic fraud vulnerabilities, and data privacy limits that restrict widespread consumer delegation.
4. Formulate Strategic Enterprise Response Models: Define how retail organizations must structure their catalog data, checkout endpoints, and search strategies to remain discoverable to algorithmic buyers.

Review of Literature:

Theoretical Foundations of the Consumer Decision Journey and AI Integration

The classic conceptualization of consumer purchasing behaviour is the Consumer Decision Journey (CDJ), formulated as a circular loop consisting of four primary phases: initial consideration, active evaluation, transaction closure, and post-purchase experience. Traditionally, digital marketing and retail operations optimized visual assets, search keywords, and site copy to influence human decisions at specific touchpoints along this journey.

Recent academic and applied literature highlights how the integration of artificial intelligence has progressively compressed this decision loop. In online retail sectors, AI-enhanced analytics have demonstrated high predictive capabilities, explaining and anticipating consumer purchase behaviours with mathematical precision. For instance, empirical research in digital retail operations shows that deploying predictive algorithms improves merchant responsiveness to market changes by 32%, increases customer retention by 28%, and boosts repeat purchasing by 34.7%. However, these early AI integrations functioned primarily as "copilots" designed to optimize human decision-making.

The transition to agentic commerce represents a clean break from these historical models. By acting as "delegation engines," autonomous agents do not merely guide the consumer; they actively take over the execution of the decision journey itself.

The Evolution of the Machine-to-Machine (M2M) Economy

The operational foundation of agentic commerce lies in the Machine-to-Machine (M2M) economy, defined as a digital marketplace where autonomous software entities act as primary economic participants capable of owning, spending, and earning value independently. For decades, the realization of this autonomous economy was constrained by financial infrastructure built exclusively for human identity verification and traditional web pages optimized for human visual scanning. To facilitate financial operations within this machine-centric economy, systems are integrating artificial intelligence with smart contracts and decentralized payment rails. This integration utilizes specialized protocols, such as the x402 protocol, which repurposes the HTTP 402 "Payment Required" status code to enable micropayments from AI agents in exchange for specific API calls, computational resources, or real-time data feeds. To preserve security, autonomous agents are tethered to digital identities or Smart Accounts, allowing them to sign routine, low-value transactions within a framework of delegated authority. The human owner acts as the primary gatekeeper, utilizing hardware wallets as a root of trust to authorize session keys and establish strict spending caps. Within this framework, marketing and selling become data-science-oriented. Machine customers operate logically and rationally based on their programming, remaining immune to traditional emotional advertising and visual design, and prioritizing structured data clarity, real-time pricing, and fulfilment parameters.

Quantitative Market Analysis and Macro Projections:

Descriptive analysis of data compiled from global financial institutions, research bureaus, and advisory networks indicates that agentic commerce will experience massive growth over the next decade. There is strong industry consensus regarding the multi-trillion-dollar scale of this transition. Table 1 synthesizes the core market size forecasts and transaction volumes projected by primary industry analysts.

Table 1: Macro-Economic Projections of Agentic Commerce (2028–2034)

Sponsoring Organization	Market Forecast Metric	Projected Valuation	Target Year	Citation Sources
McKinsey & Company	Global Agentic Commerce Opportunity	\$3.0T to \$5.0T	2030	McKinsey (2025)
McKinsey & Company	US B2C Retail Revenue Orchestrated by Agents	\$900B to \$1.0T	2030	McKinsey (2025)
Gartner	B2B Spending through AI Agent Exchanges	\$15.0 Trillion	2028	Gartner (2025)
Bain & Company	US Agentic Commerce Market (Share of E-Commerce)	\$300B to \$500B (15–25%)	2030	Bain (2025)
Morgan Stanley	US E-Commerce Spending via Agentic Shoppers	\$190B to \$385B (10–20%)	2030	Morgan Stanley (2025)

Sponsoring Organization	Market Forecast Metric	Projected Valuation	Target Year	Citation Sources
Juniper Research	Total Agentic Commerce Transaction Value	\$3.5 Trillion	2031	Juniper Research (2026)
Precedence Research	Global AI Agents Market (At 45.8% CAGR)	\$236.0 Billion	2034	Precedence Research (2026)
Galileo	Agentic Payment Market Volume	\$7.0B to \$93.0B	2032	Galileo (2025)

Source: Compiled from McKinsey & Company, Gartner, Bain & Company, Morgan Stanley, Juniper Research, Precedence Research, and Galileo.

The projections in Table 1 reveal several important market dynamics. First, Gartner's forecast that \$15 trillion in B2B spending will be AI-agent intermediated by 2028 suggests that corporate procurement and industrial supply chains are adopting agentic commerce faster than retail consumer spaces. This rapid B2B adoption is driven by the highly structured, objective, and rule-based nature of corporate buying, which is highly compatible with algorithmic optimization.

In the consumer retail space, the projection by Bain & Company that up to 25% of all US e-commerce will flow through agentic channels by 2030 indicates a rapid transition away from traditional keyword-based search engines. This shift is supported by seasonal traffic statistics: during the 2025 holiday shopping period, AI-referred traffic to US retail sites saw an 805% year-over-year spike on Black Friday and a 670% surge on Cyber Monday, driving billions of dollars in online sales.

Consumer Behavioural Integration and the Trust-Adoption Gap:

To understand how this economic transition affects consumer buying behaviour, it is necessary to examine how shoppers actively engage with AI. Data from the 2026 Nielsen IQ (NIQ) Agentic Commerce Tracker indicates that AI is already deeply integrated into the early discovery phases of the purchase journey. Table 2 outlines consumer adoption metrics and levels of engagement.

Table 2: Consumer AI Shopping Adoption and Engagement Metrics (2026)

Consumer Behaviour Metric	Share of Surveyed Consumers (%)	Operational Context and Behaviour Description
Active AI Shopping Engagement	42%	Consumers who have used at least one AI tool to shop within the past month.
Automated Subscription Reorders	19%	Consumers utilizing auto-replenish or subscription features for repeat purchases.
AI-Mediated Product Search	17%	Shoppers relying on AI systems specifically to generate product recommendations.
Active Chatbot Interaction	10%	Consumers engaging directly with retailer-provided shopping assistants (e.g., Rufus, Sparky).
Voice-Activated Replenishment	10%	Consumers utilizing smart voice assistants to execute or reorder purchases.
Fully Autonomous Purchases	5%	Consumers delegating the entire transaction, including payment, to autonomous AI agents.

Source: Nielsen IQ (NIQ) Agentic Commerce Tracker (2026).

An analysis of the data in Table 2 reveals a clear "delegation ceiling." While nearly half of all consumers (42%) use AI as a research and comparison tool, only a small minority (5%) allow these systems to complete purchases autonomously.

This behaviour highlights a persistent "Trust-Adoption Gap." Surveys indicate that while 70% of consumers are comfortable with AI agents executing purchases within set guidelines, only 4% trust an agent to buy without a final human review. Consumers use AI to simplify and accelerate choices, offloading the time-consuming tasks of product discovery, review analysis, and price comparison. However, they retain final transaction authority to maintain control over financial authorizations and personal data privacy. This caution is supported by Visa's Intelligent Commerce research, which shows that control over data is important or very important to 85% of respondents. Furthermore, 54% of consumers state they are not likely to use an agent if they lack direct data control, and nearly nine in ten demand transparency into how agents make decisions.

The Transformation of Consumer Buying Behaviour:

The transition from human browsing to agentic delegation is marked by structural changes that redefine how consumers interact with retail brands:

a. The Decay of the Impulse Purchase

Traditional e-commerce is highly optimized to capture human attention and drive emotional, unplanned purchases. Web designers use visual merchandising, personalized layouts, and countdown timers to create scarcity, while marketers deploy retargeting ads to capture attention. Because autonomous AI agents operate logically and rationally based on programming, they are immune to emotional triggers, visual copywriting, and artificial urgency. Consequently, the impulse purchase is becoming an endangered species. Brands can no longer drive conversions through flashy copywriting or manipulative design patterns; instead, they must win transactions by providing superior data clarity, price competitiveness, and optimal fulfilment terms.

b. The Realignment of Customer Loyalty

Historically, customer loyalty was built on direct brand relationships, emotional affinity, and repeat exposure. In an agentic environment, consumer loyalty shifts away from the product brand or retailer and toward the assistant itself. Consumers become loyal to the agent that successfully saves them time, protects their budget, and manages their data safely. The brand becomes a commoditized supplier, visible only if the consumer's agent determines it represents the optimal value choice.

c. The Referral and Conversion Performance Paradox

A major contradiction currently exists between consumer intent and retail infrastructure. While consumer demand for AI-driven discovery is growing rapidly, actual conversions through third-party conversational engines remain low. Research indicates that less than 0.2% of e-commerce sessions currently originate from ChatGPT referrals, and these referrals convert 86% worse than traditional affiliate links. This performance gap exists because most retail websites are designed for humans, not machine readers. When an agent attempts to check real-time inventory, calculate dynamic shipping costs, or complete a transaction, it encounters unstructured data, CAPTCHAs, and rigid human checkout fields, causing the transaction to fail.

d. On-Site and Off-Site Retailer Agents

To maintain direct customer relationships, retailers are deploying specialized on-site conversational agents. These proprietary systems, such as Amazon's Rufus or Magalu's Lu, enhance discovery and conversion within their own ecosystems while collecting proprietary data. Amazon's Rufus, for instance, helped drive nearly \$12 billion in annualized incremental sales. Retailers are also launching specialized off-site assistants, such as Home Depot's *Magic Apron*, which guides consumers through complex DIY project planning and material procurement. These specialized, niche-focused agents leverage unique proprietary data and project expertise that generalist AI platforms cannot easily replicate.

e. Case Studies on Operational Performance

When retail platforms modernize their infrastructure to support agentic interactions, the performance metrics demonstrate significant revenue impact. For instance, the beauty brand Tatcha achieved a 3x conversion rate increase and a 38% higher average order value (AOV) by deploying Alhena AI's structured catalog agent. This deployment enabled external AI agents to programmatically query accurate sizing, compatibility, and ingredient information, driving 11.4% of total site revenue. Similarly, Victoria Beckham recorded a 20% increase in average order value by optimizing its digital storefront for machine readability.

f. Physical Retail as Experiential Hubs

The transition to agentic commerce is also reshaping the role of physical storefronts. As everyday replenishment and routine purchasing shift to automated behind-the-scenes systems, physical locations are evolving from transactional spaces into experiential hubs, showrooms, and marketing investments. Younger, digitally native generations continue to seek in-store engagement and experiential brand touchpoints, even as actual sales transactions are increasingly decoupled from physical foot traffic and managed by autonomous AI agents.

