

# Journal of Research and Development

*A Multidisciplinary International Level*

*Referred and Double Blind Peer Reviewed, Open Access Journal*

*ISSN:2230-9578 June- 2026 Volume-18 Issue- 6 (I)*

*K.L.E. Society's*

## **GUDLEPPA HALLIKERI ARTS, SCIENCE AND COMMERCE COLLEGE, HAVERI**

(Re-Accredited by NAAC "A" Grade with CGPA 3.13 in the Fourth Cycle)

(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**



**Mob: +91-8888454089**

**Website: <https://jrdrv.org>**

**Chief Editor:**

**Prof. Ramesh V. Bhole**

# MULTIDISCIPLINARY INTERNATIONAL JOURNAL

Website: <https://jrdrv.org>



ISSN: 2230-9578  
June - 2026  
Volume-18 Issue- 6 (I)

**Please Get in Touch**

Email: [jrdrv.org@gmail.com](mailto:jrdrv.org@gmail.com)  
Mob: +91- 8888454089, +91-9552416001



# Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN : [2230-9578](https://doi.org/10.2230-9578) | Website: <https://jrdrv.org> Volume-18, Issue-6 (I) | June- 2026

## Journal of Research and Development

*A Multidisciplinary International Double Blind Peer Reviewed Refereed  
International Research Journal*

**Volume No-18, Issue-6(I), June- 2026**

Publication Language – English, Hindi, Marathi and other Indian Languages

Periodicity of Publication- Monthly

Email: [jrdrv.org@gmail.com](mailto:jrdrv.org@gmail.com)

Journal Website: <https://jrdrv.org>

**CHIEF EDITOR**

**Dr. Ramesh V. Bhole**

Professor

Sardar Vallabhbhai Patel Arts and Science College Ainpur,

Tal Raver, Dist Jalgaon

Email: [jrdrv.org@gmail.com](mailto:jrdrv.org@gmail.com)

---

### **Disclaimer**

*The Editors shall not be held responsible for the originality or the views and opinions expressed in the papers. The author(s) alone shall bear full responsibility for the originality of their work and the ideas expressed therein.*

**© All rights reserved with the Editors.**

---



# Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN : [2230-9578](https://jrdrvb.org) | Website: <https://jrdrvb.org> Volume-18, Issue-6 (I) | June- 2026



KLE Society's

Gudleppa Hallikeri Arts, Science and Commerce College,

Haveri-581110

IQAC Initiatives

One Day National Level Seminar

On

Digital Transformation and Inclusive Development in AI Ecosystem:

A Multidisciplinary Approach

16<sup>th</sup> June 2026

Venue

Seminar Hall

**Chief Petron**

**Shri Amit P. Kore**

Chairman,

K.L.E Society, Belagavi

**Petron**

**Shri. M C Kolli**

Director,

K.L.E Society, Belagavi

**Dr. S.L. Balehosur**

Chairman, LGB

**Prof.M.M.Holliyavar**

Principal

**Editors**

Prof. R.B.Ajaraddi

Dr. Gururaj S Barki

---

## **SAPTARISHIS OF K.L.E. SOCIETY**

---



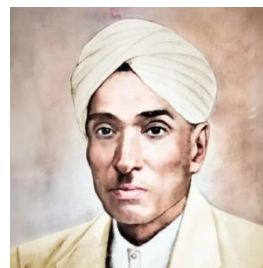
**Prof. M. R. Sakhare**



**Prof. S. S. Basavnal**



**Shri. B. B. Mamdapur**



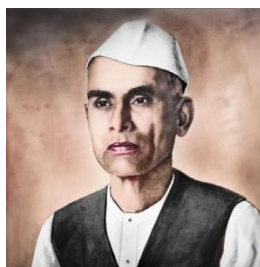
**Dr. H. F. Kattimani**



**Prof. B. S. Hanchinal**



**Prof. P. R. Chikodi**



**Sardar V. V. Patil**



## **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 16<sup>th</sup> June 2026.

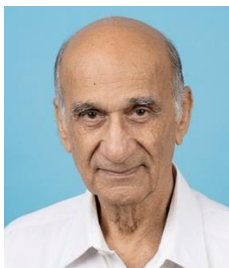
In the present era of rapid technological advancement, Artificial Intelligence (AI) has emerged as a transformative force influencing various sectors of society and the economy. From education and healthcare to business, governance, and industry, AI is driving innovation, efficiency, and growth. Academic 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 16<sup>th</sup> 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 16<sup>th</sup> 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 16<sup>th</sup> 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**



# Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN: [2230-9578](https://doi.org/10.22304/jrd.v1i1.10000) | Website: <https://jrdvb.org>

---

## JOURNAL OF RESEARCH AND DEVELOPMENT

---

*A Multidisciplinary International Double Blind Peer Reviewed Refereed  
International Research Journal*

Publication Language – English, Hindi, Marathi and other Indian Languages

Periodicity of Publication- Monthly

Email: [jrdvb.org@gmail.com](mailto:jrdvb.org@gmail.com)

Journal Website: <https://jrdvb.org>

---

### CHIEF EDITOR

---

**Dr. Ramesh V. Bhole**

Professor

Sardar Vallabhbhai Patel Arts and Science College Ainpur,

Tal Raver, Dist Jalgaon

Email: [jrdvb.org@gmail.com](mailto:jrdvb.org@gmail.com)

---

### ASSOCIATE EDITORS

---

**Prof. (Dr.) Madan Mohan Goel**

Vice-Chancellor (Former)

Rajiv Gandhi National Institute of Youth

Development, Govt. of India

Starex University, Gurugram, Haryana, India

**Dr. Praveen G. Saptarshi**

Visiting Faculty

Salisbury University, United States

---

### MANAGING EDITOR

---

**Dr. Santosh P. Mane**

Assistant Professor,

Head Department of Geography,

Sameer Gandhi Kala Mahavidyalaya



# Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN: [2230-9578](https://doi.org/10.22304/jrd.v1i1.10000) | Website: <https://jrdrv.org>

---

## EDITORIAL BOARD

---

|                                                                                                                                                                   |                                                                                                                                      |                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BABALOLA, Ayodele Samuel</b><br>Department of Pure and Applied<br>Zoology, Federal University of<br>Agriculture, PMB 2240, Abeokuta,<br>Ogun State, Nigerian   | <b>Dr. Lal Mervin Dharmasiri</b><br>Senior Professor and Chair<br>Head of Geography<br>University of Kelaniya, Sri Lanka.            | <b>Vijayanand Selvaraj</b><br>Data Strategist and Artificial<br>Intelligence Lead<br>Information Technology (IT),<br>Houston, Texas, USA           |
| <b>Dr. Munther Moh'd Ibrahim Zyoud</b><br>Assistant Professor of English<br>Language Teaching Methods-Al-Quds<br>Open University, Palestine.                      | <b>Prof. A.G. Amarasinghe</b><br>Senior Lecturer Grade<br>University of Kelaniya,<br>Sri Lanka.                                      | <b>Dr. Gyanaranjan Sahoo</b><br>Extension Scientist<br>Orissa University of Agriculture &<br>Technology, Orissa India                              |
| <b>Dr. RVS Praveen</b><br>Director<br>Digital Engineering and Assurance,<br>USA                                                                                   | <b>Dr. Ranjan Kalita</b><br>Principal<br>Rangapara College,<br>Amaribari, Rangapara,<br>(Autonomous) Assam                           | <b>Dr. S. C. Advitot</b><br>Principal<br>CBK's B. Sci, R.V. Com. & R. J.<br>Arts College, Akkalkot                                                 |
| <b>Dr. Kulkarni Swanand Gajanan</b><br>Associate Professor,<br>Mechanical Engineering Department,<br>S.K.N. Sinhgad College of<br>Engineering, Korti, Pandharpur- | <b>Dr. Anurag Shrivastava</b><br>Professor & Post Doctoral,<br>Lincoln University College (LUC)<br>Petaling Jaya, Malaysia, Malaysia | <b>Prof. (Dr.) F. M. Nadaf</b><br>Principal,<br>Government College Borda Margao<br>Goa (Autonomous), India                                         |
| <b>Dr. Tushti Sharma</b><br>Royal School of Languages,<br>The Assam Royal Global University,<br>Guwahati, Assam                                                   | <b>Dr. Sandeep Rout</b><br>Faculty of Agriculture,<br>Sri Sri University, Cuttack, Odisha                                            | <b>Dr. Daneshwar. R. Pandey</b><br>Assistant Professor,<br>Head Of Department<br>S.S Agrawal College Of Commerce<br>And Management Navsari Gujarat |

---

---

## PUBLISHER

**Dr. Ramesh V. Bhole**

'Ravichandram' Survey No-101/1, Plot, No-23, Mundada Nagar, Jalgaon

Email: [jrdrv.org@gmail.com](mailto:jrdrv.org@gmail.com) Journal Website: <https://jrdrv.org>

---



# Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN: [2230-9578](https://doi.org/10.22304/2230-9578) | Website: <https://jrdrv.org> Volume-18, Issue - 6 (I) June-2026

| Sr. No. | CONTENTS                                                                                                                                                                         | Page No. |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1       | Digital Evolution in Higher Education: Assessing Rural and Semi-Urban Academic Frameworks in Belthangady Taluk<br><b>B Ganesh Nayak</b>                                          | 1-6      |
| 2       | Green Financing in Karnataka: Progress and Challenges<br><b>Dr.Ambily Pillai</b>                                                                                                 | 7-11     |
| 3       | Green Marketing Strategy and its Impact<br><b>Dr. Kailaspathi</b>                                                                                                                | 12-18    |
| 4       | Artificial Intelligence (Ai) For E-Commerce and Digital Marketing Strategies<br><b>Dr. Leelavathi. K</b>                                                                         | 19-23    |
| 5       | Digital and Sustainable Banking: A Case Study of Canara Bank in India<br><b>Dr. M B Nagalapur</b>                                                                                | 24-26    |
| 6       | Exploring the Opportunities and Challenges of Generation Z in the Digital Era: A Sociological Perspective<br><b>Dr. Madanaik. H</b>                                              | 27-30    |
| 7       | Growth of UPI Transactions and Its Impact on Retail Commerce in India<br><b>Dr. Manjunatha J M</b>                                                                               | 31-33    |
| 8       | A Case Study of Business Analytics for Sustainable Decision Making<br><b>Dr. Nagaraja R.C</b>                                                                                    | 34-38    |
| 9       | Public Policy and Governance in the Digital Economy of Karnataka State-An Empirical Analysis<br><b>Dr.Anilkumar, Dr.R.V.Hegadal</b>                                              | 39-45    |
| 10      | Blockchain Technology-Based Innovations: Pathways to Economic and Sustainable Development<br><b>R. Darmesh Ram., Dr. B. Yasodha Jagadeeswari.</b>                                | 46-52    |
| 11      | Transformative Role of Media, communication, and digital society: An overview<br><b>Dr. Siddappa D O</b>                                                                         | 53-55    |
| 12      | The Role of Artificial Intelligence in Accounting of Small Business Enterprises: An Empirical Study of Davanagere District, Karnataka<br><b>Dr. Venkatesh Babu S</b>             | 56-60    |
| 13      | Artificial Intelligence (AI) In Commerce and Business Development<br><b>Dr. Shamala K</b>                                                                                        | 61-65    |
| 14      | Digital Transformation in Education Through Artificial Intelligence (AI)<br><b>Dr.Shambhulingappa. F. Nallanavar</b>                                                             | 66-69    |
| 15      | Green Account Management Practices in India: An Analysis of Selected Indian Banks<br><b>Fakiresh Jalihal, Dr. Ranjini M. L , Dr. Rajith Kumar H B</b>                            | 70-73    |
| 16      | Digital Banking, FinTech, and Financial Inclusion: Transforming the Landscape of Inclusive Finance<br><b>Kiran Badiger, Rajakumar Ukkund</b>                                     | 74-78    |
| 17      | A Study on ESG Integration and Financial Performance of Green Economy in India<br><b>Dr. Bellulli Kotresha</b>                                                                   | 79-84    |
| 18      | Artificial Intelligence and Employment: Reskilling for the Future Workforce<br><b>Mallanagouda Kulkarni</b>                                                                      | 85-90    |
| 19      | Human Resource Management Practices and Their Influence on Employee Performance in Private Hospitals of Vijayapura City<br><b>Revathi Girish Nandi, Dr. B. S. Navi</b>           | 91-100   |
| 20      | A Study on Digital Economy and Inclusive Growth in India<br><b>Hebbal Viswanatha Reddy Dr. Mudakappa</b>                                                                         | 101-106  |
| 21      | Digital Innovation and Dairy Farming Development: A Spatio-Temporal Analysis of Karnataka<br><b>Dawoodali M.Ingalgi, Dasharatha P. Angadi</b>                                    | 107-110  |
| 22      | A Study on Digital Banking- Use of Modern Technology- An Empirical Study<br><b>Narayana Nayak A, Dr. Supriya R</b>                                                               | 111-116  |
| 23      | Role of Artificial Intelligence in Teaching Botany: Transforming Plant Science Education<br><b>Praveenkumar J. Kaddipudi</b>                                                     | 117-122  |
| 24      | Impact of Digital Transformation on Education: Opportunities and Challenges<br><b>Purnima D. Kambale</b>                                                                         | 123-127  |
| 25      | Technology and Changing Human Behaviour<br><b>Sameer Vaman Deshpande, Atul A. Shinde, Sujata Jagtap</b>                                                                          | 128-129  |
| 26      | The Role of Artificial Intelligence in Higher Education and Skill Development<br><b>Dr. Seetalad S M</b>                                                                         | 130-132  |
| 27      | Digital Learning Readiness and Teacher Effectiveness as Determinants of Academic Achievement in Blended Learning: Evidence from Secondary School Students<br><b>Dr. Shobha M</b> | 133-137  |
| 28      | Economic Impact of Organic Farming on Farmers Community in Joida Taluk of Karnataka<br><b>Shrunga N K, Dr. H. Rajashekar</b>                                                     | 138-142  |



# Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN: [2230-9578](https://doi.org/10.22309/2230-9578) | Website: <https://jrdrv.org> Volume-18, Issue - 6 (I)| June-2026

|    |                                                                                                                                                                       |         |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 29 | A Comparative Study of UPI Downtime Incidents and Downtime Duration Across Different Categories of Banks in India<br><b>Dr. Mudakappa Sunagar, Shailaja S. Huddar</b> | 143-148 |
| 30 | Artificial Intelligence for Financial Inclusion and Digital Banking<br><b>Surekha. B</b>                                                                              | 149-153 |
| 31 | ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ಸಮಾಜದ ಮೇಲೆ ಅದರ ಪ್ರಭಾವ<br><b>ಡಾ.ಸುರೇಶ್.ಹೆಚ್.ಎನ್</b>                                                                                             | 154-155 |
| 32 | ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ಪರಿಣಾಮಕಾರಿ ಆಡಳಿತ<br><b>ಡಾ.ರಾಮಣ್ಣ. ಜಿ.ಟಿ</b>                                                                                                    | 156-158 |



## OriginalArticle

### Digital Evolution in Higher Education: Assessing Rural and Semi-Urban Academic Frameworks in Belthangady Taluk

B Ganesh Nayak

Assistant Professor, Dept. of Mathematics

Sri. Dharmasthala Manjunatheswara College(Autonomous) Ujire-574240

Manuscript ID:

**Abstract:**

JRD -2026-180601

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 1-6

June- 2026

Submitted: 05 May. 2026

Revised: 20 May.2026

Accepted: 05 June 2026

Published: 30 June 2026

*The twenty-first century has witnessed unprecedented technological advancements that continue to reshape social, economic, and educational environments across the globe. The widespread integration of digital technologies has transformed the way individuals access information, communicate, and acquire knowledge. In the field of higher education, these developments have created a pressing need to move beyond traditional teaching practices and adopt innovative, technology-enabled learning approaches. Conventional classroom methods often fail to address the diverse learning needs, digital competencies, and expectations of contemporary students. Consequently, educational institutions must embrace digital learning tools and platforms to enhance teaching effectiveness, student engagement, and academic outcomes. The integration of digital technologies is no longer viewed as an optional enhancement but as a fundamental requirement for preparing graduates to succeed in an increasingly competitive and technology-driven global workforce. This study investigates the impact, challenges, and implementation dynamics of digital learning frameworks in higher education institutions located in Belthangady Taluk of Dakshina Kannada District, Karnataka. Adopting a descriptive research design, primary data were collected from 25 faculty members and 75 undergraduate students through a structured survey. The findings reveal notable deficiencies in technological infrastructure, digital literacy, pedagogical integration, and institutional support systems. Based on these findings, the study proposes practical recommendations to strengthen digital learning practices and bridge the gap between existing educational realities and emerging technological opportunities, particularly in semi-urban and rural academic settings.*

**Keywords:** Digital Learning, Digital Transformation, Academic Frameworks, Digital Infrastructure.

#### Introduction:

Contemporary higher education has broken away from traditional boundaries, evolving into a decentralized, transparent, and highly adaptable ecosystem. In today's knowledge-centric global economy, enterprises prioritize hiring professionals who display high creative capacity, operational flexibility, and a commitment to objective results. To supply this talent pipeline, academic institutions rely on the rapid progress of Information and Communication Technology (ICT) to consistently audit, alter, and refine how courses are taught, ensuring students are prepared for real-world professional environments.

This sweeping digital shift has fundamentally rewritten the rules of information distribution. Students are no longer confined to local libraries; they can instantly access open-access journals, premier global databases, and interactive multimedia learning modules from anywhere.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

B Ganesh Nayak, Assistant Professor, Dept. of Mathematics, Sri. Dharmasthala Manjunatheswara College (Autonomous) Ujire-574240

#### How to cite this article:

B Ganesh Nayak. (2026). Digital Evolution in Higher Education: Assessing Rural and Semi-Urban Academic Frameworks in Belthangady Taluk. *Journal of Research and Development*, 18(6 (I)), 1–6. <https://doi.org/10.5281/zenodo.20636172>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636172





This democratization of information has sparked a rise in self-directed study, sharpened critical thinking skills, and significantly boosted student outcomes. Companies look at modern graduates as dynamic human capital that requires continuous development, meaning a university's agility in adopting technology directly dictates the market-readiness of its student body.

As a premier driver of global economic growth, India's economic resilience relies heavily on the strength of its higher education network. Educational digitalization serves as a powerful infrastructure force multiplier, immediately enhancing graduate employment statistics and driving systemic research innovation. The age-old "chalk-and-talk" classroom model is naturally transitioning into a hybrid framework. This new approach embraces cloud-hosted coursework, asynchronous learning schedules, and the ability to review complex ideas multiple times via recorded digital media.

Modern industries require rapid growth sustained by a tech-literate, highly resilient workforce. Fortunately, widespread mobile networks and open-access applications have dropped the barrier to entry for acquiring advanced knowledge. Data shows that India possesses the world's second-largest internet consumer base, following only China. Yet, while mature economies established their digital education networks decades ago, regional infrastructure gaps and localized digital divides continue to slow uniform rollout across the Indian subcontinent. This issue is particularly visible within rural and semi-urban administrative zones, a dynamic this paper analyzes within the educational ecosystem of Belthangady Taluk.