Delivery Infrastructure as a Pre-Purchase Ranking Signal

In an agentic shopping ecosystem, delivery data is no longer merely a post-purchase fulfilment detail; it functions as a critical pre-purchase ranking signal. When an AI agent compares two merchants selling the exact same product, it programmatically evaluates carrier speed, pickup choices, real-time tracking transparency, and localized delivery fees. To satisfy these algorithmic evaluations, logistics systems like nShift expose carrier options and service levels through structured APIs. This setup allows agents to programmatically query live rates and make decisions in real time. If a merchant's checkout, carrier management, tracking, and returns do not share a single, machine-readable data architecture, the store is effectively invisible to autonomous buyers.

Technical and Operational Security Risks:

Algorithmic Fraud and the Vulnerability Landscape -

The shift toward autonomous, machine-driven transactions significantly alters the digital security environment. Traditional fraud detection networks are highly optimized to analyse human behavioural patterns, which do not translate cleanly to agent interactions.

The scale of this threat is highlighted by several recent data points:

- **A Rise in AI-Facilitated Attacks:** Darwinium's research indicates that 97% of digital enterprises have experienced a marked increase in AI-facilitated attacks, resulting in an average annual direct loss of \$4.5 million from automated bad actors.
- **CTO and Financial Institution Concerns:** Roughly 78% of financial institutions project an increase in transaction fraud directly linked to AI agents. Furthermore, 87% of CTOs and heads of payment systems identify security and trust as the single most significant barrier to the widespread adoption of agentic payments.
- **Spikes in Malicious Bot Activity:** Visa reports a 25% spike in malicious bot-initiated transactions over a six-month period, with a 40% surge in the United States, as fraudsters increasingly deploy AI agents to automate account takeovers, hoard inventory, and exploit checkout APIs.

Authentication and Access Management in Agent Integrations:

To secure these machine-to-machine interactions, enterprise platforms are utilizing Auth0's custom authentication frameworks. Built on OAuth 2.1, these frameworks establish secure agent-merchant handshakes.

To authorize external digital proxies, platforms support two primary client registration modes:

1. **Static Client Registration:** The preferred, highly secure approach where merchants manually pre-register known AI agents (such as ChatGPT or Gemini) as client applications in their security dashboards, granting explicit control over resource access.
2. **Dynamic Client Registration (DCR):** A flexible, runtime model that allows emerging, third-party AI agents to register themselves programmatically. While DCR is highly efficient for open-ecosystem growth, it introduces significant security risks unless guarded by reverse proxies and strict Tenant Access Control Lists.

Bypassing Merchant Boundaries: Universal Checkout Infrastructure

Because open protocols like Google's UCP and OpenAI's ACP require direct merchant opt-in, millions of smaller retailers and niche products remain inaccessible to standard AI agents. To resolve this, universal checkout systems (such as Rye's Universal Checkout API) have emerged as an alternative infrastructure layer.

This browser-automation layer allows AI agents to interact with any arbitrary retailer website through three technical mechanisms:

- **Browser-Automation Agents:** Independent software engines that dynamically navigate human checkout screens, parse form fields, and input user credentials on any retail site.
- **Optimized Caching Layers:** Systems that convert successful checkout paths into deterministic, automated workflows, accelerating subsequent repeat transactions by up to 8x.
- **Fraud-Mitigation Proxy Layers:** Secure proxies that prevent traditional bot-detection software and CAPTCHAs from blocking legitimate, automated purchasing agents acting on behalf of verified consumers.

Research Limitations:

While this descriptive study provides a comprehensive overview of the convergence of AI and commerce, several research limitations must be acknowledged:

- **Over-Reliance on Corporate Forecasts:** This study relies on secondary market forecasts compiled by major advisory and consulting firms. Because agentic commerce is in its early stages of deployment, these projections use speculative growth models that may overestimate adoption speed or downplay unexpected technical and regulatory roadblocks.
- **Geographic Bias in Available Data:** Current retail traffic statistics, consumer survey samples, and pilot deployments are heavily concentrated in North America and Western Europe. This limits the generalizability of these findings to emerging digital markets in Asia, Africa, and Latin America, which may follow alternative adoption paths.
- **Lack of Direct Empirical Validation:** This research utilizes a descriptive design based on secondary sources and lacks direct primary validation, such as consumer focus groups, web-usability testing under agentic conditions, or direct developer surveys.

Conclusion

The convergence of artificial intelligence and digital commerce represents a major shift from human-mediated search to autonomous, machine-to-machine transactions. As agentic commerce matures, it is restructuring traditional marketing funnels, shifting customer loyalty from product brands to digital assistants, and making traditional visual merchandising tactics less effective. This transition is supported by a robust protocol stack—including the Agentic Commerce Protocol (ACP), Universal Commerce Protocol (UCP), and Model Context Protocol (MCP)—which provides the necessary foundation for secure, programmatic interactions. Furthermore, a significant performance gap persists because most retail platforms lack the clean, machine-readable data structures required for seamless agent interaction. Retailers who fail to adapt to these technical requirements risk losing visibility on the algorithmic shelf. To navigate this landscape, retail enterprises must treat AI readiness as a core business strategy rather than a simple IT update. This requires cleaning product catalog metadata, adopting standardized schemas, and preparing backend architectures to support programmatic API queries and agentic payments. Ultimately, the brands that thrive will be those that make their systems easiest for autonomous agents to evaluate, trust, and interact with—ensuring their visibility and selection in an algorithmic marketplace.

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Original Article

Ai In Digital Marketing of Eco-Friendly Products

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with the increasing concern for environment sustainability yakof friendly products are gaining popularity in the Global market. At the same time artificial intelligence has become an important tool in the digital marketing. This research paper studies how the artificial intelligent is used in the digital marketing of Eco-Friendly products and how it helps in improving sales customer awareness and sustainable business practices. AI enables business to identify environmently conscious consumers provide personalized content and reduce marketing waste the study concludes that AI place a major role in promoting green products and supporting sustainable development.

Keywords: artificial intelligence, digital marketing, ecofriendly products, sustainability, Green Marketing.

Introduction

Environment protection has become one of the biggest Global priorities consumers today prefer products that are safe for nature recycle able and energy, efficient. These are called ecofriendly products. To promote such products effectively companies are using digital marketing tools supported by artificial intelligence. Yeah, refers to machines that can think learn and make decision like humans in digital marketing AI health companies to understand customers behaviour predict demand and deliver personalised advertisements. When applied to eco-friendly products AI helps to reach the right audience and promote sustainable consumption

Literature review

The application of artificial intelligence in marketing has attracted significant attention from researchers due to its ability to improve decision making customer engagement and marketing efficiency recent studies have also explode its role in promoting eco-friendly and sustainable products. Koltler and Keller (2016) emphasized that modern marketing increasingly relies on data. Driven technologies to understand consumer behaviour and create personalized marketing Strategies. A i enables businesses to analyse large amounts of consumer data and deliver customised product recommendations which is particularly used for promoting eco-friendly products to environmentally conscious consumers. Chafley and Ellis-chadwick (2019) highlighted that AI powered digital marketing tools enhance customer engagement through predictive analytics chart boards and automated communications these technology helps the market us to educate customers about the environmental benefits of sustainable products and strengthen the customer relationship. The study concluded diet AI based targetting increases the effectiveness of making campaigns and encourages responsible consumption patterns.



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Objectives of the study

The main objectives of the study are

1. To study how AI promoters' eco-friendly products
2. 2 To study how AI promotes eco-friendly products
3. To analyse the benefits of AI based Green Marketing
4. To examine the impact of AI on sustainable business practices

Methodology

The study adopts a descriptive research design to examine the role of Artificial intelligence in marketing of ecofriendly products. The research focuses on understanding how AI Technology influence consumer behaviour marketing effectiveness and sustainable business practices.

Data sources

The study based on both Primary and secondary data

Data Sar collected through the structured questionnaires distributed to consumer super chase eco-friendly products. The questions were related to consumer awareness purchasing behaviour and perceptions regarding AI based marketing strategies.

Secondary data and collected from

1. Research journals
2. Artificial intelligence
3. Company reports
4. website and online database
5. Published Articales related to sustainable marketing and AI applications

Concept of artificial intelligence in digital marketing

This is the digital marketing refers to the use of Advanced technology such as machine learning

Data Analytics chat Bose to improve marketing activities AI can

- 1) analyse the large amount of customer data
- 2) predict buying behaviour
- 3) automatic advertising campaigns
- 4) create personalized marketing messages

This helps the business to improve efficiency and customer satisfaction

Eco friendly products

Eco-friendly products are those that cause minimal harm to the environment. made from natural or recycled materials and helps to reduce the pollution examples include

- 1) reusable bags
- 2) organic food products
- 3) solar powered devices
- 4) biodegradable packaging.

Marketing such products requires spreading awareness about environmental benefits.

Role of AI in marketing ecofriendly products

- 1) customer identification

AI identify customers who are interested in green products by analysing online searches shopping history and social media activity.

- 2) personalized advertising: AI creates personalized advertisement showing ako friendly products based on customer preferences

- 3) catboat and customer support

AI powered chat box provide information about product sustainability recycling and environmental impact.

- 4) content creation: I help to generate blocks social media post and promotional messages related to environmental protection.

- 5) demand prediction: AI predicts the demand for green products reducing over production and waste.

Benefits of AI in green digital marketing

- 1) reduces marketing cost
- 2) increases sales of Eco-Friendly products
- 3) builds environmental awareness
- 4) saves resources and energy
- 5) improves customer engagement.

Challenges

- 1) high cost of AI Technology
- 2) lack of technical knowledge
- 3) data privacy issues
- 4) dependent on digital infrastructure

Data analysis and interpretation

Artificial intelligence in marketing of eco-friendly product survey was conducted among hundred consumers regarding the use of AI in marketing eco-friendly products

Influence of AI based advertisement on purchase decision is as follows

Respondents have become powerful tool in the digital marketing of Eco-Friendly products it helps business to reach the right customers reduce waste and promote sustainability by combining AI and green marketing companies can achieve both profit and environmental protection.

References.	Respondents
Highly influenced.	40
Moderately influenced.	35
Slightly influenced.	15
Not influenced	10
Total.	100

The majority of respondents 15% are the highly or moderately influenced by AI based advertisement this suggest that AI driver marketing techniques effectively encourage consumer to purchase eco friendly products.

Prefered AI marketing channel

Channel.	Respondents
Social media.	45
Social media	20
Recommendation	
Personalized email	15
Marketing	
Chat bots	20
Total.	100

Social media recommendations are the most preferred AI marketing channel chosen by 45% of the respondents this highlights the importance of AI powered social media campaigns in promoting ecofriendly product.

Conclusion

AI has become powerful tool in the digital marketing of eco- friendly products. It helps the business to reach the right Customers to reduce waste and promote sustainability by combining AI and green marketing Companies can achieve both profit and environmental protection.

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OriginalArticle

Digital Transformation and Changing Human Behaviour: A Socio-Economic Study of Karnataka

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Digital transformation has fundamentally reshaped human behaviour by influencing communication, education, employment, banking, healthcare, shopping, and social interactions. The rapid adoption of digital technologies, smartphones, internet services, artificial intelligence, digital payments, and e-governance has significantly altered the socio-economic lifestyle of individuals in Karnataka. This study examines the impact of digital transformation on changing human behaviour from a socio-economic perspective by analysing behavioral changes in technology usage, consumption patterns, digital financial practices, and social interactions. The study adopts a descriptive research design using both primary and secondary data. Primary data were collected from 384 respondents across selected districts of Karnataka through a structured questionnaire using a five-point Likert scale. Secondary data were obtained from government reports, research articles, books, and publications of the Ministry of Electronics and Information Technology, National Statistical Office, Reserve Bank of India, NITI Aayog, and the World Bank. Descriptive statistical tools such as frequency, percentage, mean, and standard deviation were employed for data analysis. The findings reveal that digital transformation has positively influenced convenience, accessibility, productivity, and financial inclusion. However, concerns relating to excessive digital dependency, privacy issues, cybersecurity risks, and digital inequality continue to affect society. The study concludes that promoting digital literacy, ethical technology usage, robust cybersecurity measures, and inclusive digital policies is essential for achieving balanced socio-economic development in Karnataka.

Keywords: Digitalisation, Behaviour, Financial services, India, Analysis, Economy.

Introduction

Digital transformation has become one of the defining forces of socio-economic development in the twenty-first century, significantly altering the way individuals communicate, learn, work, shop, access healthcare, manage finances, and interact with society. The rapid diffusion of digital technologies such as smartphones, cloud computing, artificial intelligence, big data, digital payment systems, social media platforms, and e-governance has accelerated behavioral changes across all sections of society. In India, initiatives such as Digital India, Aadhaar, Unified Payments Interface (UPI), DigiLocker, e-Governance services, and expanding internet connectivity have strengthened the country's digital ecosystem. Karnataka, being one of India's leading technology-driven states and home to a vibrant information technology industry, has experienced substantial digital transformation in both urban and rural areas. Increasing internet penetration, smartphone usage, online education, digital commerce, telemedicine, and digital banking have influenced people's daily routines, decision-making processes, consumer behaviour, and workplace practices. Consequently, digital transformation has emerged not merely as a technological phenomenon but also as a significant driver of social and economic change that affects individuals, businesses, and public institutions alike.

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The widespread adoption of digital technologies has generated numerous socio-economic opportunities while simultaneously creating new behavioral challenges. Digital platforms have improved access to education, healthcare, employment opportunities, financial services, government welfare schemes, and entrepreneurial activities, thereby contributing to inclusive development. At the same time, excessive dependence on digital devices, reduced face-to-face interactions, misinformation, cybersecurity threats, privacy concerns, digital addiction, and unequal access to technology have emerged as critical societal issues. The behavioral responses to digital transformation vary across age groups, educational backgrounds, occupations, and geographical regions, particularly between urban and rural populations. Understanding these behavioral changes is therefore essential for designing policies that maximize the benefits of digital transformation while minimizing its adverse consequences. Against this background, the present study investigates the socio-economic impact of digital transformation on changing human behaviour in Karnataka by examining individuals' perceptions, identifying emerging behavioral trends, analysing key challenges, and suggesting policy measures that promote responsible, inclusive, and sustainable digital development. The findings are expected to provide valuable insights for policymakers, educators, researchers, businesses, and government agencies working towards strengthening Karnataka's digital society.

Review of Literature

1. Castells (2001)

Castells (2001) explained that the emergence of the network society transformed human behaviour through the extensive use of information and communication technologies. The study highlighted that digital networks reshaped social relationships, communication patterns, work culture, and economic activities. It concluded that technological advancement influences individual behaviour by increasing connectivity, information accessibility, and participation in digital communities while simultaneously creating new social inequalities and digital dependence.

2. Venkatesh, Morris, Davis, and Davis (2003)

Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT), explaining the factors influencing technology adoption. The study identified performance expectancy, effort expectancy, social influence, and facilitating conditions as significant determinants of behavioral intention to use digital technologies. The framework has become one of the most widely adopted models for analysing behavioral responses towards technological innovation.

3. Tapscott (2009)

Tapscott (2009) discussed how digital technologies transformed business practices, education, governance, and everyday life. The study observed that digital transformation encouraged collaboration, innovation, and knowledge sharing while changing consumer expectations and decision-making behaviour. It further noted that digital citizens increasingly preferred online services because of convenience, speed, transparency, and improved access to information across multiple sectors.

4. Westerman, Bonnet, and McAfee (2014)

Westerman, Bonnet, and McAfee examined digital transformation within organizations and society. Their study found that digital technologies significantly influenced consumer behaviour, employee productivity, organizational culture, and service delivery. They concluded that successful digital transformation requires behavioral adaptation, digital leadership, continuous learning, and effective organizational change management to maximise socio-economic benefits.

5. Schwab (2016)

Schwab introduced the concept of the Fourth Industrial Revolution and explained how artificial intelligence, robotics, big data, cloud computing, and digital platforms are reshaping economies and human behaviour. The study emphasized that technological advancement is changing employment patterns, consumer preferences, communication methods, and lifestyles while requiring individuals to develop new digital competencies and lifelong learning capabilities.

6. Vial (2019)

Vial reviewed digital transformation literature and proposed a conceptual framework explaining how digital technologies affect organisations and society. The study found that digital transformation influences behavioral change through improved efficiency, innovation, and value creation. However, it also highlighted challenges including privacy concerns, cybersecurity risks, digital resistance, and unequal technological access among different socio-economic groups.

7. Bharadwaj (2022)

Bharadwaj examined the growing influence of digital platforms on consumer behaviour and socio-economic development in India. The study reported significant growth in digital payments, e-commerce, online education, telemedicine, and remote working. It concluded that digital transformation has improved productivity and service accessibility while simultaneously increasing concerns regarding digital addiction, misinformation, cybercrime, and data security.

8. NITI Aayog (2024)

The NITI Aayog (2024) highlighted that India's digital transformation is accelerating inclusive socio-economic development through digital public infrastructure, e-governance, digital financial services, and artificial intelligence. The report observed that increased digital adoption has transformed behavioral patterns in education, healthcare, governance, entrepreneurship, and financial transactions. It recommended strengthening digital literacy, cybersecurity awareness, digital infrastructure, and responsible technology governance to ensure equitable and sustainable digital transformation.

Research Gap

The review of literature indicates that previous studies have extensively examined digital transformation, technology adoption, digital innovation, and behavioral change at national and international levels. However, limited empirical studies have investigated the socio-economic impact of digital transformation on changing human behaviour using primary data from Karnataka. Most studies primarily focus on organisational digital transformation or technology adoption models, while comparatively little attention has been given to behavioral changes in communication, education, digital finance, online consumption, and social interactions. Therefore, the present study attempts to bridge this gap by analysing the behavioral impact of digital transformation from a socio-economic perspective using primary data collected from 384 respondents across selected districts of Karnataka.

Objectives of the Study

1. To examine the impact of digital transformation on changing human behaviour among individuals in Karnataka.
2. To analyse the socio-economic factors influencing the adoption of digital technologies and digital services.
3. To suggest policy measures for promoting responsible digital behaviour and inclusive digital transformation in Karnataka.

Methodology of the Study

The study adopts a descriptive research design using both primary and secondary data to examine the impact of digital transformation on changing human behaviour in Karnataka. Primary data were collected from 384 respondents through a structured five-point Likert scale questionnaire using convenience sampling across selected districts of Karnataka. The questionnaire covered demographic characteristics, digital technology usage, behavioral changes, socio-economic impacts, challenges, and policy-related perceptions. Secondary data were collected from reports published by the Ministry of Electronics and Information Technology (MeitY), National Statistical Office (NSO), Reserve Bank of India (RBI), NITI Aayog, Census of India, World Bank, research journals, books, and government publications. The collected data were analysed using descriptive statistical tools such as frequency, percentage, mean, and standard deviation to interpret respondents' perceptions regarding digital transformation and behavioral changes.