## Structural Breakdown of Digital Learning Adoption

To remain competitive, modern academic spaces must align their organizational strategies with digital networks; refusal to adapt leads directly to institutional obsolescence. The current technological evolution across higher education can be viewed through seven distinct functional areas:

- **Distance Architecture and Web Courseware:** Structured, web-enabled degrees effectively serve working professionals and remote populations, giving them access to curated content built by subject-matter experts for self-paced study.
- **Paperless, Automated Grading Systems:** Moving exams online via multiple-choice or adaptive testing drastically reduces grading turnaround times, removes subjective human bias, and delivers instant diagnostic data to the student.
- **Cloud-Based Knowledge Repositories:** Campus web portals and Learning Management Systems (LMS) store academic literature, notes, and Open Educational Resources (OER) so students can study whenever they want.
- **Asynchronous Lecture Frameworks:** Pre-recorded educational videos from world-class institutions allow students to rewatch complicated math proofs or theoretical arguments until they achieve full clarity.
- **Local Studio Production and Lecture Capture (LCS):** Progressive colleges invest in multimedia studios to record their own professors' lectures, uploading them to intranet portals as a safety net for students who miss class.
- **Synchronous Virtual Classrooms:** Live video-conferencing tools enable real-time academic debates, peer-led breakrooms, and direct interactions with global industry leaders.
- **Inspirational Knowledge Seminars:** Weaving high-impact, expert public talks (such as TED Talks) directly into the curriculum expands student perspectives and anchors abstract theories to practical realities.

## Socio-Economic Value of Technological Integration

India's primary macroeconomic advantage is its demographic dividend, with over 65% of its population sitting under the age of 35. This group represents a highly flexible, tech-native labor force capable of generating massive economic value. However, to meet corporate expectations, colleges must weave digital fluencies into their daily routines. This change brings several clear advantages:

1. **Elevating Workplace Employability:** Hybrid academic models build the practical, hands-on tech skills that modern industries look for.
2. **Optimizing Personal Output:** Comfort with digital platforms translates directly into improved project management, documentation habits, and personal productivity for students.
3. **Building Global Competitiveness:** Consistent exposure to web-based research tools, cloud sharing, and data analytics enables local students to hold their own in international job markets.
4. **Securing Long-Term Career Growth:** Graduates who study in tech-rich environments show higher professional resilience and navigate mandatory career upskilling with ease.
5. **Smoothing Enterprise Integration:** Prior exposure to virtual collaboration platforms means new hires adapt much faster to modern corporate structures.

## Key Impediments to Digital Transformation

Despite the clear benefits, rolling out a comprehensive digital overhaul across semi-urban and rural areas involves several major bottlenecks:

### Technical and Cultural Obstacles



- **Hardware and Network Limitations:** Rural student bodies regularly contend with unstable mobile data connections, weak bandwidth, and unexpected electrical blackouts.
- **Cultural Inertia:** Stepping away from familiar, face-to-face instruction frequently encounters behavioural pushback from conservative educators and students alike.
- **Pedagogical Friction in STEM:** Teaching dense quantitative subjects like mathematics, logic, or statistics online requires advanced handwriting tablets and specialized interactive visual aids.
- **Distraction and Misaligned Engagement:** Students frequently redirect their screen time away from formal learning management systems and toward entertainment networks.
- **Faculty Training Gaps:** Managing a lively, collaborative online class requires specialized technical training that many veteran educators lack.
- **Institutional Funding Realities:** A large percentage of rural degree colleges operate under tight budgets, preventing them from purchasing expensive enterprise software licenses.

## Review of Relevant Literature

- **Sowmya (2019):** Noted that authentic academic innovation happens when digital assets are purposefully used to turn passive ideas into active learning tools. Applying these resources effectively closes the gap between what a syllabus promises and what a student can actually execute, establishing a baseline for future education models in developing locales.
- **Dr. Aquil Busrai (2019):** Warned that higher education will lag behind industry realities unless it embraces intentional digital restructuring. However, schools must deploy technology mindfully so it acts as a tool for clear learning goals rather than overcomplicating the classroom experience.
- **Shailendra Sharma (2019):** Argued that top-tier colleges rely heavily on future-ready, tech-enabled learning spaces to encourage peer collaboration and seamless information exchange. Building corporate alliances to improve infrastructure gives colleges a competitive edge while offering students a superior education.

## Scope, Goals, and Methodology

### Strategic Objectives

1. To gauge how digital integration shapes undergraduate learning experiences inside degree colleges.
2. To analyze student expectations and their day-to-day satisfaction with digital classrooms.
3. To spot structural alignment gaps between current online academic content and official university syllabi.
4. To deliver actionable, data-proven recommendations based on fields insights.

### Methodology Framework

This investigation applies a descriptive, diagnostic, and empirical research design to analyze digital tools in the local region. Primary data was gathered using an objective, close-ended questionnaire, coupled with qualitative interview mapping. Secondary resources were extracted from peer-reviewed journals, institutional files, and verified academic databases.

The final study sample consisted of 100 participants, broken down as follows:

- **75 Undergraduate Students** evenly distributed across Arts, Science, Commerce, Business Administration, and Computer Applications.
- **25 Active Faculty Members** instructing across these same academic departments.

Convenience sampling was utilized to ensure the study accurately mirrored the infrastructural realities of the area.

### Geographical Area

The fieldwork was bound to **Belthangady Taluk** within the Dakshina Kannada district of Karnataka, India.

Investigations focused on six major local colleges:

1. Government First Grade College, Belthangady
2. Kalpataru College, Belthangady
3. Guru Deva College, Belthangady
4. Government First Grade College, Mundaje
5. S.D.M. College (Autonomous), Ujire
6. Sacred Heart College, Madanthyar

### Data Analysis and Statistical Interpretation

The quantitative findings from the field survey are detailed below, split into student metrics and faculty responses.

**Table 1: Respondent Profile by Academic Focus**

| Department Category   | Sample Count () | Total Proportion (%) |
|-----------------------|-----------------|----------------------|
| Humanities / B.A.     | 15              | 20.00%               |
| Commerce / B.Com.     | 15              | 20.00%               |
| Pure Sciences / B.Sc. | 15              | 20.00%               |

|                        |           |                |
|------------------------|-----------|----------------|
| Management / BBA       | 15        | 20.00%         |
| Computing / BCA        | 15        | 20.00%         |
| <b>Combined Sample</b> | <b>75</b> | <b>100.00%</b> |

**Table 2: Student Familiarity with Digital Ecosystems**

| Measured Literacy Level | Student Count () | Percentage (%) |
|-------------------------|------------------|----------------|
| High Familiarity        | 30               | 40.00%         |
| Moderate Familiarity    | 25               | 33.33%         |
| Unaware / Low Literacy  | 20               | 26.66%         |
| <b>Combined Sample</b>  | <b>75</b>        | <b>100.00%</b> |

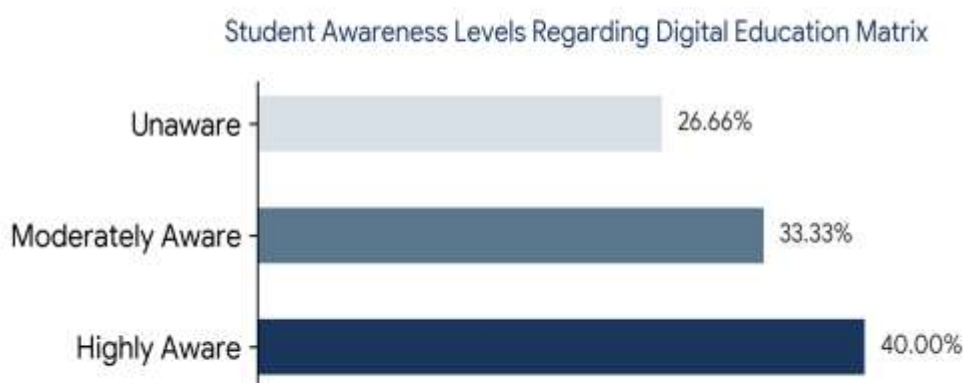


**Table 3: Primary Media Formats Utilized in Classrooms**

| Core Delivery Tool     | Selection Count () | Total Share (%) |
|------------------------|--------------------|-----------------|
| Video Modules          | 30                 | 40.00%          |
| Lecture Recordings     | 12                 | 16.00%          |
| Slide Decks / PPT      | 33                 | 44.00%          |
| <b>Combined Sample</b> | <b>75</b>          | <b>100.00%</b>  |

**Table 4: Student Adaptability and Comfort Metrics**

| Perceived Comfort Index   | Student Count () | Sample Percentage (%) |
|---------------------------|------------------|-----------------------|
| Exceptionally Comfortable | 45               | 60.00%                |
| Moderately Comfortable    | 25               | 33.33%                |
| Uncomfortable             | 5                | 6.66%                 |
| <b>Combined Sample</b>    | <b>75</b>        | <b>100.00%</b>        |

**Table 5: Comprehensive Student Satisfaction Feedback**

| Experience Grade       | Response Volume () | Total Percentage (%) |
|------------------------|--------------------|----------------------|
| Top Tier (Excellent)   | 20                 | 26.66%               |
| Satisfactory (Good)    | 40                 | 53.33%               |
| Marginal (Average)     | 15                 | 20.00%               |
| <b>Combined Sample</b> | <b>75</b>          | <b>100.00%</b>       |

**Table 6: Primary Expected Benefit from Educational Technology**

| Key Student Motivation     | Count ()  | Total Weight (%) |
|----------------------------|-----------|------------------|
| Autonomous Study           | 15        | 20.00%           |
| Post-Class Review/Revision | 45        | 60.00%           |
| Simplification of Topics   | 15        | 20.00%           |
| <b>Combined Sample</b>     | <b>75</b> | <b>100.00%</b>   |



**Table 7: Instructor Views on Curricular Gaps**

| Identified Disconnect Root Cause | Faculty Count ( ) | Relative Share (%) |
|----------------------------------|-------------------|--------------------|
| Outdated Syllabus Additions      | 6                 | 24.00%             |
| Shallow Curricular Depth         | 5                 | 20.00%             |
| Delayed Content Update Cycles    | 10                | 40.00%             |
| Pacing Disconnect with Students  | 4                 | 16.00%             |
| <b>Total Faculty Sample</b>      | <b>25</b>         | <b>100.00%</b>     |

**Table 8: Necessary Institutional Support Forms Required by Teachers**

| Core Support Requirement              | Faculty Count ( ) | Total Proportion (%) |
|---------------------------------------|-------------------|----------------------|
| Strong Administrative Backing         | 15                | 60.00%               |
| Allotted Professional Upskilling Time | 4                 | 16.00%               |
| Privacy and IP Security               | 6                 | 24.00%               |
| <b>Total Faculty Sample</b>           | <b>25</b>         | <b>100.00%</b>       |

**Table 9: Overall Faculty Assessment of Tech Integration Progress**

| Strategic Progress Grade    | Faculty Count ( ) | Total Percentage (%) |
|-----------------------------|-------------------|----------------------|
| Advanced (Excellent)        | 4                 | 16.00%               |
| Moderate (Good)             | 8                 | 32.00%               |
| Intermediate (Average)      | 10                | 40.00%               |
| Needs Work (Satisfactory)   | 3                 | 12.00%               |
| <b>Total Faculty Sample</b> | <b>25</b>         | <b>100.00%</b>       |

## Primary Field Findings

- **Methodological Balance:** By polling exactly 20% of respondents from each core discipline, the study safeguards its findings against major bias, mirroring the whole institutional landscape rather than just tech-leaning fields.
- **Awareness Blindspots:** While basic digital competencies are high, over a quarter of the student body (26.66%) lacks functional literacy regarding these platforms, illustrating an urgent need for campus-wide on boarding.
- **Static Slide Dominance:** Tech usage remains stuck on basic slide-deck projections (44%) instead of interactive streaming video or structured lecture capture systems (16%). This proves that technology is mostly being used to show traditional text on screens, rather than driving new teaching models.
- **High Student Readiness:** 60% of students state they feel highly comfortable with tech tools, and 80% view these changes positively, proving that learners are ready for advanced systems.
- **Review-Driven Demand:** 60% of the student base treats online resources primarily as a revision tool, indicating strong student demand for permanent, cloud-accessible lecture vaults.
- **Rigid Syllabus Updates:** 40% of the faculty note that lagging university revision timelines are the primary source of curricular gaps, making it difficult to keep up with industry transformations.
- **Administrative Funding Hurdles:** 60% of educators report that a lack of financial backing and infrastructure directly limits classroom success, highlighting that true digital change requires institutional investment.
- **Skeptical Faculty Sentiments:** In contrast to enthusiastic students, 52% of faculty rank current digital progress as only average or satisfactory due to steep workload adjustments, technical problems, and lack of support.

## Strategic Recommendations

### I. Structured Faculty Professional Development

Institutions must create continuous Faculty Development Programs (FDPs) centered on hands-on technical skills. These workshops should move beyond basic slide presentation tools, training instructors to comfortably navigate comprehensive Learning Management Systems (LMS) and run interactive virtual classrooms.

### II. Targeted Technical Paths and Skill Alignment

Teachers should evaluate student interests individually, pairing them with field-specific professional platforms and technical applications. Connecting a student's career goal to matching technical fluencies enhances user engagement and ensures graduates are highly employable.

### III. Bridging Tech Inequity with Open Cloud Repositories

To counter regional digital access imbalances, colleges should establish shared, permanent cloud hubs. Storing lecture materials and notes in accessible, low-bandwidth archives allows remote students to review material at their own convenience, bypassing poor live internet connections.



## IV. Designing Curated Educational Media Hubs

Colleges should actively weave high-quality educational channels and verified digital videos directly into the syllabus. This provides students with structured alternative references, transforming modern screen habits from mindless distraction into intentional, self-guided study.

## Conclusion

The enduring strength of contemporary higher education depends on an institution's ability to identify macroeconomic shifts, match modern industry needs, and build deep digital literacies within its students. College administrations must rigorously audit emerging educational paths, allocate capital toward infrastructure, and provide faculty with the training needed to master these interfaces. This demands a shared effort: leadership must provide financial and technical resources, while faculty must consistently expand their technical skills.

Furthermore, active alumni networks can provide massive value by sharing real-world insights, market trends, and practical technical expectations with the student body. Modernizing classic syllabi through digital means is non-negotiable; ignoring these shifts leaves graduates ill-prepared for a ruthlessly competitive economy.

As India continues its path of macroeconomic development, sustaining this momentum relies entirely on the calibre of its higher education network. Transforming classroom frameworks and implementing reliable digital tools within regional environments like Belthangady Taluk marks a vital step toward securing an agile, future-ready national workforce.

## Bibliography & References

1. Busrai, A. (2019). Digital transformation paradigms in institutional structures. *University News: A Weekly Journal of Higher Education*, 57(25), 11–15.
2. Kothari, C. R. (2011). *Research methodology: Methods and techniques* (2nd ed., pp. 91–92). New Delhi: New Age International Publishers.
3. Kumar, A. (2017). Innovation and innovations in management education: Issues and approaches. *University News*, 55(48), 22–26.
4. Nagendra Parashar, B. S. (2017). Internship program: A need for quality education in management. *University News*, 55(42), 14–19.
5. Naik, B. M. (2017). Making universities world class: Prerogatives for government and universities. *University News*, 55(37), 8–13.
6. Sharma, S. (2019). Technological enablement matrices within premier Indian academic ecosystems. *Education World*, 11–14.
7. Sowmya, D. E. (2019). Digital resources and structural impacts on modern learner retention profiles. *Edu Tracks: A Monthly Magazine*, 8(10), 31–35.
8. *The Hindu BusinessLine*. (n.d.). Education verticals and internet penetration indices database. Retrieved from [www.thehindu.com/education](http://www.thehindu.com/education).



## OriginalArticle

### Green Financing in Karnataka: Progress and Challenges

Dr. Ambily Pillai

Associate Professor

Department of Commerce

Smt. G.B.Ankalkoti Govt. First Grade College, Shiggaon

Manuscript ID:

JRD -2026-180602

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 7-11

June- 2026

Submitted: 05 May. 2026

Revised: 20 May.2026

Accepted: 05 June 2026

Published: 30 June 2026

#### Abstract:

Green finance is important for achieving sustainable development goals and meeting climate targets. This paper examines how green financing is functioning in Karnataka, looking at the efforts of financial institutions, government programs, and private investments that support eco-friendly projects. Karnataka has been ahead in renewable energy, particularly in solar and wind power, thanks to smart policies and good cooperation between the public and private sectors. Even with this progress, there are big challenges in expanding green finance. The paper takes a close look at these areas, explaining their main points, limitations, and how they are used in practice. It also provides helpful strategies to better include green finance in sustainability efforts. By clearly explaining these concepts, the study hopes to encourage more academic interest and prepare the way for future research. The paper concludes with practical policy recommendations that highlight the value of blended finance models, green bonds, and local regulations in building a strong and lasting green financial system in Karnataka.

**Keywords:** Green Finance, Sustainable Development, Green Bonds, Green Initiatives, Green Investments.

#### Introduction:

Climate change is one of the biggest challenges the world is facing right now, and it needs immediate attention. To tackle this issue, countries need to stop relying on systems that produce a lot of carbon emissions and instead switch to more sustainable, low-carbon approaches. This shift needs a lot of financial support, which has led to the growth of "green financing." Green finance refers to various financial activities such as banking, micro-finance, insurance, and investments that are aimed at improving the environment. Around the world, including in India, financial systems are changing to support the United Nations Sustainable Development Goals and the goals set by the Paris Agreement. In India, the Reserve Bank and the Securities and Exchange Board have introduced tools like green bonds and green lending for renewable energy to help with this shift. At the state level, Karnataka is a key example of how green finance is working. As one of the most developed states in India, Karnataka has been a leader in setting up renewable energy projects. It has large solar parks, like Pavagada, and is quickly expanding in wind energy. The state's policies, such as the Karnataka Renewable Energy Policy and its efforts to promote electric vehicles, have made it a favorable place for eco-friendly investments. However, turning these policies into actual financial actions is not easy. Large renewable energy projects have drawn investments from international and institutional investors, but smaller areas like MSMEs, sustainable farming, rainwater harvesting, and circular waste systems still face serious funding issues.



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20636241



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Ambily Pillai, Associate Professor, Department of Commerce, Smt. G.B.Ankalkoti Govt. First Grade College, Shiggaon

#### How to cite this article:

Ambily Pillai. (2026). Green Financing in Karnataka: Progress and Challenges. *Journal of Research and Development*, 18(6 (I)), 7–11. <https://doi.org/10.5281/zenodo.20636241>



Financial institutions often avoid these areas because of long payback periods, the lack of standard green ratings, and poor risk management tools. This leads to an uneven spread of green capital across the state's economy.