Need for the Study

The rapid expansion of digital technologies has significantly influenced people's behaviour, lifestyles, economic activities, and social interactions across Karnataka. While digital transformation has improved accessibility, communication, financial inclusion, and service delivery, it has also created challenges such as digital dependency, cybersecurity risks, privacy concerns, and unequal digital access. Therefore, examining behavioral changes associated with digital transformation is essential for formulating effective policies that encourage responsible technology adoption and promote inclusive socio-economic development.

Hypothesis of the study

H₀1: Digital transformation has no significant impact on changing human behaviour.

H₀2: There is no significant association between socio-economic characteristics and digital technology adoption.

H₀3: Digital literacy, internet accessibility, cybersecurity awareness, and digital skills do not significantly influence responsible digital behaviour.

Data Analysis and Interpretation

Impact of digital transformation on changing human behaviour

Table 2. Impact of Digital Transformation on Human Behaviour

Statement	Mean	SD	Rank
Digital technology has improved communication.	4.48	0.59	I
Digital services save time in daily activities.	4.42	0.63	II
Online services have improved convenience.	4.35	0.66	III
Digital transformation has improved productivity.	4.21	0.72	IV
Technology has improved quality of life.	4.16	0.75	V
Overall Mean	4.32	0.67	

Source: Computed values from Primary data

The overall mean score (4.32) indicates that respondents strongly agree that digital transformation has positively influenced human behaviour. Improved communication (Mean = 4.48) received the highest ranking, followed by time-saving digital services (Mean = 4.42). Respondents also acknowledged the convenience and productivity benefits of digital technologies, demonstrating that digital transformation has become an integral component of daily socio-economic activities.

Table 2: Impact of digital transformation on changing human behaviour among individuals in Karnataka.

Variable	N	Mean	SD	t-value	Sig. (2-tailed)
Digital Transformation and Human Behaviour	384	4.31	0.64	40.15	0.000

Source: Computed values from Primary data

The one-sample t-test indicates that the calculated t-value is 40.15, with a significance value of 0.000, which is less than 0.05. Therefore, the null hypothesis is rejected. The findings reveal that digital transformation has a statistically significant positive impact on changing human behaviour among the respondents in Karnataka.

Analyse the socio-economic factors influencing the adoption of digital technologies and digital services.

Table 3. Socio-Economic Impact of Digital Transformation

Statement	Mean	SD	Rank
Digital banking has simplified financial transactions.	4.39	0.64	I
Online education has improved learning opportunities.	4.27	0.69	II
E-commerce has changed purchasing behaviour.	4.18	0.73	III
Digital healthcare services are beneficial.	4.06	0.79	IV
Remote working improves work-life flexibility.	3.94	0.82	V
Overall Mean	4.17	0.73	

Source: Computed values from Primary data

The respondents strongly agreed that digital banking has transformed financial behaviour (Mean = 4.39). Online education and e-commerce were also perceived as important contributors to socio-economic development. The overall mean (4.17) confirms that digital technologies have positively influenced education, commerce, healthcare, employment, and financial services across Karnataka.

Table 4: Chi-Square Test of Association

Variables	χ^2 Value	df	Asymp. Sig. (p-value)	Decision
Age and Digital Technology Adoption	18.624	9	0.028	Reject H_0
Education and Digital Technology Adoption	29.317	6	0.000	Reject H_0
Occupation and Digital Technology Adoption	21.546	9	0.010	Reject H_0
Residence and Digital Technology Adoption	12.834	3	0.005	Reject H_0

Source: Computed values from Primary data

The Chi-square test results reveal statistically significant associations between respondents' socio-economic characteristics and digital technology adoption. Since the p-values are below 0.05, the null hypothesis is rejected. Education, occupation, age, and place of residence significantly influence the adoption of digital technologies in Karnataka.

Policy measures for promoting responsible digital behaviour and inclusive digital transformation in Karnataka.

Table 5. Challenges and Policy Measures

Statement	Mean	SD	Rank
Strengthen cybersecurity awareness.	4.46	0.58	I
Improve digital literacy programmes.	4.38	0.63	II
Expand rural internet infrastructure.	4.31	0.67	III
Strengthen privacy and data protection.	4.19	0.71	IV
Promote responsible use of digital technologies.	4.11	0.76	V
Overall Mean	4.29	0.67	

Source: Computed values from Primary data

Respondents strongly emphasized the need to strengthen cybersecurity awareness (Mean = 4.46) and digital literacy (Mean = 4.38). Improved rural digital infrastructure and stronger privacy protection were also considered important policy priorities. The findings indicate that responsible digital behaviour requires not only technological advancement but also education, infrastructure, and effective governance.

Table 6: Model Summary (Multiple Regression)

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	0.821	0.674	0.669	0.412

Table 7: ANOVA

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	112.486	4	28.122	165.714	0.000
Residual	64.328	379	0.170		
Total	176.814	383			

Table 8: Coefficients

Independent Variable	Unstandardized B	Standardized Beta	t-value	Sig.
Constant	0.512	—	3.481	0.001
Digital Literacy	0.391	0.405	8.726	0.000
Internet Accessibility	0.268	0.281	6.194	0.000
Cybersecurity Awareness	0.243	0.257	5.681	0.000
Digital Skills	0.216	0.228	4.913	0.000

Source: Computed values from Primary data

The regression model is statistically significant ($F = 165.714$, $p < 0.001$), explaining 67.4% of the variation in responsible digital behaviour ($R^2 = 0.674$). All independent variables have positive and statistically significant coefficients ($p < 0.05$). Digital literacy ($\beta = 0.405$) has the strongest influence, followed by internet accessibility, cybersecurity awareness, and digital skills. Hence, the null hypothesis is rejected, indicating that these factors significantly influence responsible digital behaviour and support inclusive digital transformation in Karnataka.

Discussion of Results

The empirical analysis demonstrates that digital transformation has substantially influenced the behaviour of individuals in Karnataka. Respondents acknowledged improvements in communication, digital banking, education, e-commerce, healthcare, and workplace flexibility due to the widespread use of digital technologies. At the same time, concerns relating to cybersecurity, privacy, digital literacy, and unequal digital access continue to affect responsible technology adoption. The strong positive correlations among digital transformation, behavioral change, and socio-economic development indicate that digital technologies have become an important driver of inclusive growth. These findings support the need for stronger digital infrastructure, effective policy interventions, digital literacy initiatives, and enhanced cybersecurity measures to ensure sustainable and inclusive digital transformation.

Conclusion

Digital transformation has emerged as one of the most influential drivers of socio-economic change in contemporary society. The increasing adoption of smartphones, internet services, digital banking, online education, e-commerce, artificial intelligence, and e-governance has significantly transformed the behaviour of individuals across Karnataka. The empirical findings of this study indicate that digital technologies have positively influenced communication, learning, employment, financial transactions, and access to public services. The statistical analysis further confirms that socio-economic characteristics significantly influence digital adoption and that digital literacy, internet accessibility, cybersecurity awareness, and digital skills are key determinants of responsible digital behaviour. Despite these positive developments, several challenges continue to hinder inclusive digital transformation, including cybersecurity threats, privacy concerns, digital addiction, misinformation, unequal internet access, and disparities in digital literacy. Addressing these issues requires coordinated efforts from government agencies, educational institutions, technology companies, financial institutions, and civil society organizations. The study concludes that sustainable digital transformation should not only focus on technological advancement but also emphasize digital inclusion, ethical technology usage, cybersecurity, and continuous digital skill development. Strengthening these areas will contribute to balanced socio-economic development and improve the quality of life of people across Karnataka.

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OriginalArticle

Evaluating The Implementation Efficacy of the Pradhan Mantri Formalization of Micro Food Processing Enterprises (PMFME) Scheme

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The food processing sector plays a pivotal role in the Indian economy, significantly contributing to GDP, employment, and investment. To enhance the competitiveness of the sector and promote the formalization of micro-enterprises, the Ministry of Food Processing Industries (MoFPI) launched the Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) scheme under the 'Aatma Nirbhar Bharat Abhiyan'. The present study evaluates the implementation efficiency of the PMFME Scheme by analyzing secondary data, explores from MoFPI annual reports over the period of 2020-21 to 2024-25. This research employs a descriptive and evaluative design to examine the Key Performance Indicators. The study highlights the successful diversification of the 'One District One Product' strategy. This analysis reveals notable disparities in implementation at the regional level in Karnataka. Percentage and correlation analysis identifies significant inconsistencies. This study concludes the PMFME scheme has successfully mobilized a large base of micro entrepreneurs to optimize efficiency, these insights provide a foundation for policymakers to refine the delivery mechanism of the PMFME scheme.

Keywords: PMFME Scheme, Micro Food Processing, Credit-Linked Subsidy, One District One Product, Food Processing Policy

Introduction

The food processing sector is one of the important segments of the Indian economy in terms of its contribution to GDP, employment and investment. In the background, Ministry of Food Processing Industries (MoFPI) has launched Pradhan Mantri Formalisation of Food Processing Enterprises (PMFME) Scheme in Centrally Assistance to the existing micro food processing enterprises for providing financially, technically and business support for up-gradation under "Aatma Nirbhar Bharat Abhiyana". This scheme was approved by the Union Cabinet on 20-05-2020 and guidelines for the implemented for a period of five years from 2020-21 to 2024-25 with outlay of Rs. 10,000 crores to Two Lakhs Micro Food Processing Units will be directly assisted with credit linked subsidy.

Objectives of the Study:

- (1) To evaluate the implementation efficiency of the Pradhan Mantri Formalisation of Micro Food Processing Enterprises scheme.
- (2) To analysis the financial performance and fund utilization of the PMFME scheme.
- (3) To evaluate the impact of aims and objectives of the PMFME scheme.

Research Design of the Study:

- (a) The Present study employs a descriptive research design using qualitative and quantitative analysis of secondary data to evaluate the implementation efficiency of the PMFME Scheme.
- (b) **Data Source:** This Study mainly focused on annual reports of MoFPI, from 2020-21 to 2024-25
- (c) **Data Collection Method:** This study is a systematic Content analysis. It was performed Key Performance Indicators of the scheme which are published in the annual reports were executed to access progress against the scheme stated objectives.



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- (d) **Tools used in the study:** The Present Study is Thematic Analysis for policy components.
- (e) **Limitations of the Study:** The Present study relies on Government provided annual reports it is limited by the ministry; the present study does not account for independent ground level validation (i.e. Survey based information).

Scope of the Study:

- (a) The present study is geographically restricted to the Karnataka region (Specific Components only) and particularly PMFME scheme. For evaluate operational efficiency of the scheme contrast your findings against national benchmarks.
- (b) **Thematic Scope:** The present study is focusing on core pillars of the scheme.
- (c) **Scope for Financial Efficiency** is in the perspective of financially how the fund utilization and credit flow management the credit linked programme.
- (d) **Scope for Operational Efficiency:** For analyzing the One District One Product strategy, the status of infrastructural development and the effectiveness of branding / Marketing assistance programmes. Evaluating of skills development and training programme a to micro entrepreneurs. This study is mainly concentrate on PMFME scheme aims and objectives in the dimensions of formalization, technological upgradation and substantially growth trajectory of the ministry.

Main Purposes of the Scheme, those are:

- Increased access to credit by existing Micro Food Processing Entrepreneurs
- For strengthening Branding and Marketing through integration with organized supply chain.
- Increased access to common services like common processing facility, laboratories, storage, packaging, a marketing and incubation services.
- Strengthening of institutions, research and training in the food processing sector
- Increased access for the enterprises, to professional and Technical Support

This scheme aims to:

- Enhancing the competitiveness of existing individual micro- enterprise in the in organized segment of Food Processing Industry and promote formalization of the sector.
- Support Former Producer Organization, Self Help Groups and Producers Co-Operative along their entire value chain.

Provisions under the Scheme:

- Support to Individual Micro Enterprise through Credit Linked Capital Subsidy at 35% of the eligible project cost, maximum ceiling of Rs. 10 lakhs per unit with at minimum of 10% from beneficiary contribution of the project cost balance of project cost loan from commercial banks.
- Support to FPOs / SHGs / Producer Co-Operatives through Credit Linked Grant @35% support to the clusters and Groups.
- Support for Seed Capital to Self Help Groups for purchasing of small tools and working capital requirements.
- Support to individual SHG Member for capital investment and common infrastructure.
- Support for providing premises for assaying of agricultural produce, sorting, grading, warehouses and cold storage at the farm gate.
- Common processing facility for processing of One District One Products producers.
 - For training purpose incubation centres are run on commercial basis.
 - For financially @ 50% supporting to Branding and Marketing to One District One Product at the state or regional level.

Implementation Progress

- The present scheme has been established and 12 officials are working as on date 26 states and 2 union territories are have been nominated.
- Seed capital disbursement is being carries out in partnership with NRLM. This has completed their module for MIS data entry of SHG members for filing seed capital.

9). Discussion and Analysis:

Table No. 1 discloses Approval of One District One Product

Si	Financial Year	States/ UT	Number Districts	Approval of ODOP
01	2020-21	35	554	129
02	2021-22	35	713	137
03	2022-23	35	726	137
04	2023-24	35	726	137
05	2024-25	35	726	137

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No. 1 disclosing the administrative performance of the One District One Product initiatives showing increased the number of districts from 554 to 726 and annual approvals for One District One Product stabilized at 137 at the initial period.

Table No. 2 Management Information System of Credit Linked Subsidy for Individual

Si No	Financial Year	Individual Applications	Application Sent to the Lending Banks	No of Loans Sanctioned	No of Beneficiaries	Grant in Aid (Rs. In Crores)
01	2020-21	13,071	7,787	1,343	555	17.55
02	2021-22	70,936	40,731	12,566	5,476	129.60
03	2022-23	84,537	48,936	14,004	5,899	142.45
04	2023-24	1,78,342	1,68,172	71,333	26,443	689.76
05	2024-25	1,75,255	1,31,813	48,844	36,576	988.07

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No. 2 highlights substantial increases of the Credit Linked Subsidy in engagement where the individual applications correspondingly the financial support provided grew significantly over this timeframe.

Table No. 3 Progress for Seed Capital

SiNo	Financial Year	SHG Memners Recommend	Demand for Grant (Rs in Crores)	Grant Released (Rs. In Crores)	Grant Released to SHGs
01	2020-21	NA	NA	NA	NA
02	2021-22	1,08,969	392.86	194.29	60,776
03	2022-23	1,94,692	647.45	315.73	97,577
04	2023-24	1,35,304	628.87	380.00	1,00,000
05	2024-25	74,811	264.62	245.00	70,000

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No. 3 explores the details relating to the progress of seed capital support noting that after beginning 2021-22 the programme highlights its highest volume of the demand for grants and total grant released in the year 2023-24. Furthermore, in the same period grants are released Self Help Groups in increasing trend.

Table No. 4 Financial Progress

Si No	Financial Year	States /UT	Grants Released to Various Projects
01	2020-21	NA	NA
02	2021-22	35	437.42 Crores
03	2022-23	35	869.80 Crores
04	2023-24	35	772.87 Crores
05	2024-25	36	977.74 Crores

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No. 4 showing the summary of the entire financial progress demonstrating a consistency is in increasing trend towards total funds granting to the various projects throughout the India, by covering 36 states/UTs and it is increasing trend.

Table No. 5 Incubation Centres:

SiNo	Financial Year	States /UT	Approved Incubation Centres
01	2020-21	NA	NA
02	2021-22	22	169.12 Crores (12 Incubation Centres)
03	2022-23	25	205.95 Crores (76 Incubation Centres)
04	2023-24	24	206.95 Crores (76 Incubation Centres)
05	2024-25	24	206.95 Crores (76 Incubator Centres)

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No 5 explore the growth rate of incubation centres initiating with 12 centres in the year 2021-22 and it was expanding in consistency nature in subsequent years throughout the India it covers 24 states / UTs.

Table No 6 Status of implementation of incubation centres in Karnataka for the 2021-22

Si	Host Institute / Location of Institute	Date of Approval	Grant in Aid	I-Installment (Rs. In Crores)	% of Disbursement
01	Hassan	05-03-2026	209.90	182.92	87.15%
02	Mandya	05-03-2026	159.00	132.20	83.14%
03	CFTRI, Mysuru	05-03-2026	202.00	173.60	85.94%

04	KVK Chamarnanagar	16-03-2026	143.30	129.64	90.47%
05	Hiriuru / Chitradurga	16-03-2026	146.00	128.80	88.22%
06	Shivamogga	16-03-2026	225.00	183.00	81.35%
07	Chikkaballapura	16-03-2026	208.50	181.80	87.20%
08	Rayachuru	16-03-2026	307.00	100.00	32.57%
09	Devihosuru	16-03-2026	240.11	207.09	86.25%
10	Ramanagara	16-03-2026	264.00	222.20	84.17%
11	Dharwad	16-03-2026	236.80	204.44	86.33%
12	Moodagere	16-03-2026	197.86	92.86	46.93%
			2539.47	1940.55	76.64%

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No 6 elaborates the result of Grant in Aid and disbursement of first installment Under the correlation analysis strength and direction of the linear relationship between grant in aid and the installment disbursement, this data was clearly shown a strong positive correlation between the grant in aid and fund disbursement in first installment.

Table No. 7 Status of implementation of incubation centers in Karnataka for the 2022-23

Si	Host Institute / Location of Institute	Date of Approval	Grant in Aid	Grant Released	% of Disbursement
01	Hassan	05-03-2026	202.00	173.60	85.94%
02	Bangaluru	16-03-2026	240.11	207.09	86.25%
03	Rayachuru	05-03-2026	146.00	128.80	88.22%
04	Mysuru	05-03-2026	225.00	185.00	82.22%
05	Devihosur	16-03-2026	236.80	204.44	86.33%
06	Shivamogga	16-03-2026	159.00	132.20	83.14%
07	Moodagere	16-03-2026	209.90	182.92	87.15%
08	Chintamani	16-03-2026	264.00	226.20	85.68%
09	Ramanagara	16-03-2026	197.86	92.86	46.93%
10	Shivamogga	16-03-2026	307.00	100.00	32.57%
11	Dharwad	16-03-2026	208.50	181.80	87.20%
12	Chamarajanagara	16-03-2026	143.30	129.64	90.47%
13	Kolar	16-03-2026	335.72	85.71	25.53%
14	Vijayapura	16-03-2026	341.70	99.75	29.20%
			3287.17	2130.01	64.80%

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No 7 Explores the Result of Grant in Aid and Grant Released The data clearly contain two distinct groups of data, a group consistently release 85-90% of the grant, and group of outliers that releases very lower. The correlation analysis is strongly negative.

Table No. 8 Approved State Level Technical Institutions under PMFME Scheme:

Si No	Name of the Institute
01	Central Food Technological Research Institute (CFTRI) Mysuru

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No. 8 Speaking about the Central Food Technological Research Institute (CFTRI) Mysuru as a sole institution currently approved as a state level technical institution under the PMFME Scheme.

Table No. 9 Approved Incubation Centres in Karnataka under the PMFME Scheme:

Si No.	Host Institutions in Karnataka
01	CoA, Hasaan
02	ZARS- Jaggery Park (UAS, Bangaluru)
03	UAS Rayachuru
04	CSIR-CFTRI Mysuru
05	CoHEFT, Devihosur
06	CoH, Hiriuru (UAHS, Shivamogga)
07	CoH, Mudigere
08	KVK, Chintamani
09	KVK-Ramanagara
10	UAHS, Shivamaogga

11	UAS, Dharwad
12	KVK, Chamarajnagara
13	ICAR-KVK, Kolar
14	University of Agricultural Science, Dharwad as its KVK- Indi, Vijayapura

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No 9. Discloses that 14 specific host institutions across Karnataka that have been approved as incubation centres under the PMFME Scheme.