This research paper examines how green financing is functioning in Karnataka. It looks at what has been done so far and explores the challenges. The study analyzes the role of different financial players, including commercial banks, regional rural banks, non-banking financial companies, and state agencies, in green investments. It also looks at the main obstacles, such as high initial costs and limited awareness about green products, that prevent wider adoption. In the end, the paper aims to provide useful insights and recommendations to close the gaps in financing, ensuring that Karnataka's growth is both strong and environmentally friendly.

### Objectives Of the Study:

To understand the current status of green financing and its growth in Karnataka, especially in areas like renewable energy, electric vehicles, and sustainable agriculture.

To evaluate how financial institutions such as commercial banks, rural banks, and non-banking financial companies are ensuring compliance and offering green loans in the state.

To identify the main challenges and issues faced by both lenders and borrowers, such as high initial costs, difficulties in risk assessment, and a lack of awareness about green finance.

### Significance Of the Study:

This study also serves as a key basis for future research in sustainable finance. It provides a thorough overview of how green investments have been spread across various regions in Karnataka up to 2026, offering researchers a historical perspective to examine how effectively capital has been utilized and how successful policies have been over time.

### Research Methodology:

This study employs a descriptive research method that depends only on secondary data. The required qualitative and quantitative information was gathered from official reports by the Government of India and the Government of Karnataka, along with peer-reviewed articles, institutional documents, and annual reports from both public and private organizations and banking institutions in India.

### Data Analysis:

Karnataka is India's premier green energy state, generating over 75% - 80% of its total grid power from renewable sources like wind and solar. However, the state's data analysis reveals a stark dichotomy: rapid progress in capacity expansion is severely constrained by foundational financial, structural, and regulatory challenges.

### Data Analysis: Progress & Targets:

| Metric / Sector             | Key Progress Indicators & Data                                                                         | Projected Goals                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Renewable Energy            | 25,675 MW installed capacity. Up to 80% daily power demand met by renewables.                          | Target of 38 GW renewable energy capacity by 2030.                           |
| Solar Energy                | Home to the Pavagada Solar Park (2,000 MW).                                                            | Expansion of mega projects and rooftop solar (PM Surya Ghar).                |
| E-Mobility & Infrastructure | Over 14,151 rooftop solar installations and rising EV adoption in Bengaluru under the state EV policy. | Development of comprehensive EV charging networks across major highways.     |
| Energy Efficiency           | Consistently top-ranked in the State Energy Efficiency Index (SEEI) with scores hitting 86.25.         | Implementation of the Energy Conservation and Efficiency Policy (2022–2027). |

### Data Analysis: Core Challenges:

| Challenge Category | Data & Analysis Findings                               |
|--------------------|--------------------------------------------------------|
| High Capital       | Achieving India's enhanced Panchamrit targets requires |

|                                          |                                                                                                                                                                                                                                 |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Expenditure (CAPEX)</b>               | approximately INR 162.5 Lakh Crore (\$2.5 trillion) nationally. Karnataka requires massive, targeted credit lines that traditional state budgets struggle to provide alone.                                                     |
| <b>Over-Reliance on Public Funds</b>     | 83% of green finance for climate mitigation in India relies on domestic sources. The private sector and institutional lending for smaller-scale, localized green projects must significantly outpace public budgetary spending. |
| <b>Financial Risks &amp; Bankability</b> | Renewable projects in the region suffer from high perceived investment risks (e.g., delayed payments from state distribution companies, transmission bottlenecks).                                                              |
| <b>Methodological Barriers</b>           | Institutional hesitancy and the absence of a universal taxonomy for what qualifies as "green" complicate the tracking and channeling of capital to crucial adaptation and mitigation projects.                                  |

## Result:

Green financing in Karnataka is making good progress thanks to policies that support renewable energy and eco-budgeting, but there are still major challenges like high initial costs, unclear regulations, and the need for more scalable and customized green financial products.

## Progress:

1. Eco-Budgeting: Karnataka launched an "eco-budget" that aligns state spending with global climate goals such as the Paris Agreement. This initiative also aims to increase carbon sinks by focusing on environmental protection.
2. Renewable Energy Growth: The state is among the leaders in energy efficiency, often ranking first in the State Energy Efficiency Index (SEEI). Renewable energy now accounts for more than half of the state's total power generation capacity.
3. Sustainable Transport: The government is supporting and offering subsidies for electric vehicles. The Bengaluru Metropolitan Transport Corporation (BMTC) has already tested electric buses, and the state is increasing the number of EV charging stations across the region.
4. SDG Budgeting: The state is carefully tracking and allocating a significant amount of money, such as Rs. 54,916.16 crore, towards achieving Sustainable Development Goals (SDGs) and local environmental targets.

## Persistent Challenges:

1. Investment and Viability Gap: There is a big financial gap for large-scale sustainable projects. For instance, moving the state's transport fleet to electric vehicles requires a lot of money, with a subsidy gap of INR 60-70 lakhs per bus.
2. Data and Impact Tracking: It is difficult to measure the environmental and financial benefits due to the absence of standard green metrics and reporting tools.
3. Regulatory Fragmentation: Inconsistent rules from the state and central government, along with limited green banking options, make it hard for small and medium businesses (SMEs) to get credit for adopting green technologies.
4. Awareness and Risks: Lack of awareness among investors and higher perceived risks for new sustainable business models in areas like agriculture and water management are slowing down market growth.

## Finding:

Karnataka is advancing its green economy through significant investments in renewable energy and creating state-level policies. However, there are still major obstacles to overcome, such as limited public awareness, high initial costs, and risks connected to funding decentralized sustainable projects.

## Findings on Progress:

1. Policy and Budgetary Commitments: The government has created specific plans like the Karnataka Energy Conservation and Energy Efficiency Policy to promote sustainable industrial growth and energy-efficient upgrades. An "eco-budget" has also been introduced, allocating 100 crore rupees to help compensate for forest damage and support ecosystem services.
2. Energy Efficiency Leadership: Karnataka consistently ranks among the top performers in the State Energy Efficiency Index (SEEI), scoring over 86.25. State agencies like SDA Karnataka run programs for building energy efficiency (BEEP), electric vehicle (EV) charging stations, and LED street lighting.
3. Renewable Energy and Agriculture: The state has introduced innovative local solar energy projects like Surya Raitha to support farmers, which combine government assistance with bank loans and agreements to buy the generated power.



## Primary Challenges in the State:

1. Lack of Public Awareness: Surveys conducted in cities like Bengaluru show that despite the availability of green loans and incentives, people are slow to adopt them due to technology barriers and limited awareness about green finance and paperless processes.
2. Investment Risks and Cost Barriers: Projects like solar irrigation at the feeder level have turned out to be costly for state utilities such as BESCOM. The high upfront costs are mainly shouldered by public bodies.
3. Data and Measurement Gaps: There is a lack of reliable and standardized data to measure the environmental benefits of financial returns, making it difficult for private investors to make informed decisions.
4. Institutional Constraints: Financial institutions and local banks struggle to incorporate Environmental, Social, and Governance (ESG) factors into their lending processes, which limits the availability of customized green financial products.

## Discussion:

Green financing in Karnataka is undergoing significant changes, driven by the state's strong commitment to sourcing a large portion of its electricity from renewable sources and reducing carbon emissions. However, scaling up these investments remains challenging due to high initial costs, inconsistent rules, and the lack of standardized green financial instruments.

## The Progress:

1. Renewable Energy Leadership: Karnataka is at the forefront of energy efficiency and clean energy production in the country. Around half of the state's electricity comes from solar and wind power, and the goal is to reach 38 gigawatts of renewable energy by 2030.
2. State-Level Budgeting: Karnataka has introduced a new "eco-budget" to allocate funds for addressing the negative impacts of natural and human activities on forests.
3. Sustainable Transportation: Organizations like the Bengaluru Municipal Transport Corporation (BMTC) are working to increase the number of electric buses on the road. They support this effort by providing low-cost loans and partnering with private companies.
4. Energy Efficiency Index: Karnataka has consistently performed well in the State Energy Efficiency Index (SEEI). They have implemented programs for making buildings more energy-efficient and have set up electric vehicle (EV) charging stations.

## The Challenges:

1. High Borrowing Costs & Risk Premiums: Despite the progress, green bonds and loans in India still have higher interest rates compared to traditional loans because of the associated risks and limited available information.
2. Lack of Uniform Standards: There is no widely accepted definition for "green" projects, which complicates the assessment of their impact, measurement of outcomes, and evaluation of real environmental benefits.
3. Maturity Mismatches: Green projects typically require long time horizons to deliver returns, while investors often seek short-term gains, leading to a mismatch in timing.
4. Greenwashing Concerns: Many sustainability claims are misleading, and the lack of transparency makes it difficult for investors to trust and verify the actual impact of these projects.
5. Private Sector Reluctance: It is difficult to attract private investment in small-scale climate projects due to unclear returns and a lack of quality project proposals that banks can support.

## Recommendations:

Karnataka has been making progress in green financing by supporting renewable energy, smart grid systems, and electric vehicle infrastructure at the state level. However, there are still some challenges that make it difficult to scale up these efforts. These include uncertain borrowing costs, the risk of greenwashing, and a lack of clear rules for green banking.

To overcome these challenges and promote sustainable development, the following steps are recommended:

1. Issue State Green Bonds: The Karnataka government can issue Green Bonds to fund its climate-related projects. These bonds are appealing to international investors as they focus on social and environmental benefits.
2. Standardize Green Taxonomy: Create clear guidelines at the state level to help identify real green investments from those that are not. This will prevent misleading claims and ensure transparency.
3. Encourage Commercial Banking: Develop local rules that encourage banks to focus their lending on clean energy, waste management, and sustainable water projects, rather than just traditional areas like agriculture.
4. Reduce Risks for Green Investments: Collaborate with international development banks like the World Bank and Asian Development Bank, and set up state-backed credit guarantees to lower the cost of loans for green small and medium enterprises.



5. Improve Skills and Tools: Provide training programs for financial institutions to help them better access and manage risks related to climate-friendly projects, leading to more informed decisions.

## Conclusion:

Karnataka has made a solid beginning in green financing because of good policies and big progress in large renewable energy projects. However, to become a real leader in green economy, it needs to fix the big gap in finance between large infrastructure and smaller, local uses. To do this, it should create ways to lower risks, provide easier banking options, and focus on more than just solar power. This will help Karnataka's green growth stay balanced and long-term. The study highlights that Karnataka's work in green financing is very impressive, especially in quickly getting loans for big solar projects and electric vehicles for daily use. Because of smart policies, global ESG investments, and special banking tools like low-interest loans, Karnataka has become a top clean energy area. But just having good policies isn't enough to fix these financial issues. To make the most of green financing, Karnataka should move away from only using traditional loans and start using new financial tools. Setting up state-backed blended finance options, local green municipal bonds, and easy green credit ratings for small borrowers are important steps. By fixing these problems, Karnataka can build a fair, strong, and inclusive financial system that supports both the economy and the environment for a long time.

## Reference:

1. Canara Bank. (n.b.). Canara Green Wheels. Canara Bank Official Portal. <https://canarabank.com>
2. Das, S., & Chatterjee, A. (2025). Green bonds and infrastructure syndication: Mobilizing international capital for India's clean energy corridors. *Energy Policy Studies*, 32(4), 310–327.
3. Ecofy. (n.b.). Green financing for MSMEs and rooftop solar. Ecofy Finance. [ecofy.co.in](https://ecofy.co.in)
4. Government of Karnataka. (2022). Karnataka Renewable Energy Policy 2022-2027. Department of Energy, Government of Karnataka.
5. Karnataka Bank. (n.b.). KBL Ravi Kiran solar loan scheme. Karnataka Bank Limited. <https://karnatakabank.com>
6. Kumar, P., & Nair, V. (2023). Financing the eco-transition: Challenges faced by MSMEs in Karnataka's industrial clusters. *International Journal of Cleaner Production*, 389, 114–128.



## OriginalArticle

### Green Marketing Strategy and its Impact

**Dr. Kailaspathi**

Associate Professor and Head Department of Commerce,  
Government First Grade College Chittapur, Dist: Kalaburagi

Manuscript ID: **Abstract**

JRD -2026-180603

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 12-18

June- 2026

*Green marketing consists of all activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs with minimal detrimental impact on the natural environment. Critically, a greater part of the public believes that green marketing refers solely to the promotion or advertising of products with environmental characteristics. Terms like Phosphate Free, Recyclable, Refillable, Ozone Friendly, and Environmentally Friendly are what consumers most often associate with green marketing. This paper meticulously discusses concepts surrounding green marketing and sustainable development, strategies for sustainable development, consumer demography, and the associated benefits.*

**Keywords:** Phosphate Free, Recyclable, Refillable, Ozone Friendly, and Environmentally Friendly

#### Introduction

The concept of green marketing emerged directly from societal marketing (Kotler, 1999). It is an intentional attempt to distinguish a product as being environmentally friendly (eco-friendly). It holds the foundational view that marketing—as a core function of business—must not only satisfy specific customer needs but must also account for the broader interests of society. All stakeholders affected by corporate operations must be considered when establishing organizational policies and objectives, a reality that has accelerated the recent trend toward corporate "greening". While popular claims center on recycling or ozone safety, green marketing is a much broader concept applicable to consumer goods, industrial goods, and services alike.

#### Significance of Green Marketing

- **Long-term Cost Efficiency:** Although modifying business or production processes involves upfront start-up costs, it yields long-term savings. For example, installing solar energy is an initial investment that yields future energy cost savings.
- **Competitive Advantage:** Developing products and services with environmental impacts in mind grants businesses access to entirely new markets, increases profitability, and provides a distinct competitive advantage over non-responsible alternatives.
- **Sustainable Development:** Defined by the World Commission on Environmental Development (1978) as "meeting the needs of the present without compromising the ability of the future generations to meet their own needs". The core requirement is integrating economic and ecological considerations into corporate decision-making.

#### Review of Literature

The following are the some of the review of literature :

Sewar alkhatib petra Kecskes and Veronika Kellar (2023) in their paper Green marketing in digital Age : A Systematic Literature Review in their paper environmental issues have long been a concern regarding the environmental effects of the production, distribution and consumption of production have led to many research efforts over the years to create what is known as green or environmentally friendly products.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Kailaspathi, Associate Professor and Head Department of Commerce, Government First Grade College Chittapur, Dist: Kalaburagi

#### How to cite this article:

Kailaspathi. (2026). Green Marketing Strategy and its Impact. *Journal of Research and Development*, 18(6 (I)), 12–18. <https://doi.org/10.5281/zenodo.20636276>



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20636276





**Hansini Premi Monica Sharma G. S. Dangayach (2021)** : in the study marketing strategies and consumer perception towards green products have been evolving quickly, and the emergence of the 'green world' is a reality now. This paper summarized an in-depth study of research papers, articles, and reports since 1990 and also provided insights into the consumer behavior in responding to, adopting the green products, and identifying the factors (whether personal factors or environmental factors) which are responsible for the significant inclination and rise in consumption of green products.

**Anirban Sarkar (2012)**: Argued that green marketing must not be treated as a mere marketing fad or trend but must be pursued with vigor due to its deep environmental and social dimensions.

Elham Rahbar et al. (2011): Conducted a factor and regression analysis on 250 respondents in Penang, Malaysia, revealing that customer trust in eco-labels and eco-brands significantly impacts actual purchase behavior.

**Alsmadi (2007)**: Investigated Jordanian consumers, finding a high level of environmental conscience. However, this did not always translate to final purchase choice due to lower confidence in green claims and higher faith in traditional products.

**Sanjay K. Jain & Gurmeet Kaur (2004)**: Examined the Indian consumer market, demonstrating that green consumerism acts as a powerful catalyst for corporate environmentalism.

## Research Methodology

### 3.1 Research Design

This study utilizes a **conceptual-empirical blended qualitative strategy**. It blends traditional conceptual analysis with a structured empirical field survey. In alignment with standard qualitative paradigms (Ader et al., 2008), the conceptual components do not rely on strictly manipulated independent or dependent experimental variables. Instead, an elastic research process was utilized, allowing findings from the literature review to actively shape the descriptive boundaries of the study.

### 3.2 Objectives of the Study

The specific structural objectives driving this investigation are:

1. To systematically evaluate and map the theoretical and practical process of green marketing.
2. To identify and understand corporate green marketing mix strategies geared toward sustainable development.
3. To empirically assess the relationship between consumer demographics, green awareness, product pricing, and final purchase behavior.

### 3.3 Data Collection & Source Framework

To address the conceptual and empirical requirements of the study, a dual data-collection approach was established:

- **Primary Data:** Collected via a primary field survey distributed to a sample of 100 final consumers. Data was captured across key consumer variables including gender, age, educational background, awareness levels, brand preference, pricing perceptions, and information channels.
- **Secondary Data:** Acquired through a comprehensive review of previously published research, books, academic journals, and environmental publications.

### 3.4 Sampling Design

- **Target Population:** General retail consumers.
- **Sample Size (N):** 100 active respondents.
- **Sampling Technique:** Convenience / Purposive Sampling to ensure representation across key age brackets, gender demographics, and educational levels.

### 3.5 Data Analysis Tools and Statistical Framework

Collected data was coded, tabulated, and analyzed using both descriptive and inferential statistical techniques by using the SPSS software v31.

1. **Descriptive Statistics:** Percentage and frequency distribution mapping for consumer demographic and perceptual profiles.
2. **Parametric Inferential Testing (T-Test):** Applied to evaluate the mean score variances between two mutually exclusive groups (Male vs. Female) regarding green marketing awareness.
3. **Non-Parametric Testing (ANOVA / F-Test):** Utilized to observe variance across multiple distinct consumer age brackets regarding green product preferences.
4. **Chi-Square ( $\chi^2$ ) Test of Independence:** Implemented to test the significance of association between consumer awareness levels and actual final purchase behavior.

## Green Marketing Strategies for Sustainable Development

Organizations must alter production and consumption systems fundamentally to address issues like pollution, ozone depletion, and habitat loss. Academicians outline the strategic architecture of green marketing through both internal and external mix elements:

### 4.1 Green Product Strategies

Green products are durable, non-toxic, manufactured from recycled materials, or minimally packaged. Effective product strategies involve:

Reducing packaging materials and using sustainable raw material sources.

Designing products that are highly durable, repairable, and completely safe for final disposal or composting.

## 4.2 Green Logistics Strategies

The primary application of eco-logistics is the implementation of a **reverse channel system**. Unlike traditional linear disposal where waste is dumped indiscriminately, reverse logistics extracts and reuses valuable substances found within post-consumer waste.

## 4.3 Green Pricing Strategies

Green products often carry a higher immediate shelf-price than conventional alternatives. However, conventional goods are artificially cheap because they completely exclude the socio-environmental costs of raw production, usage, and disposal. Marketers must use informative strategies to judge value objectively.

## 4.4 Green Promotion Strategies

Promotion should address the relationship between products and the biophysical environment, advance green lifestyles, or present a corporate image of environmental responsibility. Firms must:

- Educate and empower consumers regarding specific environmental fixes.
- Provide clear performance reassurances.
- Maximize highly receptive media mixes like direct marketing, public relations, and eco-packaging messages.