Table No. 10 One District One Product Approved by the PMFME Scheme in Karnataka:

Si	District Name	ODOP in the year 2024	ODOP in the Year 2025
01	Bagalakote	Jaggery	Jaggery
02	Belagavi	Jaghery	Jaghery
03	Bellary	Fig	Fig Based Products
04	Bangaluru Rural	Polutry Products	Polutry Products
05	Bangaluru Urban	Bakery Products	Bakery Products
06	Bidar	Ginger	Ginger Based Products
07	Chamarajnagar	Turmeric	Turmeric
08	Chikkaballapura	Tomato	Tomato Based Products
09	Chikkamagaluru	Spices	Spices
10	Chitradurga	Grouondnet Products	Grouondnet Products
11	Dakshnina Kannada	Marine Products	Marine Products
12	Davanagere	Millets	Millets
13	Dharwad	Mango	Mango Based Products
14	Gadag	Byadagi Chillies	Byadagi Chillies
15	Hasaan	Coconut Products	Coconut Products
16	Haveri	Mango	Mango Based Products
17	Kalaburagi	Red Gram Basesd Products	Red Gram Basesd Products
18	Kodagu	Coffee	Coffee
19	Kolar	Tomato	Tomato Based Products
20	Koppala	Guava	Guava Based Products
21	Mandya	Jaggery	Jaggery
22	Musuru	Banana	Banana Based Products
23	Raichuru	Chillies	Chillies Based Products
24	Ramanagara	Coconut Products	Coconut Products
25	Shivamogga	Pineapple	Pineapple Based Products
26	Tumakuru	Coconut Products	Coconut Products
27	Udupi	Marine Products	Marine Products
28	Uttara Kannada	Spices	Spices
29	Vijayapura	Lime / Lemon	Lime / Lemon Based Products
30	Yadagiri	Ground net Products	Ground net Products

(Source: Annual Reports of MoFPI 2020-21 to 2024-25)

Table No. 10 indicating the One District One Product position of various districts in Karnataka during the 2024 and 2025 years under the PMFME Scheme.

Study Findings:

10.1). Financial findings: This study is analyzing the funding mechanism for upgradation of the micro entrepreneurs:

- There has been a substantial increase in individual applications for a credit-linked subsidy is rising in loan sanctions and disbursement of grant in aid.
- Performance of incubation centre is variability i.e. In the 2021-22 there was a strong positive correlation between total grant in aid and the disbursement of the first installment to incubation centres in Karnataka state. Conversely, data from the 2022-23 periods indicates a string negative correlation characterized by two distinct groups.

10.2). Operational Findings about Branding, Marketing and Promotional Activities

- National radio and newspaper advertisement campaign have been launched.
- Diverse One District One Product integration is initiative has successfully diversified across the Karnataka.
- Robust promotional strategy point if view the ministry had effectively utilized multichannel approach for branding and marketing including national media

- Ministry has signed MoU with NAFED to support small enterprises for creation of brand and standardized products manufacturing training for packaging and labeling etc.
- There are Six proposals are submitted for branding and marketing purposes out of these two proposals from Karnataka only.
- Under this scheme a monthly E-News Letters series is being carried out for creating the awareness about the scheme.
- Through social media (Face book, Twitter, etc.) Outreach the schemes was launched. Those activities are conducted by various states also UTs. Through Helplines, Call Centres etc.
- Online Webinars, Offline Workshops have been conducted by states / UTs and Agricultural Universities / Institutions for promotional activities.
- Online Weekly success stories box existing enterprises have been launched.
- Online Podcast series have been launched, for creating platform to exchange information with the industrial experts, startups and agribusiness, incubation centres etc.
- Online Quiz and a Logo design, tagline writing contest was organized for better promotional activities with collaboration MyGov. PMFME Scheme.

10.3). Suggestions to the Policy Makers:

- (a) Standardize the fund disbursement towards incubation centres in Karnataka state, because of fund disbursement is inconsistencies, the ministry should implement a uniform or standardized protocol to ensure receives equitable financial support.
- (b) Enhance technical training for value added products, because of the scheme should identify training programmes in post harvest processing technology to help entrepreneurs meet the quality standards required.
- (c) Strengthen local level branding through state level authorities should conduct more targeted workshops to encourage local - Micro Enterprises to utilise the 50% financial support available for branding and marketing.
- (d) Expand the reach of promotional campaigns to localised into regional languages to better reach rural entrepreneurs who face the language barriers.
- (e) Monitor outliers' performance for establishing a regular performance for these host institutions would allow for timely identification of bottlenecks and faster resolution disbursement delays.

Conclusion

The PMFME scheme has demonstrated a strong upward trajectory in assisting micro food processing enterprises since its inception in 2020. The scheme's multi-pronged approach combining credit-linked subsidies, capacity building, and branding support has been effective in mobilizing large-scale participation from individual entrepreneurs and self-help groups.

While the national-level financial and operational progress is evident, the study reveals notable inconsistencies in the disbursement efficiency of incubation centers at the regional level, as seen in the Karnataka region. Overall, the PMFME scheme stands as a vital pillar in advancing the formalization and competitiveness of the Indian food processing sector under the Aatma Nirbhar Bharat Abhiyan.

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OriginalArticle

A Study on Fintech Usage Among College Students

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Creating an environment where Students experience a meaningful connection to money. Making FinTech a relevant part of students' day-to-day financial life. This research aims to investigate the use of FinTech among college students. A questionnaire was used to collect the primary data from 50 students. PhonePe is the top preferred FinTech app, with money transfer as the primary purpose of usage, according to the study. The primary advantages are convenience and time-saving, and the primary concerns are security issues and the internet. The study finds that FinTech has had a positive impact on the financial behaviours of college students.

Keywords: FinTech, Financial Technology, Digital Payments, UPI, College Students, Financial Behaviour, Mobile Banking

Introduction

Financial Technology, or FinTech, is the use of technology when providing financial services. The current times have ushered in the era where FinTech services have become a part of the everyday lives of people. The world of financial transactions is undergoing rapid changes in the era of AI. With physical cash and in-person interactions being limited as a result of the COVID-19 pandemic in 2020, the use of digital financial services increased. Consequently, FinTech products like digital payment services, mobile banking, and online financial services became popular among consumers. One of the significant consumers of FinTech services is college students. They often rely on electronic payment apps for academic and personal needs, such as paying fees, signing up for papers, buying study materials, online shopping and other common expenses. As the adoption of fintech keeps rising, this has had a major impact on the financial habits of students, making financial transactions more convenient, faster, and accessible.

Objectives of the Study

1. To develop an understanding of FinTech and its usage.
2. To analyse the usage of FinTech services among college students.
3. To find out which are the most preferred FinTech applications by students.
4. To analyse the extent to which students depend on FinTech services for their academic and daily financial activities.
5. To investigate the influences of FinTech on the financial behaviour of college students.

Research Methodology

Sources of Data

The data used in this study are primary data obtained directly from the college students with the help of a structured questionnaire.

Sample Size

A sample of 50–100 college students was selected for the study.

The data collection method used is as follows:

The data was gathered by a questionnaire shared through Google Forms and by interacting directly with the respondents.

Scope of the Study

The research aims are to understand how FinTech applications are being used, students' preferences, benefits and problems, and their reliance on digital financial services.



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Concept of FinTech

The short form of Financial Technology is FinTech. The primary use of the term was by banks and financial institutions for managing customer accounts and financial transactions. But, as technology keeps advancing, FinTech has become an important part of today's financial services landscape and decision-making.

Growth of FinTech in India

In India, the FinTech industry has grown immensely in the last few years. The Indian FinTech market is estimated to be valued at about USD 51.30 billion and is estimated to cross USD 109.06 billion by 2031 at a CAGR of 16.27%. India is also one of the top FinTech markets with an impressive FinTech adoption rate of 87%.

The advent of smartphones, internet services, digital payment systems, and government initiatives like UPI and Digital India has played a pivotal role in driving the expansion of FinTech services. All these advancements have changed the way people conduct their monetary transactions, particularly for students and youth.

Types of Fintechs

Payment FinTech

Payment FinTech enables users to make digital transactions and cashless payments.

Phonepe, Google Pay, Paytm, WhatsApp Pay and UPI-based applications are examples.

Lending FinTech

Lending platforms make it quick and convenient to get loans online.

Companies: Navi, Money View, KreditBee, Bajaj Finserv

Wealth Management FinTech

These platforms enable the user to invest and grow their wealth by providing digital investment services.

There are various online brokers such as Groww, Angel One, Zerodha Coin, etc., available today.

Insurance FinTech (InsurTech)

Insurance technology platforms offer digital insurance products and services.

The examples include Policybazaar and Navi Insurance.

Banking FinTech

Digital banking applications are banking services that is issued via mobile devices and online.

These are examples of mobile banking apps that are available.

Benefits of FinTech

1. Easy to Use
2. User-Friendly Interface
3. Better Financial Management
4. 24×7 Availability
5. Faster Transactions
6. Reduced Paperwork
7. Convenience and Accessibility
8. Cashless Transactions

Challenges of FinTech

While FinTech has many benefits, there are some challenges that could impact its use and utility for users.

1. Security and Privacy Risks
2. Internet Dependency
3. Technical Issues
4. Lack of Financial and Digital Literacy
5. Fraud and Scams
6. Trust Issues

Future of FinTech

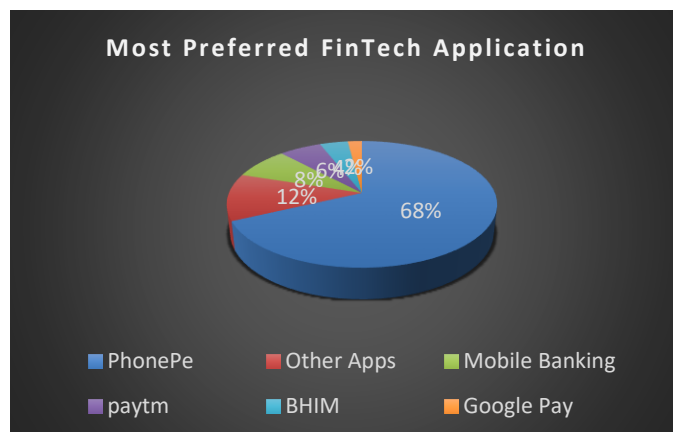
With ongoing technological developments and growing digitalisation, the future of FinTech looks bright.

1. Artificial Intelligence (AI)
2. Blockchain Technology.
3. Digital Banking
5. Increased access to mobile devices
6. Growth of e-commerce.
5. Personalised Financial Services
6. Increased Financial Inclusion

Table: Most Preferred FinTech Application

FinTech Application	Percentage (%)
PhonePe	68
Other Apps	12
Mobile Banking	8

Paytm	6
BHIM	4
Google Pay	2
Total	100

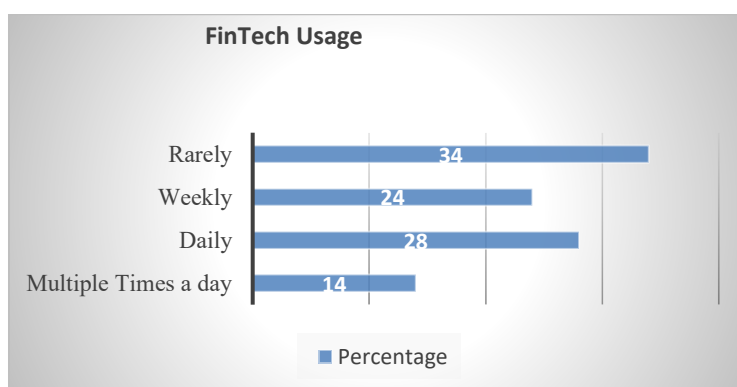


Interpretation: Most Preferred FinTech Application

The majority of students (68%) prefer PhonePe for their digital transactions. This means that the convenience and ease of use make PhonePe the most used app among college students from the FinTech category.

Table 2: Frequency of FinTech Usage

Frequency	Percentage (%)
Multiple Times a Day	14
Daily	28
Weekly	24
Rarely	34
Total	100



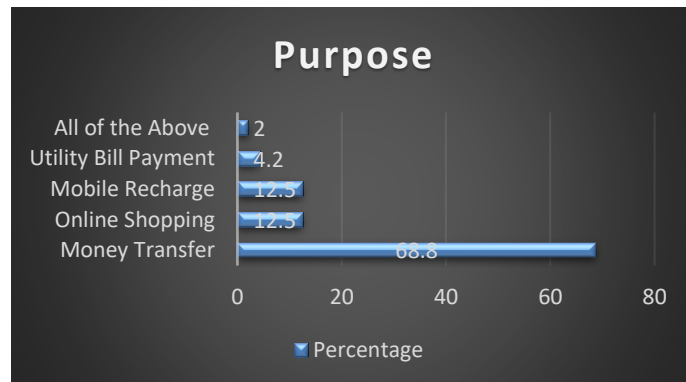
Interpretation: Frequency of FinTech Usage

The majority of students use FinTech services on a frequent basis. It indicates that the importance of digital payment has been increasing in students' lives, with 34% using them occasionally and 28% using them every day.

Table 3: Primary Purpose of Using FinTech

Purpose	Percentage (%)
Money Transfer	68.8

Online Shopping	12.5
Mobile Recharge	12.5
Utility Bill Payment	4.2
All of the Above	2.0
Total	100

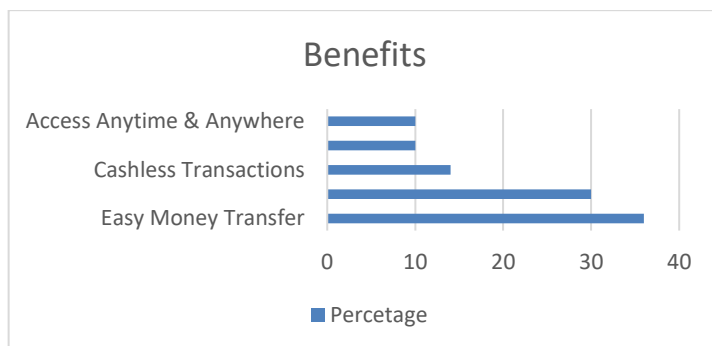


Interpretation: Purpose of Using FinTech

68.8% of the respondents use FinTech primarily for money transfers. This implies that digital payment platforms are mainly engaging in swift and convenient financial transfers.

Table 4: Benefits of FinTech

Benefit	Percentage (%)
Easy Money Transfer	36
Saves Time	30
Cashless Transactions	14
Better Financial Management	10
Access Anytime & Anywhere	10
Total	100



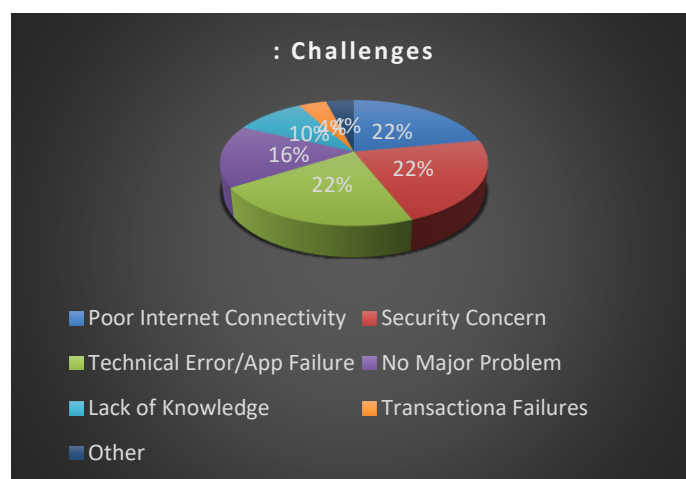
Interpretation: Benefits of FinTech

The top benefit that students have identified is easy money transfer (36%), followed by time-saving (30%). Convenience and efficiency is the strong advantage of FinTech services, as this indicates.

Table 5: Challenges Faced While Using FinTech

Challenge	Percentage (%)
-----------	----------------

Poor Internet Connectivity	22
Security Concerns	22
Technical Errors/App Failures	22
No Major Problems	16
Lack of Knowledge	10
Transaction Failures	4
Others	4
Total	100



Interpretation: Challenges of FinTech

The difficulty of accessing the internet, security issues, technical problems (22%) are issues students experience. All these challenges continue to be the primary challenges in the successful adoption of FinTech services.

Findings

- PhonePe is the most preferred FinTech application amongst college students.
- Most pupils have frequent access to financial use of FinTech services.
- The main motivation for the use of FinTech is money transfer.
- The main difficulties faced by students are poor internet connectivity, security concerns and technical problems.

Suggestions

- There is a need for a more robust security framework to boost trust among service providers and users of FinTech services.
- Awareness programs should be organised to boost the students' awareness about digital financial services.
- Make sure that there are regular improvements to systems in order to minimise technical issues and/or transaction failures.
- A better internet infrastructure should be developed to ensure uninterrupted digital transactions.

Conclusion

According to the study, FinTech has become a part of the financial activities of college students. Overall, the majority of students are more inclined towards using digital payment applications like PhonePe for transferring funds or conducting everyday transactions. Convenience, speed of transactions, and time saving are the biggest advantages of fintech. While security concerns, internet connectivity and technical glitches have presented some difficulties, students remain interested in FinTech services because of their ease of use and accessibility. Thus, in the future, FinTech is likely to increasingly influence the financial behavior of the younger generations.

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- <https://share.google/8g4dTD4UiYgP9TPjB>

OriginalArticle

Interdisciplinary Research in Artificial Intelligence and Sustainability Enabled Hospital Planning, Operations and Resource Optimization: A Practical Implementation Study in Metropolitan and Teir II city Healthcare

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Healthcare institutions in emerging and semi-urban markets often struggle with operational inefficiencies, asset underutilization, workforce misalignment, and unstructured marketing. While Artificial Intelligence (AI) holds transformative potential, its practical, operational-level implementation remains limited. This study evaluates the nine-month implementation of AI-enabled operational systems combined with structured management practices across two settings: a Tier-II hospital and a metropolitan diagnostic center. Interventions included asset codification and AI-enabled tracking, structured workforce training, low-code digital tools, and workflow restructuring to improve patient navigation and departmental coordination. Additionally, traditional healthcare outreach was integrated with AI-driven marketing analytics, digital reputation management, and new service lines. The results demonstrate marked improvements in asset utilization, workforce productivity, patient engagement, and financial sustainability. Within its first year, the diagnostic center achieved a stable monthly income of approximately ₹3 lakhs. Concurrently, the hospital enhanced its operational systems and staff preparedness for corporate healthcare standards and accreditation frameworks. Ultimately, this study demonstrates that integrating AI technologies with robust operational leadership and structured management frameworks can significantly enhance healthcare efficiency, capacity building, and long-term sustainability in developing healthcare markets.

Keywords: Artificial Intelligence in Healthcare, Hospital Operations Management, Asset Tracking, Resource Optimization, Diagnostic Centre Management, Healthcare Marketing Strategy, Digital Healthcare Systems.

Introduction

Healthcare institutions operate within complex systems that require careful coordination between infrastructure, clinical services, workforce management, and patient engagement. Many hospitals and diagnostic centers, particularly those located in semi-urban or developing regions, struggle with operational inefficiencies due to lack of structured management systems and limited adoption of digital technologies. Artificial Intelligence (AI) has emerged as a powerful tool capable of transforming healthcare management through predictive analytics, workflow automation, and intelligent decision-support systems. However, the benefits of AI can only be realized when technology is implemented alongside effective operational planning, workforce development, and strategic leadership.