## Empirical Data Analysis, Interpretation, and Hypotheses Testing

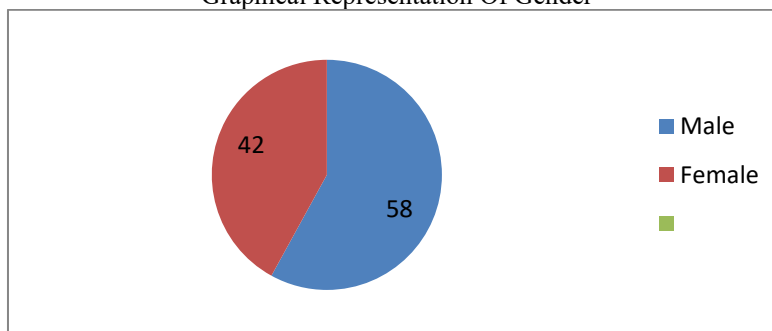
### 5.1 Demographic and Awareness Profile Breakdown

**Table 1: Gender Distribution**

| Gender                                                                                                    | No. of Respondents | Percentage  |
|-----------------------------------------------------------------------------------------------------------|--------------------|-------------|
| <b>Male</b>                                                                                               | 58                 | 58%         |
| <b>Female</b>                                                                                             | 42                 | 42%         |
| <b>Total</b>                                                                                              | <b>100</b>         | <b>100%</b> |
| <i><b>Interpretation: The sample shows a balanced gender representation with a 58% male majority.</b></i> |                    |             |

Source: field study

**Graphical Representation Of Gender**



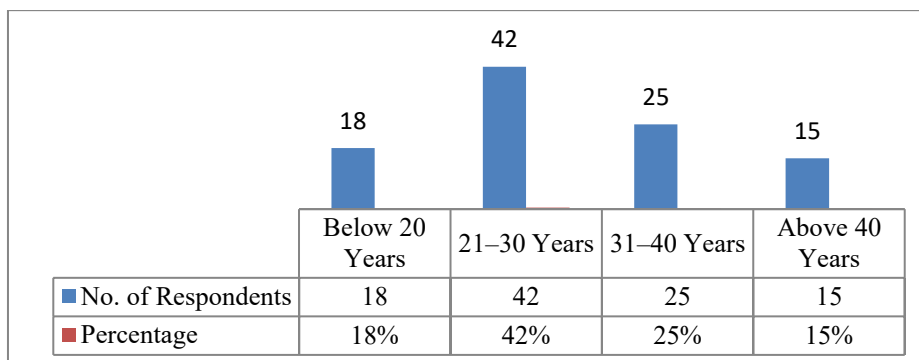
The above pi diagram which represents out the total demography 100 58% of the respondents belongs to male and 42 % of the respondents are of the female category

**Table 2: Age Distribution**

| Age Group                                                                                                                      | No. of Respondents | Percentage  |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------|
| <b>Below 20 Years</b>                                                                                                          | 18                 | 18%         |
| <b>21–30 Years</b>                                                                                                             | 42                 | 42%         |
| <b>31–40 Years</b>                                                                                                             | 25                 | 25%         |
| <b>Above 40 Years</b>                                                                                                          | 15                 | 15%         |
| <b>Total</b>                                                                                                                   | <b>100</b>         | <b>100%</b> |
| <i><b>Interpretation: The dominant consumer demographic group lies within the young adult cohort of 21–30 years (42%).</b></i> |                    |             |

Source: field study

## Graphical Representation of Age of the Respondents



The above shown diagram which depict the 42% of the respondents fall under the age group of 21-30 years followed by 25% of the respondents are under the age group of 31-40 years which represents the young age respondents are responded

**Table 3: Educational Qualification**

| Qualification                                                                                            | No. of Respondents | Percentage |
|----------------------------------------------------------------------------------------------------------|--------------------|------------|
| SSLC/PUC                                                                                                 | 20                 | 20%        |
| Graduate                                                                                                 | 45                 | 45%        |
| Post Graduate                                                                                            | 25                 | 25%        |
| Others                                                                                                   | 10                 | 10%        |
| Total                                                                                                    | 100                | 100%       |
| <i>Interpretation: The sample is highly literate, with 45% holding undergraduate university degrees.</i> |                    |            |

Source: field study

**Table 4: Awareness of Green Marketing Concepts**

| Awareness Level                                                                                                              | No. of Respondents | Percentage |
|------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|
| Highly Aware                                                                                                                 | 40                 | 40%        |
| Moderately Aware                                                                                                             | 35                 | 35%        |
| Slightly Aware                                                                                                               | 15                 | 15%        |
| Not Aware                                                                                                                    | 10                 | 10%        |
| Total                                                                                                                        | 100                | 100%       |
| <i>Interpretation: A strong majority of 75% of consumers display moderate-to-high baseline awareness of green marketing.</i> |                    |            |

Source: field study

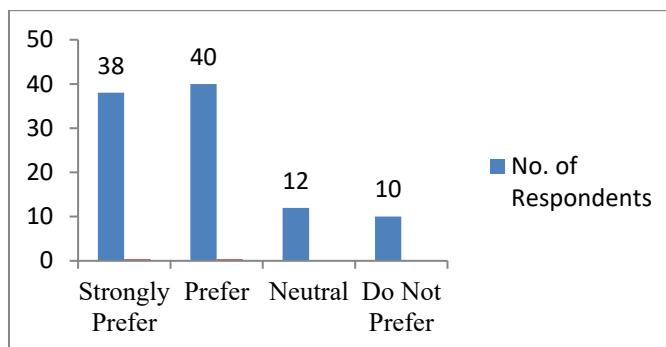
## 5.2 Consumer Behavior and Market Perceptions

**Table 5: Consumer Preference Matrix**

| Preference                                                                                                            | No. of Respondents | Percentage |
|-----------------------------------------------------------------------------------------------------------------------|--------------------|------------|
| Strongly Prefer                                                                                                       | 38                 | 38%        |
| Prefer                                                                                                                | 40                 | 40%        |
| Neutral                                                                                                               | 12                 | 12%        |
| Do Not Prefer                                                                                                         | 10                 | 10%        |
| Total                                                                                                                 | 100                | 100%       |
| <i>Interpretation: A massive 78% of consumers actively prefer choosing green variants over standard alternatives.</i> |                    |            |

Source: field study

## Graphical representation of Consumer Preference Matrix



The above graph which depicts the consumer preference matrix shows that 40% of the respondents prefer the preferences, 38% of the respondents are strongly prefer.

**Table 6: Key Purchase Drivers**

| Influencing Factors                                                                                                             | No. of Respondents | Percentage |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|
| Environmental Protection                                                                                                        | 35                 | 35%        |
| Health Benefits                                                                                                                 | 30                 | 30%        |
| Quality                                                                                                                         | 20                 | 20%        |
| Brand Image                                                                                                                     | 10                 | 10%        |
| Government Awareness                                                                                                            | 5                  | 5%         |
| Total                                                                                                                           | 100                | 100%       |
| <i>Interpretation:</i> Environmental protection (35%) and personal health benefits (30%) serve as primary purchasing catalysts. |                    |            |

Source: field study

**Table 7: Consumer Price Perceptions**

| Price Opinion                                                                                                                 | No. of Respondents | Percentage |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|
| Very Expensive                                                                                                                | 30                 | 30%        |
| Expensive                                                                                                                     | 40                 | 40%        |
| Reasonable                                                                                                                    | 20                 | 20%        |
| Cheap                                                                                                                         | 10                 | 10%        |
| Total                                                                                                                         | 100                | 100%       |
| <i>Interpretation:</i> 70% of respondents consider eco-friendly products significantly more expensive than standard products. |                    |            |

Source: field study

**Table 8: Information Channel Exposure**

| Source                                                                                                                        | No. of Respondents | Percentage |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|
| Television                                                                                                                    | 20                 | 20%        |
| Social Media                                                                                                                  | 35                 | 35%        |
| Newspapers                                                                                                                    | 15                 | 15%        |
| Friends and Relatives                                                                                                         | 18                 | 18%        |
| Advertisements                                                                                                                | 12                 | 12%        |
| Total                                                                                                                         | 100                | 100%       |
| <i>Interpretation:</i> Digital and social media spaces represent the most vital information sources (35%) for green products. |                    |            |

Source: field study

**Table 9: Product Performance Satisfaction**

| Satisfaction Level | No. of Respondents | Percentage |
|--------------------|--------------------|------------|
| Highly Satisfied   | 36                 | 36%        |
| Satisfied          | 42                 | 42%        |
| Neutral            | 14                 | 14%        |

|                                                                                                                |            |             |
|----------------------------------------------------------------------------------------------------------------|------------|-------------|
| <b>Dissatisfied</b>                                                                                            | 8          | 8%          |
| <b>Total</b>                                                                                                   | <b>100</b> | <b>100%</b> |
| <b>Interpretation: Post-purchase satisfaction trends high, with a combined 78% positive satisfaction rate.</b> |            |             |

Source: field study

**Table 10: Final Impact on Buying Behavior**

| Perceived Impact                                                                                                        | No. of Respondents | Percentage  |
|-------------------------------------------------------------------------------------------------------------------------|--------------------|-------------|
| <b>Strong Impact</b>                                                                                                    | 44                 | 44%         |
| <b>Moderate Impact</b>                                                                                                  | 32                 | 32%         |
| <b>Low Impact</b>                                                                                                       | 16                 | 16%         |
| <b>No Impact</b>                                                                                                        | 8                  | 8%          |
| <b>Total</b>                                                                                                            | <b>100</b>         | <b>100%</b> |
| <b>Interpretation: The majority (76%) state green marketing exerts a clear, positive impact on their buying habits.</b> |                    |             |

Source: field study

### 5.3 Inferential Statistical Testing

#### Test 1: Two-Sample Independent Parametric T-Test

- **Objective:** Compare mean green marketing awareness between genders.
- **Hypotheses:**
  - H0: There is no significant difference between male and female respondents regarding awareness.
  - H1: There is a significant difference between male and female respondents regarding awareness.

| Gender        | Sample Size (n) | Mean Score | Standard Deviation ( $\sigma$ ) |
|---------------|-----------------|------------|---------------------------------|
| <b>Male</b>   | 58              | 4.2        | 0.85                            |
| <b>Female</b> | 42              | 3.8        | 0.78                            |

- **Calculated Values:**
  - Calculated t-value=2.14
  - Table t-value (at 5% Significance level) =1.98
- **Statistical Decision:** Since  $|t_{calc}|(2.14) > t_{table}(1.98)$ , the null hypothesis (H0) is rejected.
- **Inference:** There is a statistically significant difference between male and female respondents regarding green marketing awareness.

#### Test 2: One-Way ANOVA (F-Test)

- **Objective:** Test preference variations across distinct age cohorts.
- **Hypotheses:**
  - H0: There is no significant difference among age groups regarding green product preference.
  - H1: There is a significant difference among age groups regarding green product preference.

| Source of Variation | Sum of Squares (SS) | Degrees of Freedom (df) | Mean Square (MS) | Calculated F-value | Table F-value (5%) |
|---------------------|---------------------|-------------------------|------------------|--------------------|--------------------|
| Between Groups      | 42.5                | 3                       | 14.17            | <b>4.26</b>        | <b>2.70</b>        |
| Within Groups       | 319.2               | 96                      | 3.32             |                    |                    |
| Total               | 361.7               | 99                      |                  |                    |                    |

- **Statistical Decision:** Since  $F_{calc}(4.26) > F_{table}(2.70)$ , the null hypothesis (H0) is rejected.
- **Inference:** Different age generations hold significantly varied preference intensities toward purchasing eco-labeled products.

#### Test 3: Chi-Square ( $\chi^2$ ) Test of Independence

- **Objective:** Evaluate the association between baseline awareness and final purchase choice.
- **Hypotheses:**

H0: There is no association between green marketing awareness and final purchase behavior.

H1: There is a significant association between green marketing awareness and final purchase behavior.

- **Calculated Values:**

Calculated  $\chi^2$  Value=12.45

Table  $\chi^2$  Value (at 5% significance, df=4) =9.49

- **Statistical Decision:** Since  $\chi^2_{calc}(12.45) > \chi^2_{table}(9.49)$ , the null hypothesis (H0) is rejected.



- **Inference:** A statistically significant association exists between how aware a consumer is and their actual purchase choices.

## 6. Key Findings and Suggestions

### Key Findings

- **Widespread Awareness & Satisfaction:** Consumers show a high baseline awareness and strong post-purchase satisfaction with green alternatives.
- **The Pricing Wall:** A major structural obstacle is that most consumers perceive green alternatives as premium or overly expensive.
- **The Power of Digital Spaces:** Social media platforms represent the single most powerful source of public environmental data and brand discovery.

### Suggestions

1. **Optimize Price Points:** Corporations must leverage production scaling to reduce green product retail prices and attract price-sensitive consumers.
2. **Expand Digital Outreach:** Launch high-impact environmental education campaigns via social and digital media spaces to increase engagement.
3. **Institutional Policy Support:** Governments should encourage green investments by providing manufacturing subsidies, tax breaks, and clear corporate incentives.
4. **Iterate Packaging Quality:** Firms should invest in better, structurally sound biodegradable and eco-friendly packaging standards.

### Conclusion

Green marketing has transformed from a niche differentiator into an essential strategy for environmental protection and sustainable development. While consumers demonstrate positive purchasing behavior and awareness, businesses must address the structural barriers of premium pricing and product information gaps. When synchronized globally through strict regulatory rules and standardized green mix operations, green marketing will drive positive organizational performance, lower pollution levels, and preserve environmental safety for generations to come.

### References :

1. Sarkar, A. (2012). Green Marketing and Sustainable development-Challenges and Opportunities. *International Journal of Marketing, Financial Services & Management Research*, 1(9), 120-134.
2. Alsmadi, S. (2007). Green Marketing and the Concern over the Environment: Measuring Environmental Consciousness of Jordanian Consumers. *Journal of Promotion Management*, 13(3-4), 151-177.
3. Jain, S. K., & Kaur, G. (2004). Green Marketing: An Attitudinal and Behavioural Analysis of Indian Consumers. *Global Business Review*, 5(2), 187-205.
4. Chopra, S. L. (2007). Turning over a New Leaf. *Indian Management*, 64, April.
5. Rehbar, E., & Al Wahid, N. (2011). Investigation of green marketing tools effect on consumer's purchase behavior. *Business Strategy Series*, 12(2).
6. Chan, H. K., He, H., & Wang, W. Y. C. (2012). Green marketing and its impact on supply chain management in industrial markets. *Industrial Marketing Management*, 41(4), 557-562.
7. Bhattacharya, S. (2011). Consumer Attitude towards Green Marketing in India. *The IUP Journal of Marketing Management*, 62-70.
8. Polonsky, M. J., & Mintu, A. T. (Eds.). (1997). *Environmental marketing strategies: practice, theory, and research*. Haworth Press Inc.



## OriginalArticle

### Artificial Intelligence (Ai) For E-Commerce and Digital Marketing Strategies

Dr. Leelavathi. K

Associate Professor, HOD Dept. of P G Studies in Commerce,  
Govt. Arts College (Autonomous), Chitradurga-577501

Manuscript ID:

**Abstract**

JRD -2026-180604

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 19-23

June- 2026

Submitted: 05 May. 2026

Revised: 20 May.2026

Accepted: 05 June 2026

Published: 30 June 2026

*Artificial Intelligence (AI) has emerged as a transformative technology that is reshaping e-commerce and digital marketing strategies across industries. AI technologies, including machine learning, natural language processing, predictive analytics, and deep learning, enable businesses to improve customer experiences, automate operations, and enhance decision-making processes. In e-commerce, AI applications such as recommendation systems, chatbots, dynamic pricing, inventory management, fraud detection, and visual search contribute to increased efficiency and customer satisfaction. Similarly, AI-driven digital marketing strategies facilitate customer segmentation, personalized marketing, predictive analytics, content optimization, programmatic advertising, and sentiment analysis, thereby improving marketing effectiveness and return on investment. This study examines the role and significance of AI in e-commerce and digital marketing, highlights its major applications and benefits, and discusses the challenges associated with its implementation, including data privacy concerns, ethical issues, high costs, and technological complexity. The paper also explores emerging trends and future opportunities that are expected to shape the digital business environment. The findings indicate that strategic adoption of AI can provide organizations with sustainable competitive advantages, improved customer engagement, and enhanced business performance in the evolving digital economy.*

**Keywords:** Artificial Intelligence (AI), E-Commerce, Digital Marketing, Machine Learning, Predictive Analytics, Customer Personalization, Chatbots, Recommendation Systems, Customer Experience, Marketing Automation, Business Performance, Digital Transformation

#### Introduction

The rapid growth of digital technologies has transformed the global business landscape. E-commerce and digital marketing have become essential components of modern business operations, allowing organizations to reach customers across geographical boundaries. With increasing competition and growing customer expectations, businesses are adopting Artificial Intelligence (AI) to improve efficiency, personalize customer experiences, and enhance decision-making. Artificial Intelligence refers to the simulation of human intelligence by machines and computer systems capable of learning, reasoning, problem-solving, and decision-making. AI technologies such as machine learning, deep learning, natural language processing (NLP), computer vision, and predictive analytics are increasingly integrated into e-commerce platforms and digital marketing strategies. In e-commerce, AI helps businesses recommend products, optimize inventory management, detect fraud, automate customer support, and improve logistics operations. In digital marketing, AI enables targeted advertising, customer segmentation, content generation, sentiment analysis, and campaign optimization. As a result, organizations can achieve greater customer satisfaction, increased sales, and improved operational performance.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636304



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Leelavathi. K, Associate Professor, HOD Dept. of P G Studies in Commerce, Govt. Arts College (Autonomous), Chitradurga

#### How to cite this article:

Leelavathi. K. (2026). Artificial Intelligence (Ai) For E-Commerce and Digital Marketing Strategies. Journal of Research and Development, 18(6 (I)), 19–23. <https://doi.org/10.5281/zenodo.20636304>



This paper explores the role of AI in e-commerce and digital marketing strategies, discusses its applications, reviews existing literature, identifies challenges, and examines future opportunities.

## Objectives of the Study

The major objectives of this study are:

1. To understand the concept and significance of Artificial Intelligence in e-commerce and digital marketing.
2. To examine the applications of AI in e-commerce operations.
3. To analyze the role of AI in digital marketing strategies.
4. To evaluate the benefits of AI adoption for businesses and customers.
5. To identify challenges associated with AI implementation.
6. To explore future trends and opportunities of AI in e-commerce and digital marketing.

## Review of Literature

### Kaplan and Haenlein (2019)

Kaplan and Haenlein highlighted that AI technologies are transforming business operations by enhancing automation, customer interactions, and decision-making processes. Their study emphasized the growing importance of AI in digital commerce and marketing activities.

### Davenport, Guha, Grewal, and Bressgott (2020)

The researchers examined how AI is reshaping marketing functions. They found that AI improves customer engagement, personalization, and predictive capabilities, enabling firms to create more effective marketing campaigns.

### Huang and Rust (2021)

Huang and Rust proposed that AI will significantly influence the future of marketing by automating routine tasks while enhancing customer experience through personalization and intelligent interactions.

### Chaffey and Ellis-Chadwick (2019)

Their work on digital marketing emphasized the importance of AI-driven analytics, customer segmentation, and targeted marketing strategies in achieving business growth and customer retention.

### Verhoef et al. (2021)

The authors explored digital transformation and customer experience management. They concluded that AI technologies play a crucial role in improving customer journeys and creating competitive advantages.

### Jarek and Mazurek (2019)

The study investigated AI adoption in marketing and found that machine learning algorithms enhance customer insights, improve campaign effectiveness, and support strategic decision-making.

### Kietzmann et al. (2018)

The researchers discussed AI applications in social media marketing, highlighting how AI tools assist businesses in understanding customer sentiment and managing online engagement.

### Brynjolfsson and McAfee (2017)

Their research emphasized that AI-driven automation and data analytics are transforming industries, including e-commerce, by improving productivity and customer satisfaction.

### Kumar et al. (2021)

The authors found that AI-based recommendation systems significantly increase customer engagement and online sales by delivering personalized product suggestions.

### Dwivedi et al. (2021)

The study analyzed the impact of AI on business and society and concluded that AI creates opportunities for innovation while presenting ethical and regulatory challenges.

## Concept of Artificial Intelligence

Artificial Intelligence refers to the capability of machines and computer systems to perform tasks that typically require human intelligence. AI systems use algorithms, data, and computational power to learn from experiences and improve performance.

Major AI technologies include:

Machine Learning (ML)

Deep Learning

Natural Language Processing (NLP)

Computer Vision

Predictive Analytics

Robotics

Expert Systems

These technologies enable businesses to automate operations and derive valuable insights from large datasets.



## **AI Applications in E-Commerce**

### **5.1 Personalized Product Recommendations**

Recommendation engines analyze customer browsing history, purchase behavior, and preferences to suggest relevant products.

Examples:

Amazon product recommendations

Netflix content recommendations

Online retail personalized suggestions

Benefits:

Increased sales

Improved customer satisfaction

Higher conversion rates

### **5.2 Chatbots and Virtual Assistants**

AI-powered chatbots provide instant customer support and answer customer queries 24/7.

Advantages:

Reduced operational costs

Improved customer service

Faster response times

Examples:

Customer service chatbots

Voice assistants

### **5.3 Dynamic Pricing**

AI algorithms adjust product prices based on demand, competitor pricing, and customer behavior.

Benefits:

Revenue optimization

Better competitiveness

Increased profitability

### **5.4 Inventory Management**

AI helps forecast demand and optimize inventory levels.

Advantages:

Reduced stock shortages

Lower inventory costs

Improved supply chain efficiency

### **5.5 Fraud Detection and Security**

AI systems monitor transactions and identify suspicious activities.

Benefits:

Reduced fraud risks

Enhanced customer trust

Improved transaction security

### **5.6 Visual Search Technology**

AI-powered visual search allows customers to upload images and find similar products.

Benefits:

Enhanced shopping experience

Improved product discovery

Increased customer engagement

## **AI in Digital Marketing Strategies**

### **6.1 Customer Segmentation**

AI analyzes customer data and groups consumers based on behavior, demographics, and preferences.

Benefits:

Better targeting

Personalized campaigns

Higher marketing effectiveness

### **6.2 Predictive Analytics**

Predictive analytics uses historical data to forecast customer behavior and market trends.

Applications:

Demand forecasting

Customer churn prediction

Sales forecasting



## 6.3 Personalized Marketing

AI enables businesses to deliver personalized messages and offers to customers.

Benefits:

Increased engagement

Better customer relationships

Improved conversion rates

## 6.4 Programmatic Advertising

AI automates digital advertising by purchasing and optimizing ad placements in real time.

Advantages:

Efficient ad spending

Better targeting

Higher return on investment (ROI)

## 6.5 Content Creation and Optimization

AI tools assist marketers in generating content, optimizing keywords, and improving search engine rankings.

Applications:

Blog writing

SEO optimization

Social media content generation

## 6.6 Sentiment Analysis

AI analyzes social media posts, reviews, and customer feedback to understand public opinion.

Benefits:

Brand reputation management

Customer insight generation

Marketing strategy improvement

## Benefits of AI in E-Commerce and Digital Marketing

### Improved Customer Experience

AI enables personalized interactions and faster customer support.

### Enhanced Decision-Making

Businesses can use AI-generated insights for strategic planning.

### Increased Sales and Revenue

Recommendation systems and targeted marketing improve conversions.

### Cost Reduction

Automation reduces labor costs and operational expenses.

### Better Customer Retention

Personalized experiences increase customer loyalty.

### Competitive Advantage

AI helps organizations respond quickly to market changes.

### Efficient Resource Utilization

Businesses can allocate resources more effectively through data-driven insights.

## Challenges of AI Adoption

### Data Privacy Concerns

AI requires large volumes of customer data, raising privacy and security concerns.

### High Implementation Costs

Developing and maintaining AI systems can be expensive.

### Algorithmic Bias

AI models may produce biased outcomes if trained on biased datasets.

### Lack of Skilled Professionals

Organizations often face shortages of AI experts and data scientists.

### Ethical Issues

AI decision-making may create concerns regarding transparency and accountability.

### Technological Complexity

Integration of AI systems with existing business processes can be challenging.

## Future Trends of AI in E-Commerce and Digital Marketing

### Hyper-Personalization

AI will deliver highly customized experiences based on real-time customer data.

### Voice Commerce

Voice assistants will play a greater role in online shopping.

### AI-Driven Customer Experience



Advanced AI systems will provide seamless customer interactions across channels.

### **Augmented Reality (AR) Integration**

AI and AR technologies will enhance product visualization and virtual shopping experiences.

### **Predictive Customer Analytics**

Businesses will increasingly use AI to anticipate customer needs and preferences.

### **Autonomous Marketing Systems**

Future AI systems may independently manage and optimize marketing campaigns.

### **Advanced Fraud Prevention**

AI will continue improving transaction security and cyber threat detection.

### **Suggestions**

1. Businesses should invest in AI infrastructure and employee training.
2. Organizations must ensure ethical and responsible AI practices.
3. Strong data privacy policies should be implemented.
4. AI systems should be regularly monitored to reduce bias.
5. Small and medium enterprises should gradually adopt AI technologies.
6. Collaboration between industry and academia should be encouraged to develop AI expertise.

### **Conclusion**

Artificial Intelligence has become a powerful driver of innovation in e-commerce and digital marketing. By leveraging machine learning, predictive analytics, natural language processing, and automation, businesses can enhance customer experiences, optimize operations, and improve marketing effectiveness. AI-powered applications such as recommendation engines, chatbots, dynamic pricing, predictive analytics, and personalized marketing have revolutionized how organizations interact with customers and compete in digital markets.

Despite challenges related to privacy, ethics, implementation costs, and technical complexity, the benefits of AI significantly outweigh its limitations. As technology continues to evolve, AI will play an increasingly important role in shaping the future of e-commerce and digital marketing. Organizations that strategically adopt AI technologies will be better positioned to achieve sustainable growth, improve customer satisfaction, and maintain a competitive advantage in the digital economy.

### **References:**

1. Brynjolfsson, E., & McAfee, A. (2017). *Machine, platform, crowd: Harnessing our digital future*. W.W. Norton & Company.
2. Chaffey, D., & Ellis-Chadwick, F. (2019). *Digital marketing: Strategy, implementation and practice* (7th ed.). Pearson Education.
3. Davenport, T. H., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, 48(1), 24–42. <https://doi.org/10.1007/s11747-019-00696-0>
4. Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., ... Williams, M. D. (2021). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges and opportunities. *International Journal of Information Management*, 57, 101994.
5. Huang, M. H., & Rust, R. T. (2021). A strategic framework for artificial intelligence in marketing. *Journal of the Academy of Marketing Science*, 49(1), 30–50.
6. Jarek, K., & Mazurek, G. (2019). Marketing and artificial intelligence. *Central European Business Review*, 8(2), 46–55.
7. Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons*, 62(1), 15–25.
8. Kietzmann, J., Paschen, J., & Treen, E. (2018). Artificial intelligence in advertising: How marketers can leverage AI. *Business Horizons*, 61(3), 263–267.
9. Kumar, V., Ramachandran, D., & Kumar, B. (2021). Influence of new-age technologies on marketing: A research agenda. *Journal of Business Research*, 125, 864–877.
10. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901.



## Digital and Sustainable Banking: A Case Study of Canara Bank in India

Dr. M B Nagalapur

Associate Professor of Commerce,  
Government First Grade College, Haveri (Gandhipur) Karnataka

Manuscript ID:

**Abstract**

JRD -2026-180605

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 24-26

June- 2026

*This study evaluates the intersection of digital transformation and environmental sustainability within India's public sector banking (PSB) domain, selecting Canara Bank as a foundational case study. Amid rapid tech-driven evolution and stringent environmental regulations from the Reserve Bank of India (RBI), banks face pressure to align operations with Environmental, Social, and Governance (ESG) frameworks. This article examines Canara Bank's digital integration strategy, specifically analyzing how mobile infrastructure, green deposit instruments, and advanced corporate reporting models optimize resource use while mitigating systemic climate risk. The analysis shows that digital channels directly reduce paper consumption and scope 1 and 2 emissions. However, achieving net-zero ambitions requires a more proactive approach to analyzing financed Scope 3 emissions within corporate portfolios*

Submitted: 05 May. 2026

Revised: 20 May.2026

Accepted: 05 June 2026

Published: 30 June 2026

### Introduction

The global financial services ecosystem is experiencing a major paradigm shift. Financial institutions are transforming from passive intermediaries into active facilitators of sustainable economic transitions. In India, this shift is governed by two forces: The technological momentum of a mobile-first digital payment infrastructure. National commitments to achieve net-zero carbon emissions by the year 2070.

Historically, Public Sector Banks (PSBs) in India focused primarily on expanding financial inclusion and physical network outreach. Today, managing climate risk exposure and modernizing digital service delivery have become strategic priorities.

This paper explores how **Canara Bank**, a leading public sector bank headquartered in Bengaluru, connects its digital transformation roadmap with sustainable banking frameworks. It examines the practical operational metrics, green product frameworks, and reporting standards that shape modern sustainable banking in India.

### Literature Review

The concept of "Green Banking" or "Sustainable Banking" traditionally referred to an institution's internal efforts to minimize its direct carbon footprint through paperless transactions, energy-efficient offices, and solar-powered branch infrastructure.

Recent literature expands this definition. Researchers emphasize that a bank's ultimate environmental impact lies in its **financed emissions (Scope 3)**—the environmental footprint generated by the entities and industries it chooses to fund.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636344



### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

### Address for correspondence:

Dr. M B Nagalapur, Associate Professor of Commerce, Government First Grade College, Haveri (Gandhipur) Karnataka

### How to cite this article:

M B Nagalapur. (2026). Digital and Sustainable Banking: A Case Study of Canara Bank in India. Journal of Research and Development, 18(6 (I)), 24–26. <https://doi.org/10.5281/zenodo.20636344>



| Author / Source                                                                                                                                                                                                                                                                       | Core Research Contribution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chartered Secretary-September-2024-Green Banking- CS Pawan Kumar Agarwal- CS Kirti Kesarwani-Page No.81-85                                                                                                                                                                            | Green Banking is not just a trend but a crucial aspect of sustainable development in India. As the country navigates the dual challenges of economic growth and environmental sustainability, Green banking in India is still evolving, with increasing efforts from both the government and the private sector to integrate sustainability into the financial system.                                                                                                                                                                                                                                                                                                                         |
| Scientific Culture, Vol. 12, No.1, (2026), Pp. 553-562- Sustainable Digital Banking: Green Practices In The Financial Sector- S. Md. Shakir Ali, Kiran Suraj S, Sonali Karnik, Ronak R Modi, Sidharth Jain, Murshaduddin Killedar                                                     | The findings demonstrate that digital banking practices—such as e-statements, mobile platforms, automation, and energy-efficient IT systems—positively influence ecological outcomes, including reduced paper usage, electricity consumption, and carbon emissions. The study demonstrates digital innovation plays an essential part in achieving sustainability for banking operations.                                                                                                                                                                                                                                                                                                      |
| International Journal Of Research In Commerce And Management Studies- ISSN 2582-2292 Vol. 7, No. 05 Sep-Oct; 2025 Page. No. 529-558- Sustainable Banking In The Digital Age: Insights From Fintech, Blockchain, And Green Finance Research-Faheema Mohammed Manu And Dr. N. Rajendran | This bibliometric study on Sustainable Banking in the Digital Age shows a clear and fast-growing research path, fuelled using new technologies—like FinTech, blockchain, AI, and machine learning—in eco-friendly financial systems. In the last ten years, academic output has moved from occasional contributions to a strong and rapid growth trend, showing that sustainable digital banking has evolved from a niche topic to a significant focus in both academia and industry.                                                                                                                                                                                                          |
| International Journal of Computer Auditing, Vol.6, No.1, Publication date: 2024- Digital Banking as a Catalyst for Sustainable Finance: Promoting ESG Principles in India- Jasdeep Kaur & Pragya Nayyar                                                                               | There has been an immense change in Indian banking sector as the sector has increasingly implemented these ideas because it is understood that ESG alters the business environment and this all has happened to ensure viable sustainable solutions. This combination not only aids and improves accessibility and efficiency but also inculcates a sense of social accountability within the sector. ESG is helping to create a new path for sustainable growth where economic development is balanced with social and environmental justice. The alliance between digital banking and ESG principles can be further strengthened by taking a few concrete actions to build on this progress. |

This case study bridges a gap in the current literature by providing an empirical review of a large-scale Indian PSB adapting to new global reporting standards.

### 3. Methodology

This research uses a single-case explanatory design, analyzing Canara Bank through data compiled from official disclosures. The primary data points are sourced from the bank's formal filings:

Business Responsibility and Sustainability Report (BRSR)

Green Deposit Policy & Lending Framework

Corporate disclosures aligning with global sustainability metrics.

Quantitative indices include energy consumption, carbon equivalents (\$MT\CO\_2e\$), and customer satisfaction scores, evaluated against the bank's stated operational goals.

### 4. Case Analysis: Canara Bank's Strategic Pillars

#### 4.1 Digital Transformation as an Environmental Enabler

Canara Bank has scaled up its digital infrastructure to migration retail transactions away from physical, branch-dependent workflows. This strategy targets operational decarbonization through multiple channels:

- **Paperless Onboarding:** Implementing end-to-end digital onboarding via e-KYC and mobile self-service systems minimizes physical document loops.
- **Mobile & Internet Architectures:** Encouraging retail transactions through digital apps reduces resource use and minimizes energy requirements at physical brick-and-mortar branches.
- **Cloud & Server Migration:** Upgrading legacy networks to energy-efficient centralized server pools helps reduce the structural energy footprint of decentralized operations.



## 4.2 Green Deposit Framework & Capital Allocation

To direct capital toward sustainable projects, Canara Bank established a formalized Canara Green Deposit Scheme. This system operates on a structured capital mobilization model:

1. **Mobilization Access:** Deposits are integrated into digital banking channels, allowing individuals and corporates to open specialized fixed or recurring green accounts online.
2. **Earmarked Use of Proceeds:** Funds are legally ring-fenced under oversight committees, ensuring capital allocations are directed strictly toward renewable energy production, climate change adaptation, and biodiversity conservation.

## 4.3 Advanced ESG Reporting Integration

A major differentiator in Canara Bank's sustainability strategy is its integration of international transparency frameworks into its reporting architecture. By aligning with advanced corporate sustainability directives alongside national BRSR guidelines, the bank has institutionalized the concept of double materiality.

This reporting model forces the bank to measure financial climate risks to its own balance sheet while assessing how its corporate loan allocations alter local ecosystems.

## 5. Key Findings and Discussion

According to Canara Bank's empirical disclosures, the bank's operating metrics demonstrate clear progress toward environmental target benchmarks:

- **Total Operational Energy Footprint:** Measured at **1,021,304.18 GJ**, reflecting concentrated consumption reduction efforts via energy-efficient branch retrofitting.
- **Direct Operational Footprint (Scope 1 + 2):** Documented at **176,441.35 MT \$CO<sub>2</sub>e\$**. The bank targets full operational carbon neutrality by the fiscal year **2035**.
- **Asset Security & Customer Experience:** Maintained a **85.54% Customer Satisfaction Score** with zero confirmed data breaches, showing that scaling up digital banking channels did not compromise cyber security controls.
- **Financed Portfolio Adjustments:** Committed to increasing its green energy lending portfolio by **25% year-on-year**. This target drives capital away from high-carbon heavy manufacturing and thermal power sectors, directly mitigating long-term portfolio credit risk.

## 6. Challenges and Future Outlook

Despite these digital milestones, public sector banking institutions face unique operational challenges:

1. **Legacy Infrastructure Drag:** Replacing decentralized infrastructure across thousands of rural branches requires substantial capital expenditures.
2. **Financed Emission Data Gaps:** Tracking precise Scope 3 financed emissions across medium and small enterprise (MSME) portfolios remains complex due to limited reporting capabilities at the borrower level.
3. **Elevated Cyber Risk:** As transactions migrate to digital interfaces, systemic vulnerabilities like phishing, device-vandalism, and digital payment fraud require continuous financial investment in cyber defense layers.

## 7. Conclusion

Canara Bank's integration of digital banking and sustainable finance illustrates how large public sector financial institutions can drive green transitions. By using digital channels to reduce its direct operational footprint and introducing green deposit frameworks to reshape its loan books, the bank demonstrates a viable path toward carbon neutrality. For sustainable banking to succeed across India, future initiatives must focus on improving Scope 3 tracking transparency for corporate clients and building stronger digital security defenses.

## References

1. Canara Bank. (2026). *Business Responsibility and Sustainability Report (BRSR) FY 2025-26*.
2. Canara Bank. (2026). *Canara Green Deposit Policy & Lending Framework*.
3. ESGNews Team. (2026). *Canara Bank Aligns with CSRD Standards and Addresses Financed Emissions*.
4. Chartered Secretary-September-2024-Green Banking- CS Pawan Kumar Agarwal- CS Kirti Kesarwani-Page No.81-85
5. Scientific Culture, Vol. 12, No.1, (2026), Pp. 553-562- Sustainable Digital Banking: Green Practices In The Financial Sector- S. Md. Shakir Ali, Kiran Suraj S, Sonali Karnik, Ronak R Modi, Sidharth Jain, Murshaduddin Killedar
6. International Journal Of Research In Commerce And Management Studies- ISSN 2582-2292 Vol. 7, No. 05 Sep-Oct; 2025 Page. No. 529-558- Sustainable Banking In The Digital Age: Insights From Fintech, Blockchain, And Green Finance Research-Faheema Mohammed Manu And Dr. N. Rajendran
7. International Journal of Computer Auditing, Vol.6, No.1, Publication date: 2024- Digital Banking as a Catalyst for Sustainable Finance: Promoting ESG Principles in India- Jasdeep Kaur & Pragya Nayyar



## Exploring the Opportunities and Challenges of Generation Z in the Digital Era: A Sociological Perspective

Dr. Madanaik. H

Associate Professor of Sociology  
Government First Grade College, Davangere.