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This study examines the practical implementation of AI-supported operational frameworks in two healthcare environments: Teir II Hospital and a diagnostic center in Metropolitan city. The interventions focused on improving operational efficiency, resource utilization, workforce development, and market engagement while maintaining realistic and sustainable management practices.

Review of Literature

Recent literature emphasizes the growing importance of AI in healthcare systems. It discusses how AI technologies can augment healthcare delivery by improving clinical decision making and operational efficiency. AI algorithms have been widely applied in radiology, pathology, and predictive healthcare analytics. According to latest data, AI applications in healthcare management include patient flow optimization, predictive admission modelling, and resource allocation planning. Hospitals adopting AI-enabled operational systems have reported improvements in patient throughput and reduced administrative burden. Growing demand in healthcare highlights the role of AI in administrative and operational healthcare functions, including scheduling, inventory management, and workflow automation. Their research emphasizes that AI can significantly reduce operational inefficiencies when combined with structured management processes. Studies in hospital infrastructure management also emphasize the importance of **asset management systems and equipment utilization monitoring**. Proper asset tracking enables hospitals to improve equipment availability and reduce capital expenditure losses caused by underutilized medical infrastructure. Similarly, research on healthcare marketing indicates that **digital engagement and reputation management through social media platforms and patient reviews** can significantly influence patient choice, particularly when combined with traditional community outreach strategies. While existing literature highlights the theoretical benefits of AI in healthcare systems, there is a limited number of studies focusing on **practical operational implementation within small and mid-scale healthcare institutions**, which this study aims to address.

Need for the Study

Many healthcare institutions operate without structured operational frameworks, resulting in inefficient resource utilization, limited marketing strategies, and workforce misalignment. Newly established diagnostic centers often face challenges in achieving financial sustainability due to inadequate market planning and operational monitoring. The need for this study arises from the necessity to demonstrate practical and scalable models of AI-supported healthcare management, particularly in environments where resources are limited and operational structures are evolving. The experiences from Teir II Hospital and the diagnostic center in Metropolitan city provide insights into how AI tools, operational restructuring, workforce training, and marketing strategy development can collectively strengthen healthcare institutions.

Objectives of the Study

1. The study aims to achieve the following objectives:
2. To examine the role of AI in improving hospital planning and operational efficiency.
3. To evaluate the implementation of asset codification and AI-enabled asset tracking systems in healthcare institutions.
4. To analyze the impact of structured workforce training and role alignment in improving hospital operations.
5. To assess the effectiveness of integrated marketing strategies combining traditional outreach and AI-enabled digital analytics.
6. To evaluate the impact of low-code and AI-enabled digital systems in diagnostic center operations.
7. To identify practical management approaches that improve healthcare sustainability.

Scope and Period of Study

The study focuses on operational transformation within two healthcare institutions:

Teir II Hospital

A diagnostic center in Metropolitan city

The scope includes:

- Hospital asset management systems
- Workforce development and training
- Marketing and patient engagement strategies
- Diagnostic center operational planning and service expansion.

The period of study covers **approximately nine months of operational intervention and monitoring**.

Research Methodology

The study adopts a **descriptive and implementation-based research methodology**, focusing on practical operational interventions and observational analysis.

The methodology included:

Operational Assessment

Initial evaluation of hospital infrastructure, equipment inventory, patient flow systems, and workforce structure.

Asset Mapping and Classification

All hospital assets were identified, codified, and categorized to create a structured asset management framework.

AI-Enabled Monitoring Systems

Digital trackers and AI tools were introduced to monitor equipment utilization and operational performance.

Workforce Evaluation and Training

Staff interviews were conducted to identify skill gaps and role misalignment. Training programs were implemented to strengthen operational capabilities and prepare staff for structured healthcare environments.

Marketing Strategy Implementation

A combined approach using traditional community outreach and AI-enabled marketing analytics was implemented to improve patient engagement.

Diagnostic Centre Operational Development

Market analysis, introduction of new service lines, and adoption of low-code digital systems were implemented in the diagnostic center.

Results Achieved

The interventions produced several operational improvements.

Teir II Hospital

- Implementation of **structured asset codification and classification system**
- Deployment of **AI-enabled asset tracking tools**
- Improved equipment availability and utilization across departments
- Development of structured **internal and external hospital signages** for better patient navigation
- Increased engagement of medical consultants in operational growth initiatives
- Implementation of **staff training and role alignment programs**
- Improved readiness for **corporate healthcare standards and NABH accreditation frameworks**.

Asset Management & Utilization (Tier-II Hospital)					
Metric	Baseline (Month 0)	Post-Intervention (Month 9)	Change	Unit	How measured / source
Total assets identified & codified	0	93	93	count	Physical codification and Audit
Assets under AI-enabled tracking	0	10	10	count	movable and high risk
Assets tracked (% of total)	0	10	10	%	Software analytics
Equipment availability rate	0	95	95	%	Real time data analytics
Equipment utilization rate	9	75	66	%	Log books and Bio medical Dept
Average equipment idle / downtime	3	0.5	-2.5	hrs/wk	Log books and Bio medical Dept
Underutilized assets identified	1	7	6	count	Bio medical dept and Asset Management
Value of underutilized assets redeployed	0	9	9	Rs. lakh	Financial data and log books
Departments covered by asset system	0	4	4	count	Physical codification and Audit

Workforce Development & Training (Tier-II Hospital)					
Metric	Baseline (Month 0)	Post-Intervention (Month 9)	Change	Unit	How measured / source
Total staff	55	40	-15	count	HR logs and registers
Staff trained	0	30	30	count	HR and Dept registers
Staff trained (% of total)	0	90	90	%	Department registers
Total training hours delivered	0	100	100	hrs	HR and Dept registers
Roles realigned / redefined	0	20	20	count	HR and Dept registers
Competency / skill-gap score (avg)	0	72	72	/100	HR and Dept registers
Staff satisfaction score (optional)	0	50	50	/5	Feedback
Attrition rate (optional)	60	25	-35	%	HR registers and department logs

Patient Navigation & Engagement (Tier-II Hospital)					
Metric	Baseline (Month 0)	Post-Intervention (Month 9)	Change	Unit	How measured / source
Internal + external signages installed	10	10	0	count	Operations and Marketing team
Avg patient wait / navigation time	20	8	-12	min	Operations
Monthly OPD footfall	55	90	35	count	Operations
Medical consultants engaged	2	5	3	count	Clinical operations and Medical Admin
Patient satisfaction score	2	5	3	/5	Operations and Marketing team
Patient complaints re: navigation (per mo.)	5	0	-5	count	Feedback mechanism

NABH / Accreditation Readiness (Tier-II Hospital)					
Metric	Baseline (Month 0)	Post-Intervention (Month 9)	Change	Unit	How measured / source
Overall NABH readiness score	0	86	86	%	Quality and Department Audits
Access, Assessment & Continuity of Care (AAC)	0	90	90	%	Quality and Department Audits
Care of Patients (COP)	0	85	85	%	Quality and Department Audits
Management of Medication (MOM)	0	85	85	%	Quality and Department Audits
Patient Rights & Education (PRE)	0	80	80	%	Quality and Department Audits
Hospital Infection Control (HIC)	0	95	95	%	Quality and Department Audits
Facility Management & Safety (FMS)	0	75	75	%	Quality and Department Audits
SOPs documented	0	95	95	count	Quality and Department Audits

Diagnostic Centre in Metropolitan city

- Development of a **structured market entry and growth strategy**
- Introduction of **new diagnostic service lines**
- Implementation of **low-code operational software platforms**
- Deployment of **AI-enabled marketing analytics tools** enabling the owner to track performance in real time
- Improved operational monitoring and decision making.

The diagnostic center has achieved **stable monthly income of approximately ₹3 lakhs**, indicating sustainable operational performance.

Diagnostic Centre (Metropolitan): Monthly Trend			
Month	Monthly Income (Rs. lakh)	Test / Scan Volume (count)	New Service Lines Live (cumulative count)
Month 1	0.2	15	0
Month 2	0.5	25	0
Month 3	0.7	35	0
Month 4	1	45	0
Month 5	1.6	49	0
Month 6	2.8	55	1
Month 7	2.8	59	1
Month 8	3.2	57	2
Month 9	3.1	65	2
Growth (M9 vs M1)	1450.0%		

I. Findings and Suggestions Findings

Findings:

1. AI-enabled asset tracking improves transparency and equipment utilization.
2. Workforce training and role alignment significantly improve operational efficiency.
3. AI-enabled marketing analytics help healthcare institutions refine outreach strategies.
4. Digital tools empower healthcare entrepreneurs to monitor and manage operations independently.
5. Structured operational planning improves financial sustainability in new healthcare establishments.

Suggestions

- Hospitals should implement structured **asset management systems before adopting advanced digital technologies**.

- Workforce development programs should be integrated into hospital operational strategies.
- Healthcare institutions should adopt **digital reputation management through patient feedback and online engagement**.
- Diagnostic centers should utilize **low-code digital platforms to monitor operational performance**.
- AI tools should be integrated gradually with operational frameworks rather than introduced as standalone technological solutions.

Conclusion

Artificial Intelligence, when combined with structured operational management and workforce development, can significantly improve the efficiency and sustainability of healthcare institutions. The experiences from Teir II Hospital and the diagnostic center in Metropolitan city demonstrate that practical, well-planned implementation of digital tools, operational restructuring, and strategic marketing initiatives can strengthen healthcare organizations.

Through initiatives such as **asset codification, AI-enabled asset monitoring, workforce training, marketing strategy development, and digital operational tools**, healthcare institutions can achieve improved operational transparency, better resource utilization, and financial stability.

The study highlights that successful healthcare transformation requires **a balanced integration of technology, management practices, and leadership engagement**, ensuring that AI serves as a practical enabler of sustainable healthcare growth.

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