Manuscript ID: **Abstract**

JRD -2026-180606

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 27-30

June- 2026

Submitted: 05 May. 2026

Revised: 20 May. 2026

Accepted: 05 June 2026

Published: 30 June 2026

*This study examines the opportunities and challenges faced by India's Generation Z in the digital era. As the first cohort to grow up with ubiquitous internet access, Gen Z treats digital connection as an essential lifeline that shapes their social, educational, economic, and political lives. The study is based on secondary data collected from journals, books, reports, research articles, newspapers, and credible online sources related to digital technology and youth studies. The secondary sources are systematically interpreted using sociological theories. A qualitative approach is employed to understand the opportunities, and challenges encountered by Generation Z in the contemporary digital environment. The paper outlines major opportunities created by the digital ecosystem: rapid acquisition of technical skills, online learning and global knowledge access, startup pathways, and emerging FinTech and EdTech. It also analyzes pressing challenges, including mental, cyber bullying, and social comparison. Additional concerns include declining everyday life skills, reduced face-to-face communication, career uncertainty, and economic pressures. The study reviews how digital platforms shape Gen Z's financial behaviours and exposing youth to unreliable influencer advice, and describes shifts in educational and professional preferences toward skill-based training and work-life balance. Finally, the paper proposes remedial measures and a future vision. The conclusion argues that while digitalization offers unprecedented opportunities for Gen Z's growth and agency, cultivating healthy digital habits and structural supports is essential to convert potential into sustainable wellbeing and social contribution.*

**Keywords:** Gen Z, digital, opportunity, challenges, technical skills FinTech and EdTech.

### Introduction

The revolutionary development of digital technology and the internet has brought the fastest change in human history. Gen Z (Generation Z) is the first generation that grew up amidst this technology. Born between the years 1997-2012, this generation has never seen a world without the internet, and for them, digital connection is not just entertainment but an essential lifeline for their social, educational, and civic existence. For India's 'Gen Z' generation, the mobile phone has become not just a tool but transformed into a "Digital Umbilicus" of their physical existence. This research paper analyzes the opportunities and challenges faced by Gen Z generation in the digital era.

### About the concept:

'Gen Z' means the group of people born roughly between 1997 and 2012. 'Digital era' refers to the period in human history when digital technologies such as computers, the internet, smart phones, artificial intelligence, and digital communication have become central to everyday life. The digital era is the time in which information is created, stored, shared, and accessed mainly through digital devices and networks rather than traditional paper-based or analog methods.

Key Features of the Digital Era: Widespread use of computers and smartphones, Internet-based communication (email, social media, video calls), Online education and e-learning, Digital banking and online shopping, Artificial intelligence and automation, Instant access to information from anywhere



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636369



### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

### Address for correspondence:

Dr. Madanaik. H, Associate Professor of Sociology, Government First Grade College, Davangere.

### How to cite this article:

Madanaik. H. (2026). Exploring the Opportunities and Challenges of Generation Z in the Digital Era: A Sociological Perspective. *Journal of Research and Development*, 18(6 (I)), 27–30.  
<https://doi.org/10.5281/zenodo.20636369>



## Objectives:

1. To examine the opportunities created by digital technologies for Generation Z, particularly in the areas of education, employment, communication, and social participation.
2. To analyze the social, and cultural challenges faced by Generation Z in the digital era.

## Methodology:

This study adopts a descriptive and analytical research design to explore the opportunities and challenges faced by Generation Z in the digital era from a sociological perspective. The research is primarily based on secondary data collected from scholarly journals, books, government reports, research articles, newspapers, and credible online sources related to digital technology and youth studies. Data collected from secondary sources are systematically reviewed, classified, and interpreted using sociological theories. A qualitative approach is employed to understand the social experiences, opportunities, and challenges encountered by Generation Z in the contemporary digital environment.

## Theoretical framework:

The findings are analyzed and presented through thematic interpretation to provide a comprehensive sociological understanding of Generation Z's position in the digital era. For this study, the following sociological theories can provide a strong theoretical framework:

**1. Structural Functionalism** (Émile Durkheim and Talcott Parsons): This theory views society as a system of interconnected parts working together to maintain stability. Digital technologies can be seen as institutions that facilitate education, communication, socialization, and economic participation for Generation Z.

**2. Symbolic Interactionism** (George Herbert Mead and Herbert Blumer): This theory examines how individuals create meanings through social interactions. It is useful for understanding how Generation Z constructs identity, self-image, and relationships through social media and online communication. The theory explains the influence of digital interactions on behavior and social perceptions.

**3. Network Society Theory** (Manuel Castells): Castells argues that modern society is organized around digital networks. This theory helps explain how Generation Z uses digital platforms for learning, employment, activism, and social connections. It highlights both opportunities for global connectivity and challenges related to information overload.

**4. Social Capital Theory** (Pierre Bourdieu and Robert Putnam): Social capital refers to resources gained through social networks and relationships. Digital platforms enable Generation Z to build networks, access information, and create opportunities.

## Result and Discussion:

Main Characteristics of Generation Z has a new perspective on success. Personal satisfaction and contribution to society are more important than money. Meaningful work, equality, digital skills, and self-reliance are their priorities. In today's digital era, the online world is a key platform for Gen Z youth to express themselves and build their careers.

### Gen Z Opportunities in the Digital Era:

**1. Digital Skills and Technical Expertise:** Gen Z is very skilled in technology. They use digital devices naturally and learn new technologies quickly;

Entrepreneurship, Startup environment offers special professional opportunities for Gen Z youth.

FinTech and EdTech, Health tech, e-commerce logistics, financial tech, and ed-tech sectors are growing at unprecedented speed.

Digital platforms help part-time jobs or freelancing in free time.

Digital Marketing, Brand building and business expansion through social media.

### 2. Educational Opportunities:

Online learning preferably YouTube is preferred for career advice and skill learning.

Global knowledge can access from any point in the world.

International connection can connected with like-minded people.

### 3. Social and Political Opportunities:

Gen Z is socially conscious, open-minded, and vocal about change.

They use social media for social change. (e.g., protests against social media ban in Nepal).

### 4. Economic Opportunities:

A major way Gen Z is accessing investment is through online fintech apps.

These provide paperless account opening, ETF, mutual funds, SIP services.

FIRE Movement (Financial Independence, Retire Early): Save most of income, invest at young age.

### 5. Educational and Professional Opportunities:

Educational Changes: Preference for skill training over traditional 4-year degree. Startup environment offers special opportunities for Gen Z youth. Incubators, mentoring networks, accelerators, and venture capitals encourage young entrepreneurs.

Professional Changes: Unlike previous generations, working 10-12 hours, struggling to become a boss is not in them. Gen Z prioritizes meaningful work, equality, digital skills, and self-reliance.

### Gen Z Challenges in the Digital era:



## 1. Mental Health Challenges:

49% Gen Z experience depression, anxiety after social media use.

Connected through social media made them loneliness, uncertainty, and overload.

Self-confidence decreases due to online comparison and trolling.

Sleep disturbance due to online time.

Neuroscience data warns that intense dependence on digital connection is triggering a 'dopamine-driven addiction' cycle.

## 2. Social Media Pressure

FOMO (Fear of Missing Out): they are feared missing everything.

Dopamine addiction: Addiction grows from likes, shares, comments.

Online violence and humiliation create Cyber bullying

Constantly compare themselves with others, it made them anxieties.

Raised issues of dissatisfaction with body image.

## 3. Skill Deficits: Though Gen Z masters digital tools easily, deep life skills are decreasing:

Cursive writing skill is decreasing, youths were doesn't learn handwriting.

Food preparation less exposure due to food delivery.

Face-to-face communication discomfort in direct conversation.

Personal letter writing skill decreasing.

Home repair skills decreasing due to service apps.

## Concentration and Time Management:

Concentration decreases due to social media.

Scheduling apps hide time discipline.

## Economic Challenges:

- Career uncertainty: Experience career uncertainty even before 25 years
- Job Competition: High job competition and rapid changes.
- Economic Pressure: Low economic security, high living cost
- No Desire to Be Traditional 'Boss' 'Career Minimalism' is increasing
- Gen Z trusts Instagram, YouTube, Telegram heavily for financial advice. But most "influencers" have brand deals.

## 4. Mental Health and Social Media Impact: Gen Z relies heavily on social media for financial knowledge from Instagram, YouTube, Telegram. Dopamine increases from post likes, shares, and comments, creating addiction. Peer pressure, comparison, FOMO, study and career stress make Gen Z negative and dissatisfied.

## Remedial Measures and Future Vision:

- Social and Community Support.
- Mentoring Network: Use incubators, accelerators.
- Connect with Peers: Share information about saving and investment.
- Use Government Schemes: Utilize government facilities for youth.

## Mental Health Measures:

- Digital Detox: Break from constant online presence
- Face-to-Face Communication: Prioritize direct conversation
- Active Activities: Sports, art, reading

## Financial Management:

1. Budget → 2. Emergency Fund → 3. Pay off debt → 4. Save → 5. Invest → 6. Increase income.

## Conclusion:

Gen Z has enormous opportunities in the digital era but faces significant challenges. The mobile phone transformed into a Digital Umbilicus is the center of their existence. Gen Z is socially conscious, open-minded, and vocal about change, but maintaining balance is the biggest challenge. In the future, maintaining balance between digital and real life and cultivating healthy digital connection will be the key to Gen Z's success.

## References:

1. Buckingham David (2008) : Youth identity, and Digital media. MIT Press.
2. Durkheim Emile (1997) : The Division of Labor in Society. Free Press.
3. Guptha Bharath (2024): Content, technology and policy: Gen-Z and Social Media Connection , Jagran New Media.
4. Livingstone, Sonia (2009): Children and the internet: Great Expectations, Challenging Realities. Polity Press.
5. Mead G. Herbert (1934) : Mind, Self, and Society. University of Chicago Press.
6. Akshar Surya Magazine (10-05-2022): Digital Umbilicus.



# *Journal of Research and Development*

A Multidisciplinary International Level Referred and Double Blind Peer Reviewed, Open Access

ISSN: 2230-9578 | Website: <https://jrdrv.org> Volume-18, Issue-6 (I)| June - 2026

7. Andhra Jyothy Sunday Magazine(22-02-2026)- Life with Challenges.
8. Times of India (15-07-2025)- 10 crucial abilities Gen Z isn't learning.
9. Vijay Karnataka(21-10-2025) - Generation Z: Reimagining Success.



## Growth of UPI Transactions and Its Impact on Retail Commerce in India

Dr. Manjunatha J M

Associate Professor, Department of Commerce  
Government First Grade College, Shivamogga-Karnataka

Manuscript ID:

JRD -2026-180607

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 31-33

June- 2026

### Abstract

*The Unified Payments Interface (UPI) has transformed India's digital payment ecosystem by enabling secure, instant, and cost-effective financial transactions. Since its launch in 2016, UPI has experienced remarkable growth in transaction volume and value, significantly influencing retail commerce across urban and rural markets. This study examines the growth trajectory of UPI transactions and evaluates their impact on retail commerce in India using secondary data. The analysis reveals a substantial increase in digital payment adoption, improved consumer convenience, enhanced business efficiency, and greater financial inclusion. The findings indicate that UPI has emerged as a critical driver of India's digital economy and retail sector development.*

**Keywords:** UPI, Growth, Digital payments, Digital economy, Retail sector, Developments,

### Introduction

India has witnessed a rapid transformation in its payment ecosystem due to advancements in digital technologies and government initiatives promoting a cashless economy. Among various digital payment platforms, the Unified Payments Interface (UPI), developed by the National Payments Corporation of India (NPCI), has emerged as one of the most successful innovations in the financial technology sector. Introduced in 2016, UPI enables users to transfer money instantly between bank accounts through mobile applications without requiring complex banking details. The platform integrates multiple banks into a single digital payment framework, offering convenience, security, and interoperability. The growth of UPI has been fueled by increasing smartphone penetration, affordable internet services, supportive government policies, and changing consumer preferences. Initiatives such as Digital India, demonetization, and financial inclusion programs have accelerated digital payment adoption across the country. UPI has significantly reduced dependency on cash transactions and facilitated seamless payments for consumers and businesses alike. Retail merchants, small businesses, e-commerce platforms, and service providers have widely adopted UPI due to its low transaction cost and ease of use. The retail commerce sector has particularly benefited from the widespread acceptance of UPI. Consumers can make instant payments at physical stores, online marketplaces, and service establishments using QR codes and mobile applications. This has improved transaction efficiency, increased sales opportunities, reduced cash handling risks, and enhanced customer satisfaction. Furthermore, UPI has enabled small retailers and informal businesses to participate in the digital economy without substantial infrastructure investments. The increasing volume and value of UPI transactions indicate a major shift in consumer payment behavior and retail business operations. Understanding the growth patterns of UPI and its contribution to retail commerce is essential for policymakers, financial institutions, businesses, and researchers. This study analyzes secondary data on UPI transactions to evaluate their impact on India's retail commerce sector and the broader digital economy.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636426



### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

### Address for correspondence:

Dr. Manjunatha J M, Associate Professor, Department of Commerce, Government First Grade College, Shivamogga-Karnataka.

### How to cite this article:

Manjunatha J M. (2026). Growth of UPI Transactions and Its Impact on Retail Commerce in India. *Journal of Research and Development*, 18(6 (I)), 31–33. <https://doi.org/10.5281/zenodo.20636426>



## Review of Literature

1. Sharma and Singh (2018) observed that digital payment systems significantly improve transaction efficiency and customer convenience. Their study found that UPI adoption reduced transaction time and enhanced accessibility for consumers and merchants, contributing to greater acceptance of digital commerce in India.
2. Gupta (2019) examined the role of digital payments in retail business growth. The findings indicated that retailers adopting digital payment systems experienced improved customer retention, faster transaction processing, and increased sales due to enhanced payment flexibility.
3. Kumar and Verma (2020) analyzed consumer perception toward UPI services. The study concluded that convenience, security, and ease of use were major factors influencing customer adoption of UPI-based transactions in both urban and semi-urban areas.
4. Patel (2020) reported that mobile payment technologies have strengthened financial inclusion in India. UPI was identified as a key driver in extending banking and payment services to underserved populations and small merchants.
5. Singh and Arora (2021) investigated the impact of UPI on small businesses. The study revealed that digital payments improved business transparency, reduced cash management costs, and increased operational efficiency among retailers.
6. Mehta and Shah (2022) studied the relationship between digital payment growth and retail commerce expansion. Their findings suggested a positive association between increasing UPI usage and growth in retail transactions across multiple sectors.
7. Rao and Reddy (2023) highlighted that UPI adoption accelerated after the COVID-19 pandemic due to changing consumer behavior and increased preference for contactless payments. Retail businesses reported significant growth in digital transaction volumes.
8. Joshi and Kulkarni (2024) examined the long-term sustainability of UPI-led digital commerce. The study concluded that continuous technological innovation and policy support are essential for maintaining growth and ensuring secure digital payment ecosystems.

## Objectives of the Study

1. To examine the growth trend of UPI transaction volume and value in India.
2. To analyze the contribution of UPI transactions to retail commerce development.
3. To evaluate the relationship between UPI growth and digital retail expansion in India.

## Need for the Study

The rapid expansion of UPI transactions has transformed India's retail payment ecosystem and consumer purchasing behavior. Retail businesses increasingly rely on digital payment platforms to improve efficiency and customer satisfaction. Despite the remarkable growth of UPI, there is a need to assess its impact on retail commerce using recent data. Understanding this relationship helps policymakers formulate effective digital payment policies, supports retailers in adopting innovative payment solutions, and contributes to academic literature on digital commerce and financial technology development.

## Methodology of the Study

The study is based entirely on secondary data collected from NPCI reports, Reserve Bank of India publications, Ministry of Electronics and Information Technology reports, government publications, research articles, journals, and digital payment statistics. Data covering the period from 2018-19 to 2025-26 have been analyzed using descriptive statistical techniques such as percentage growth analysis, trend analysis, and comparative evaluation. Tables and interpretations are used to examine the growth of UPI transactions and their impact on retail commerce development in India.

**Table 1: Growth of UPI Transactions in India**

| Year    | Transaction Volume (Billion) | Transaction Value (₹ Lakh Crore) |
|---------|------------------------------|----------------------------------|
| 2018-19 | 5.35                         | 8.77                             |
| 2019-20 | 12.51                        | 21.31                            |
| 2020-21 | 22.33                        | 41.03                            |
| 2021-22 | 45.97                        | 84.17                            |
| 2022-23 | 83.76                        | 139.10                           |
| 2023-24 | 131.15                       | 199.89                           |
| 2024-25 | 185.80                       | 268.00                           |
| 2025-26 | 241.62                       | 314.00                           |

Source: NPCI Annual Reports

The table indicates exceptional growth in both transaction volume and value. UPI transaction volume increased from 5.35 billion in 2018-19 to 241.62 billion in 2025-26, demonstrating widespread adoption of digital payments. The transaction value also expanded significantly, highlighting increased reliance on UPI for retail transactions.

**Table 2: UPI Growth and Retail Commerce Indicators**

| Year    | UPI Volume (Billion) | Digital Retail Share (%) | Retail Sales Growth (%) |
|---------|----------------------|--------------------------|-------------------------|
| 2018-19 | 5.35                 | 12                       | 6.5                     |
| 2019-20 | 12.51                | 16                       | 7.2                     |
| 2020-21 | 22.33                | 22                       | 4.1                     |
| 2021-22 | 45.97                | 31                       | 9.5                     |
| 2022-23 | 83.76                | 40                       | 11.8                    |
| 2023-24 | 131.15               | 48                       | 13.6                    |
| 2024-25 | 185.80               | 56                       | 14.8                    |
| 2025-26 | 241.62               | 63                       | 16.2                    |

Source: NPCI Annual Reports

The increasing share of digital retail transactions corresponds with rising UPI adoption. Retail sales growth improved alongside digital payment penetration, indicating that UPI has facilitated greater transaction efficiency and consumer spending.

**Table 3: UPI and Digital Retail Expansion**

| Year    | UPI Volume (Billion) | QR Acceptance Points (Million) | Small Retailer Digital Adoption (%) |
|---------|----------------------|--------------------------------|-------------------------------------|
| 2018-19 | 5.35                 | 3.5                            | 18                                  |
| 2019-20 | 12.51                | 8.2                            | 25                                  |
| 2020-21 | 22.33                | 15.4                           | 34                                  |
| 2021-22 | 45.97                | 28.1                           | 46                                  |
| 2022-23 | 83.76                | 41.8                           | 58                                  |
| 2023-24 | 131.15               | 55.3                           | 67                                  |
| 2024-25 | 185.80               | 69.5                           | 74                                  |
| 2025-26 | 241.62               | 82.4                           | 81                                  |

Source: NPCI Annual Reports

The growth in QR code acceptance and retailer digital adoption demonstrates the transformative impact of UPI on retail commerce. Small businesses increasingly utilize digital payments, contributing to broader financial inclusion and retail modernization.

## Conclusion

The study concludes that UPI has emerged as a transformative force in India's retail commerce sector. The consistent increase in transaction volume and value demonstrates growing consumer confidence in digital payments. UPI has enhanced transaction efficiency, expanded digital retail participation, improved customer convenience, and strengthened financial inclusion. The positive relationship between UPI adoption and retail commerce growth indicates that digital payment systems are becoming essential components of modern business operations. Continued technological innovation, regulatory support, and digital literacy initiatives will further strengthen the role of UPI in India's evolving digital economy.

## References

- Gupta, A. (2019). Digital payment systems and retail business growth. *Journal of Commerce Studies*, 12(3), 45–58.
- Joshi, P., & Kulkarni, R. (2024). Sustainability of digital commerce through UPI. *International Journal of Digital Economy*, 18(2), 88–102.
- Kumar, S., & Verma, R. (2020). Consumer perception toward UPI services in India. *Journal of Financial Technology*, 9(1), 23–37.
- Mehta, P., & Shah, N. (2022). Digital payments and retail commerce expansion. *Indian Journal of Business Research*, 15(4), 77–91.
- National Payments Corporation of India. (2025). UPI annual report. NPCI.
- Patel, D. (2020). Mobile payments and financial inclusion in India. *Economic Affairs*, 65(4), 531–538.
- Reserve Bank of India. (2024). Annual report 2023–24. RBI.
- Rao, K., & Reddy, S. (2023). Contactless payments and retail transformation. *Journal of Retail Innovation*, 11(2), 54–68.
- Sharma, R., & Singh, A. (2018). Digital payment adoption in India. *International Journal of Management Studies*, 5(2), 101–110.
- Singh, V., & Arora, M. (2021). UPI and small business performance. *Journal of Entrepreneurship and Commerce*, 13(1), 34–47.
- Ministry of Electronics and Information Technology. (2024). Digital India report. Government of India.
- World Bank. (2023). Digital financial services and economic development. World Bank Publications.
- OECD. (2022). Digital economy outlook. OECD Publishing.
- Deloitte. (2024). India's digital payments landscape. Deloitte Insights.
- PwC. (2024). Future of digital commerce in India. PwC Research Report.



## OriginalArticle

### A Case Study of Business Analytics for Sustainable Decision Making

Dr. Nagaraja R.C

Associate Professor, Department of Commerce  
Government First Grade College,  
Ranebennur-Karnataka

Manuscript ID:

JRD -2026-180608

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 34-38

June- 2026

Submitted: 05 May. 2026

Revised: 20 May. 2026

Accepted: 05 June 2026

Published: 30 June 2026

#### Abstract

*The fast development of digital technologies, big data, artificial intelligence, and cloud computing has changed how companies make decisions. Business analytics has become a key tool for turning large amounts of data into useful information that helps with both strategic and daily business choices. In recent years, sustainability has become a top priority for businesses because of growing environmental issues, limited resources, climate change, and what customers and other stakeholders expect. Sustainable decision-making means finding a balance between economic, environmental, and social goals when making business choices. Companies are increasingly using business analytics to boost efficiency, cut waste, use resources better, and improve their sustainability efforts. Recent global studies show that the world created around 120 zettabytes of data in 2023, and this number is expected to go over 180 zettabytes by 2025. The ability to analyse this data effectively is now essential for staying competitive and being sustainable. Advanced analytics helps businesses see future trends, spot problems, improve supply chain performance, and lower environmental effects. This seminar paper looks at how business analytics helps with sustainable decision-making by studying Walmart, one of the biggest retail companies in the world. The study shows how Walmart uses predictive analytics, data visualization, supply chain analytics, and sustainability intelligence to cut food waste, improve energy use, make logistics more efficient, and support long-term sustainable growth. The paper also includes recent statistics, analysis, and advice for organizations looking to include analytics in their sustainability plans. The study concludes that business analytics is not just a technology tool but also a strategic asset that helps companies gain a sustainable competitive edge while helping the environment and society.*

**Keywords:** Big data, Artificial intelligence, Cloud computing, Machine learning.

#### Introduction

The business world today is more complex than ever, with rapid technological changes, global connections, and a growing focus on sustainability. Companies collect vast amounts of data from various sources such as customer interactions, social media, supply chains, and smart devices. However, just having data isn't enough. To gain real value, businesses need to analyse and understand this data to guide their decisions and help them reach their goals. Business analytics is the process of gathering, organizing, analysing, and interpreting data to improve decisions and company performance. It uses tools like statistics, predictive models, machine learning, data mining, and visual tools to uncover useful insights. This helps companies understand how they've performed in the past, forecast what might happen next, and make smarter choices. At the same time, companies are under more pressure than ever to act in an environmentally and socially responsible way. Sustainable development means meeting current needs without harming future generations. Making sustainable choices means finding a balance between making money and protecting the environment and supporting society. Combining business analytics with sustainability creates new opportunities. Analytics helps companies track their environmental impact, cut waste, use energy more wisely, manage resources better, and support goals related to environmental, social, and governance (ESG) factors. Organizations that use analytics effectively can boost their performance while also reducing their environmental effects.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636472



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Nagaraja R.C, Associate Professor, Department of Commerce, Government First Grade College, Ranebennur-Karnataka

#### How to cite this article:

Nagaraja R.C. (2026). A Case Study of Business Analytics for Sustainable Decision Making. *Journal of Research and Development*, 18(6 (I)), 34–38. <https://doi.org/10.5281/zenodo.20636472>



## Literature Review

Over the past twenty years, the idea of business analytics has grown a lot. Davenport and Harris (2021) claimed that companies that use analytics to make decisions perform better because they base their choices on facts, not just guesses. Their work showed that these companies are more efficient and achieve better results. Sharda, Delen, and Turban (2023) pointed out that business analytics turns raw data into useful information that helps in areas like marketing, finance, operations, and supply chain management. They outlined three main types of analytics: descriptive, predictive, and prescriptive. Porter and Kramer introduced the idea of Creating Shared Value, which suggests that businesses can improve both their profits and social impact. Their work stressed the importance of including sustainability in long-term plans. New research on sustainability shows that analytics is playing a bigger role in managing the environment. According to the United Nations Environment Programme (UNEP), companies need data-driven strategies to monitor how much they use resources, how much waste they produce, and the pollution they create. The UNEP Food Waste Index Report 2024 stressed that accurate data and analytics are key to reducing global food waste and improving sustainability efforts. Studies from McKinsey show that advanced analytics can greatly increase productivity, make operations more efficient, and cut down on losses. Companies that use analytics report real improvements in areas like forecasting, managing inventory, and running their supply chains. The research shows that business analytics has become a key skill for companies aiming to develop in a sustainable way. It supports sustainable growth by helping with better decisions, managing risks, and using resources more wisely.

## Objectives of the Study

The main goals of this study are:

- 1.To examine the concept and importance of business analytics.
- 2.To understand how business analytics connects with making sustainable decisions.
- 3.To check how using analytics can help improve both operational efficiency and sustainability.
- 4.To explore how Walmart uses business analytics in its sustainability efforts.
- 5.To find out the advantages and difficulties of using analytics for sustainable strategies.
- 6.To offer suggestions for organizations that want to grow sustainably by using analytics.

## Research Methodology

The current study uses a descriptive and analytical approach. Secondary data was gathered from the following sources:

Research journals

Books on business analytics

Industry reports

Corporate sustainability reports

United Nations publications

McKinsey reports

Walmart sustainability disclosures

The data was examined using both qualitative analysis and statistical methods. Tables and charts were used to make it easier to understand trends and how different factors relate to each other.

## Conceptual Framework of Business Analytics

Business analytics is divided into three main areas:

### Descriptive Analytics

Descriptive analytics helps understand past performance. It answers the question, "What happened?" Companies use dashboards, reports, and visual tools to summarize data and spot patterns.

### Predictive Analytics

Predictive analytics uses historical data and machine learning to predict future events. It is used for things like forecasting product demand, predicting customer behaviour, and assessing risks.

### Prescriptive Analytics

Prescriptive analytics suggests actions that organizations should take to reach their goals. It combines techniques like optimization, simulation models, and decision science to guide choices. Together, these approaches help organizations make better, more sustainable decisions.

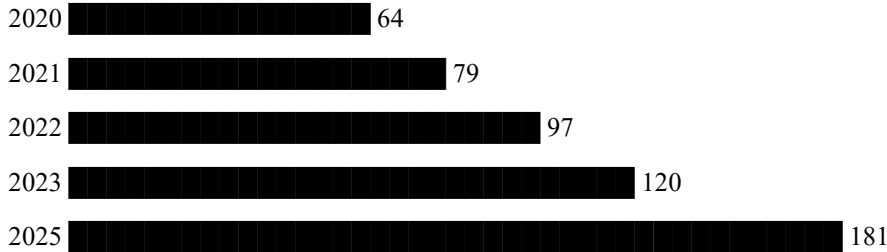
## 6. Global Statistics on Business Analytics and Sustainability

Table 1: Global Data Creation Growth

| Year             | Global Data Generated (Zettabytes) |
|------------------|------------------------------------|
| 2020             | 64                                 |
| 2021             | 79                                 |
| 2022             | 97                                 |
| 2023             | 120                                |
| 2025 (Projected) | 181                                |



## Graph 1: Data Growth Trend



The fast-growing amount of data worldwide shows how important business analytics has become in helping companies make better decisions.

**Table 2: Impact of Advanced Analytics on Business Performance**

| Performance Area         | Improvement (%) |
|--------------------------|-----------------|
| Inventory Efficiency     | 20–30           |
| Forecast Accuracy        | 20–50           |
| Logistics Cost Reduction | 15–20           |
| Productivity Improvement | 25–35           |
| Customer Retention       | 10–20           |

These numbers show that businesses using advanced analytics see real improvements in how well they run and how sustainable they are.

## 7. Sustainable Decision-Making

Sustainable decision-making involves balancing three key areas:

### Economic Sustainability

Economic sustainability focuses on making sure a business stays profitable, grows over time, uses resources efficiently, and remains financially stable in the long run.

### Environmental Sustainability

Environmental sustainability is about using energy wisely, reducing waste, lowering carbon emissions, and protecting natural resources.

### Social Sustainability

Social sustainability includes taking care of employees, keeping customers happy, following ethical practices, and supporting the local community.

Business analytics helps evaluate decisions across all these areas.

## 8.A Case Study: Walmart

Walmart is one of the biggest retail companies in the world, with thousands of stores and millions of customers every day. Because of its large size, Walmart deals with major challenges like managing inventory, transporting goods, dealing with waste, and meeting environmental goals. To overcome these challenges, Walmart has heavily invested in data analytics and artificial intelligence.

### Business Challenges

Before using advanced analytics, Walmart faced several issues such as:

- Too much inventory
- High costs for transportation and logistics
- A lot of food waste
- Inefficient use of energy
- A complicated supply chain

These problems affected both how profitable the company was and how sustainable its operations were.



## **Analytics-Driven Solutions**

### **Demand Forecasting**

Walmart uses predictive analytics to predict how much customers will buy based on:

- Past sales
- Seasonal trends
- Weather conditions
- How customers behave

This helps plan inventory better and cut down on waste.

### **Food Waste Reduction**

Food waste is a major sustainability challenge in the retail industry. According to the UNEP Food Waste Index Report 2024, around 1.05 billion metric tons of food were wasted globally in 2022, which is nearly 19% of the food available to consumers. The report also says about one billion meals are wasted every day worldwide. Walmart uses analytics to find products that are close to expiring and then takes actions like:

- Adjusting prices dynamically
- Redistributing inventory
- Starting food donation programs

In 2024, Walmart expanded food-waste reduction technologies to about 1,400 stores, which helped improve food recycling and supported its goal of reducing food waste by 50% by 2030.

### **Energy Management**

Real-time systems track:

- Electricity usage
- Heating, ventilation, and air conditioning (HVAC) performance
- Refrigeration systems

Analytics finds inefficiencies and suggests ways to fix them.

### **Transportation Optimization**

Advanced analytics helps Walmart improve:

- Delivery routes
- How well vehicles are used
- Fuel consumption

These efforts help cut down transportation costs and lower carbon emissions.

## **9. Statistical Analysis of Global Food Waste**

**Table 3: Global Food Waste Statistics (2022)**

| Indicator               | Value             |
|-------------------------|-------------------|
| Total Food Waste        | 1.05 Billion Tons |
| Food Waste Share        | 19%               |
| Meals Wasted Daily      | 1 Billion         |
| Annual Waste Per Person | 79 kg             |
| People Facing Hunger    | 783 Million       |

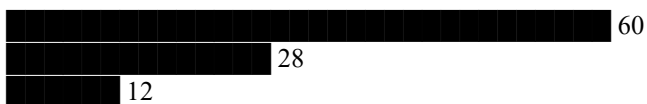
Source: UNEP Food Waste Index Report 2024.

### **Graph 2: Distribution of Food Waste**

Households: 60%

Food Service: 28%

Retail: 12%



These statistics demonstrate the need for analytics-driven waste reduction initiatives.

### **Findings**

The study shows several key points:

1. Business analytics helps make better decisions by offering insights based on real evidence.
2. Predictive analytics makes forecasts more accurate and reduces uncertainty.
3. Using analytics supports sustainability by cutting waste and making the best use of resources.
4. Walmart's use of analytics shows clear benefits for both the economy and the environment.



5. Food waste is still a big problem globally and needs smart data solutions.
6. Companies that use analytics get an edge by working smarter and being more innovative.
7. Real-time analytics helps businesses respond quickly to changes in their environment.

## Suggestions

For companies aiming for sustainable growth, they should:

Build a culture that values data.

Spend on strong analytics tools and systems.

Include sustainability goals in their analytics processes.

Improve how they manage and keep data reliable.

Use AI and machine learning to predict sustainability outcomes.

Keep track of ESG performance regularly.

Train employees in both analytics and sustainability.

Work together with others to make data more transparent.

## Conclusion

Business analytics is now a key part of making sustainable decisions in today's companies. With more data available, businesses can improve how they run, cut waste, use resources wisely, and boost their sustainability efforts. The Walmart example shows how using predictive analytics, visualizing data, and using operational insights can help make a profit while also being good for the planet. Recent global data shows that food waste, inefficient use of resources, and environmental issues are still big challenges. Analytics gives companies the tools to measure, track, and improve their sustainability efforts. As technologies like AI, machine learning, cloud computing, and big data keep growing, the role of analytics in sustainability will become even more important. Companies that successfully use analytics in their sustainability plans will be more competitive, resilient, and able to deliver value to their stakeholders in the long run.

## References

1. Davenport, T. H., & Harris, J. G. (2021). *Competing on Analytics*. Harvard Business Review Press.
2. Evans, J. R. (2022). *Business Analytics: Methods, Models and Decisions*. Pearson.
3. Porter, M. E., & Kramer, M. R. (2019). Creating Shared Value. *Harvard Business Review*.
4. Sharda, R., Delen, D., & Turban, E. (2023). *Business Intelligence, Analytics and Data Science*. Pearson.
5. United Nations Environment Programme. (2024). *Food Waste Index Report 2024*. Retrieved from <https://www.unep.org/resources/publication/food-waste-index-report-2024>
6. United Nations Environment Programme. (2024). *Food Waste Index Report 2024: Key Messages*. Retrieved from <https://wedocs.unep.org/20.500.11822/45275>
7. Walmart Corporate Sustainability Reports. Retrieved from <https://corporate.walmart.com>
8. McKinsey & Company. *Analytics and Sustainability Reports*.



## OriginalArticle

### Public Policy and Governance in the Digital Economy of Karnataka State-An Empirical Analysis

Dr.Anilkumar <sup>1</sup> Dr.R.V.Hegadal <sup>2</sup>

<sup>1</sup>HOD of Economics, SJMV BAJSS Arts & Commerce College for Women, Ranebennur.

<sup>2</sup>Professor & Principal, SJMV BAJSS Arts & Commerce College for Women, Ranebennur.

Manuscript ID:

JRD -2026-180609

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 39-45

June- 2026

Submitted: 05 May. 2026

Revised: 20 May.2026

Accepted: 05 June 2026

Published: 30 June 2026

#### Abstract:

*The digital economy has emerged as a major driver of economic growth, innovation, and governance reforms across the world. Karnataka, widely recognized as India's technology capital, has played a pioneering role in developing digital infrastructure, start-up ecosystems, and e-governance mechanisms. This study examines the role of public policy and governance in promoting the digital economy in Karnataka State through an empirical analysis of secondary data. The study evaluates digital governance initiatives, start-up ecosystem growth, digital public services, and policy interventions undertaken by the Government of Karnataka. Findings indicate that Karnataka has established itself as India's leading digital economy hub with over 19,000 start-ups, 53 unicorns, and substantial digital governance infrastructure. The study concludes that proactive public policies, robust digital infrastructure, and institutional support have significantly contributed to Karnataka's digital transformation. However, challenges relating to digital inclusion, cyber security, and regional disparities continue to require policy attention.*

**Keywords:** Digital Economy, Public Policy, Digital Governance, Karnataka, E-Governance, Start-ups, Digital Transformation.

#### Introduction:

The twenty-first century has witnessed an unprecedented digital revolution that has reshaped economies, societies, and governance systems. Digital technologies have become integral to business operations, public service delivery, education, healthcare, and financial systems. The digital economy refers to economic activities that rely on digital technologies, data, and internet-based platforms for production, distribution, and consumption of goods and services. Digital technologies increasingly influence every sector of the economy and require governments to develop flexible and coordinated policy frameworks.

The emergence of e-commerce, fintech, digital platforms, blockchain technologies, and artificial intelligence has accelerated economic growth while simultaneously creating governance challenges. Governments are now required to establish effective policies that ensure transparency, accountability, security, and fairness in digital environments.

Public policy in the digital economy involves creating legal, regulatory, and institutional frameworks that facilitate innovation while protecting public interests. Digital governance refers to the mechanisms through which governments manage digital technologies, regulate digital markets, and provide digital public services. Effective governance ensures that technological advancement contributes to social welfare and sustainable development.

Digital technologies have transformed economic activities, governance systems, and public service delivery globally. Governments increasingly rely on digital platforms to improve transparency, efficiency, and citizen participation. In India, Karnataka has emerged as a leading state in digital innovation, information technology, startup development, and e-governance.



Quick Response Code:



Website:

<https://jrdrv.org/>

DOI:

10.5281/zenodo.20636655



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr.Anilkumar, HOD of Economics, SJMV BAJSS Arts & Commerce College for Women, Ranebennur.

#### How to cite this article:

Anilkumar, & R.V.Hegadal. (2026). Public Policy and Governance in the Digital Economy of Karnataka State-An Empirical Analysis. *Journal of Research and Development*, 18(6 (I)), 39–45.  
<https://doi.org/10.5281/zenodo.20636655>



The Government of Karnataka has implemented several initiatives such as Seva Sindhu, K-GIS, Kaveri Online Services, Karnataka Startup Policy, and Karnataka Digital Economy Mission (KDEM) to strengthen digital governance and economic development. These initiatives provide an excellent case for examining how public policy influences digital economic growth and governance outcomes.

## Review of Literature:

The rapid growth of the digital economy has transformed governance structures, public service delivery, and policy frameworks across the world. Governments increasingly rely on digital technologies to improve transparency, accountability, efficiency, and citizen participation. Karnataka, recognized as India's leading information technology hub, has emerged as a significant case for studying the relationship between public policy and digital governance.

**Vaddiraju and Manasi (2019)** examined the implementation of e-governance initiatives in Karnataka through case studies on land records management and urban traffic administration. Their study found that digital governance mechanisms improved service delivery, reduced administrative delays, and enhanced accessibility for citizens. The authors concluded that Karnataka's experience demonstrates the transformative potential of digital technologies in public administration.

**Iyer and Rao (2017)** investigated the effectiveness of telecentres established across Karnataka for delivering citizen-centric services. Their findings revealed that e-governance initiatives reduced transaction costs, increased administrative efficiency, and improved interactions between citizens and government officials. The study emphasized that effective governance structures are essential for maximizing the benefits of digital service delivery.

**Sathisha and Katti (2025)** analyzed the evolution of e-governance and transformative public administration in Karnataka. Their research highlighted the state's pioneering role in implementing digital governance initiatives aimed at improving transparency, accountability, and public service efficiency. The study observed that digital platforms have significantly enhanced citizen engagement and administrative responsiveness.

A recent study by **Mohanakumari and Neelakanta (2026)** reviewed Karnataka's rural e-governance initiatives, including Panchatantra 2.0, Gandhi Sakshi Kayaka 2.0, Bapuji Seva Kendra, and Kutumba. The study reported that these initiatives have strengthened local governance, improved resource management, and enhanced citizen access to public services. The authors emphasized that digital governance contributes substantially to rural development and administrative modernization.

**Jyothi and Tadasad (2012)** examined various digital initiatives undertaken by the Government of Karnataka to bridge the digital divide. Their study found that information and communication technologies (ICTs) have played a crucial role in promoting social inclusion, digital literacy, and access to information among marginalized communities. The researchers argued that public policies focused on digital inclusion are critical for achieving equitable development.

Research on transparency and governance conducted through Karnataka's telecentre model demonstrated that citizen trust and governance effectiveness improve when digital systems ensure transparency and accountability. The study, based on survey data collected from telecentre users, established a significant relationship between transparency and successful e-governance outcomes.

Recent evidence from Karnataka's Geographic Information System (K-GIS 2.0) indicates that digital platforms have significantly enhanced administrative efficiency and public service delivery. The platform integrates more than 600 GIS layers and supports multiple mobile and web applications for governance purposes. Such initiatives demonstrate how digital infrastructure can strengthen evidence-based policymaking and administrative decision-making.

However, scholars have also identified several challenges in digital governance. Studies have pointed to issues such as cybersecurity risks, digital exclusion, administrative resistance, and misuse of digital systems. Reports on Karnataka's sub-registrar offices indicate that despite digitalization efforts, governance challenges such as corruption and procedural inefficiencies continue to persist, highlighting the need for stronger institutional accountability mechanisms.

## 2.1. Statement of the Problem:

The emergence of the digital economy has significantly transformed economic activities, governance mechanisms, and public service delivery systems across the globe. Governments are increasingly adopting digital technologies to improve administrative efficiency, transparency, accountability, and citizen participation. Karnataka, recognized as India's leading information technology and innovation hub, has implemented numerous digital governance initiatives such as Seva Sindhu, K-GIS, Kaveri Online Services, e-JanMa, and the Karnataka Digital Economy Mission (KDEM).

Despite substantial investments in digital infrastructure and governance reforms, several challenges continue to persist. These include digital inequality between urban and rural areas, cybersecurity concerns, inadequate digital literacy, regional disparities in technology adoption, data privacy issues, and varying levels of citizen access to digital services. Furthermore, while Karnataka has achieved remarkable growth in digital entrepreneurship and startup development, questions remain regarding the effectiveness of public policies in ensuring inclusive and sustainable digital economic development.

Existing studies have primarily focused on e-governance initiatives, service delivery mechanisms, or digital infrastructure development. However, there is limited empirical evidence on how public policy interventions influence

digital governance outcomes and contribute to the overall growth of the digital economy in Karnataka. Therefore, there is a need for a comprehensive empirical study that examines the relationship between public policy, governance mechanisms, and digital economic development in the state.

## 2.2. Identification of Research Gap and Research Questions:

Most existing studies on Karnataka focus primarily on e-governance initiatives, service delivery mechanisms, or specific digital platforms. Limited empirical research has examined the integrated relationship between public policy interventions, digital governance, and the growth of the digital economy in Karnataka. Furthermore, there is insufficient analysis of how public policies influence digital entrepreneurship, digital inclusion, and regional economic development simultaneously. Therefore, the present study seeks to fill this gap by providing an empirical assessment of public policy and governance in Karnataka's digital economy using recent secondary data and governance indicators.

## 2.3. Research Questions:

The study attempts to answer the following research questions:

1. How do public policy interventions influence digital governance and digital economy development in Karnataka State?
2. What are the major digital governance initiatives implemented by the Government of Karnataka?
3. To what extent have public policies contributed to the growth of Karnataka's digital economy and start up ecosystem?
4. How effective are digital governance platforms in improving transparency, accountability, and public service delivery?
5. What is the level of citizen access to and utilization of digital government services in Karnataka?

## Objectives of the Study:

To examine the role of public policy and governance in promoting the digital economy and digital transformation in Karnataka State.

1. To analyze the growth and development of the digital economy in Karnataka State.
2. To examine the major public policies and digital governance initiatives implemented by the Government of Karnataka.
3. To evaluate the effectiveness of digital governance platforms in improving public service delivery, transparency, and accountability.
4. To assess the contribution of public policy interventions to the growth of the start-up ecosystem and digital entrepreneurship in Karnataka.
5. To identify the major challenges and constraints affecting digital governance and digital economy development in the state.

## Results and Discussions:

### 4.1. Growth of Digital Economy in Karnataka: Empirical Evidence:

Karnataka is one of the largest contributors to India's digital economy. According to KDEM, the state's digital economy currently contributes approximately USD 159 billion and aims to achieve USD 329 billion by 2031, with a stretch target of USD 454 billion.

**Table 1: Karnataka Digital Economy Indicators**

| Indicator              | Value           |
|------------------------|-----------------|
| Digital Economy Size   | USD 159 Billion |
| Target by 2031         | USD 329 Billion |
| Stretch Target by 2031 | USD 454 Billion |
| State GDP              | USD 345 Billion |
| Annual Growth Rate     | 8.5%            |

Source: Karnataka Digital Economy Mission (2026).

The data indicate that digital sectors such as Information Technology, Biotechnology, IT-enabled Services, Artificial Intelligence, and FinTech are major contributors to Karnataka's economic growth.

**Table 2: Karnataka Start-up Ecosystem (2025)**

| Indicator          | Number  |
|--------------------|---------|
| Total Startups     | 19,000+ |
| Unicorns           | 53      |
| Soonicorns         | 183     |
| Active Investors   | 5,000+  |
| Innovation Hubs    | 55+     |
| Women-led Startups | 1,600+  |

Source: Karnataka Digital Economy Mission.

The Karnataka Start-up Policy 2025–2030 has allocated ₹518 crore to support 25,000 start-ups, including AI, block chain, and emerging technology enterprises. The policy also seeks to establish 10,000 start-ups outside Bengaluru, thereby promoting regional inclusion.

The Karnataka Geographic Information System (K-GIS) has emerged as one of the state's most successful digital governance initiatives.

Empirical evidence shows:

- More than 4,12,546 citizens have utilized K-GIS-enabled applications.
- Over 25,000 government officers use the platform.
- The platform received the National e-Governance Gold Award.

#### 4.2. Kaveri Online Services:

Kaveri Online Services has digitized property registration and documentation processes, improving transparency and reducing transaction costs.

#### 4.3. E-Janma and Digital Certificates:

Karnataka has successfully digitized birth and death registration systems through e-Janma, enabling citizens to obtain digitally signed certificates efficiently.

**Table 3: Performance Indicators of Digital Governance**

| Indicator                       | Achievement |
|---------------------------------|-------------|
| Citizens using K-GIS            | 4,12,546    |
| Government Officials Benefitted | 25,000+     |
| GIS Layers Available            | 600+        |
| Government Assets Digitized     | 20 Lakh     |
| Mobile Applications             | 41          |
| Web Applications                | 60          |

Source: Government of Karnataka and National e-Governance Reports.

The data reveal substantial improvements in service delivery efficiency, transparency, and citizen access to public services.

#### 4.4. Challenges in Digital Governance in India and Karnataka State:

Digital governance has transformed public administration by enhancing efficiency, transparency, accountability, and citizen participation. However, despite significant advancements in digital technologies and e-governance initiatives, several challenges continue to hinder the effective implementation and sustainability of digital governance systems. Karnataka, as one of India's leading digital states, faces many of these challenges while striving to build an inclusive and robust digital economy.

##### 1. Digital Divide and Unequal Access:

One of the most significant challenges in digital governance is the digital divide between urban and rural populations. While cities such as Bengaluru, Mysuru, and Hubballi-Dharwad enjoy advanced digital infrastructure and internet connectivity, many rural and remote areas continue to experience inadequate access to digital services.

Factors contributing to the digital divide include:

- Limited internet connectivity in rural areas
- Lack of affordable digital devices
- Socio-economic inequalities
- Low digital literacy levels
- Gender-based disparities in technology access

As a result, many citizens are unable to fully benefit from digital governance initiatives.

##### 2. Digital Literacy and Skill Gaps:

The success of digital governance depends on citizens' ability to access and utilize digital services effectively. A considerable section of the population, particularly elderly citizens, rural residents, and economically disadvantaged groups, lacks the necessary digital skills.

Key issues include:

- Limited awareness of online government services
- Difficulty in using digital platforms
- Language barriers
- Inadequate training opportunities

Digital literacy remains a critical prerequisite for achieving inclusive digital governance.

##### 3. Cyber security Threats:

As governments increasingly rely on digital systems for service delivery and data management, cybersecurity has emerged as a major concern. Cyberattacks can compromise sensitive government information, disrupt services, and undermine public trust.

Common cybersecurity threats include:

- Data breaches
- Ransomware attacks
- Identity theft
- Phishing attacks
- Malware infections

Strengthening cybersecurity infrastructure and developing robust incident response mechanisms are essential for protecting digital governance systems.

#### 4. Data Privacy and Protection Issues:

Digital governance platforms collect and process large volumes of personal and administrative data. Improper handling of such information can lead to privacy violations and misuse of citizen data. Ensuring data protection and privacy is critical for maintaining public confidence in digital governance systems.

#### 5. Infrastructure Constraints:

Digital governance requires reliable infrastructure such as broadband connectivity, data centers, cloud services, and uninterrupted electricity supply. Infrastructure limitations can significantly affect the accessibility and quality of digital services.

#### 6. Administrative Resistance to Change

The transition from traditional administrative systems to digital governance often encounters resistance from public officials and institutions.

Effective capacity-building programs and change-management strategies are necessary to facilitate digital transformation within government institutions.

#### 7. Interdepartmental Coordination Issues:

Digital governance requires coordination among multiple government departments and agencies. However, differences in systems, standards, and procedures often create operational challenges. Integrated governance frameworks and common digital platforms can help overcome these challenges.

#### 8. Regional Disparities in Digital Development:

Although Karnataka is a leading digital economy, significant disparities exist between Bengaluru and other regions of the state. Addressing regional imbalances is essential for achieving inclusive digital growth.

#### 9. Financial Constraints:

Implementing and maintaining digital governance systems require substantial financial resources. Governments must invest continuously in technology upgrades, cybersecurity, infrastructure development, and human resource training. Efficient resource allocation and public-private partnerships can help address these financial challenges.

#### 10. Legal and Regulatory Challenges:

The rapid evolution of digital technologies often outpaces existing legal and regulatory frameworks. Governments must continuously update legal frameworks to address emerging technological developments.

#### Major Findings and Suggestions:

##### 5.1. Major Findings of the Study:

- Based on the analysis of digital governance initiatives, public policy interventions, and digital economy indicators in Karnataka State, the following major findings have been derived:
- The study reveals that Karnataka has established itself as the leading digital economy state in India due to its strong Information Technology sector, innovation ecosystem, and supportive public policies. Bengaluru continues to serve as the country's foremost technology and startup hub.
- The study reveals that Government initiatives such as the Karnataka Digital Economy Mission (KDEM), Karnataka Startup Policy, Seva Sindhu, K-GIS, and Kaveri Online Services have contributed significantly to digital transformation, improved governance, and economic development.
- The study reveals that the adoption of digital governance platforms has reduced administrative delays, improved transparency, enhanced accountability, and increased accessibility to government services. Citizens are increasingly utilizing online platforms for availing public services.
- The study reveals that Karnataka has developed one of the largest startup ecosystems in Asia. Public policy support, incubation facilities, innovation hubs, and investment opportunities have encouraged entrepreneurship and digital innovation.
- The study finds a positive relationship between digital infrastructure development and the effectiveness of digital governance. Regions with better internet connectivity and technological infrastructure demonstrate higher utilization of digital services.
- The study reveals that despite substantial progress, disparities continue to exist between urban and rural areas in terms of internet access, digital literacy, and utilization of digital services. Rural populations face greater challenges in accessing digital governance benefits.

- The study reveals that a considerable segment of the population lacks adequate digital skills and awareness, limiting the effectiveness of digital governance initiatives. Elderly citizens, rural residents, and marginalized communities face greater difficulties in using digital platforms.
- The study reveals that the growing dependence on digital systems has heightened concerns regarding cybersecurity threats, data breaches, online fraud, and protection of citizens' personal information.
- The study reveals that the majority of digital investments, startup activities, and technological infrastructure remain concentrated in Bengaluru and a few urban centers. Several districts continue to lag behind in digital development.
- The study reveals that collaboration between government agencies, technology companies, educational institutions, and startup ecosystems has accelerated innovation and improved the implementation of digital governance initiatives.
- The study finds that effective digital governance contributes positively to economic growth by promoting innovation, entrepreneurship, investment, productivity, and employment generation.
- The study reveals that issues relating to policy coordination, interdepartmental integration, legal frameworks, and institutional capacity continue to affect the efficiency and sustainability of digital governance systems.

## 5.2. Policy Implications:

Based on the findings of the study, the following suggestions are proposed to strengthen public policy and governance in Karnataka's digital economy:

- The Government should expand broadband connectivity, mobile internet coverage, and digital infrastructure in rural and remote regions to ensure equitable access to digital services.
- Special initiatives should be introduced to support women, senior citizens, economically weaker sections, and marginalized communities in accessing digital technologies and public services.
- Comprehensive digital literacy campaigns should be conducted through educational institutions, community centers, gram panchayats, and self-help groups to improve citizens' digital competencies.
- The Government should establish robust cyber security mechanisms, strengthen cybercrime monitoring systems, and promote awareness regarding online safety and data protection.
- Strict implementation of data protection regulations should be ensured to safeguard citizens' personal information and enhance trust in digital governance systems.
- Digital economy investments, startup incubation centers, and innovation hubs should be expanded to Tier-II and Tier-III cities such as Hubballi-Dharwad, Belagavi, Kalaburagi, Davanagere, Shivamogga, and Haveri to reduce regional disparities.
- The Government should provide additional incentives, funding support, mentorship programs, and incubation facilities for startups working in emerging technologies such as Artificial Intelligence, Blockchain, FinTech, AgriTech, and HealthTech.
- Integrated digital governance platforms should be developed to improve data sharing, interoperability, and coordination among various government departments.
- Regular assessment of digital governance initiatives should be conducted through performance indicators, citizen feedback mechanisms, and independent audits to ensure accountability and effectiveness.
- Digital services should be designed with a user-friendly approach, multilingual interfaces, simplified procedures, and effective grievance redressal systems to enhance citizen satisfaction.
- The Government should formulate clear guidelines for ethical AI adoption, algorithmic transparency, accountability, and responsible use of emerging technologies in public administration.
- Greater collaboration between government agencies, private technology firms, academic institutions, and civil society organizations should be encouraged to accelerate digital innovation and governance reforms.

## 5.3. Concluding Remark:

The study concludes that Karnataka has made remarkable progress in building a robust digital economy through proactive public policies and innovative governance mechanisms. However, sustainable and inclusive digital transformation requires continuous investment in digital infrastructure, human capital development, cyber security, and regional equity. By addressing existing challenges and implementing the suggested measures, Karnataka can further strengthen its position as a global leader in digital governance and digital economic development.

## References:

### Books, Reports and Policy Documents:

1. Karnataka Digital Economy Mission (KDEM). (2023). *Handbook on Digital Economy Policies, Programs and Incentives in Karnataka*. Government of Karnataka.
2. KDEM Digital Economy Policies Report. (2023). *Digital Economy Policies, Programs and Incentives in Karnataka*. Government of Karnataka.
3. KDEM Policies Portal. Government of Karnataka. (2025). *Karnataka Startup Policy 2025–2030 and Karnataka IT Policy 2025–2030*.
4. OECD Digital Economy Publications. (2024). *OECD Digital Economy Outlook*. Paris: OECD Publishing.



5. NITI Aayog Official Website. (2023). *Digital Governance and Digital Transformation in India*. New Delhi: Government of India.
6. Ministry of Electronics and Information Technology (MeitY). (2024). *Digital India Annual Report*. Government of India.
7. World Bank Digital Development Program. (2024). *World Development Report: Digital Transformation and Governance*.

#### Journal Articles:

8. Vaddiraju, A. K., & Manasi, S. (2019). *E-governance: Learning from Karnataka*. Journal of Administrative Change, 65(2), 150–166.
9. Jyothi, I. D. J., & Tadasad, P. G. (2012). *Bridging the Digital Divide: E-Initiatives in Karnataka State*. SRELS Journal of Information Management, 49(1), 49–56.
10. Purtova, N., & van Maanen, G. (2022). *Data as an Economic Good, Data as a Commons, and Data Governance*. arXiv Working Paper.
11. Page, P., Knowles, P., & Mitwicki, R. (2023). *Distributed Governance: A Principal-Agent Approach to Data Governance*. arXiv Working Paper.
12. Kadekodi, G., Kanbur, R., & Rao, V. (2007). *Governance and the Karnataka Model of Development*. Economic and Political Weekly, 42(8), 649–652.

#### Government and Industry Sources:

13. Karnataka Digital Economy Mission – About Us. (2025). *KDEM Strategic Vision and Digital Economy Framework*.
14. Economic Times Startup Policy Report. (2025). *Karnataka Startup Policy 2025–2030*.
15. Times of India Skill Development Policy Report. (2025). *Karnataka State Skill Development Policy 2025–2032*.
16. CIOL Karnataka Digital Growth Report. (2025). *Karnataka's Digital Push Beyond Bengaluru*.
17. Times of India AI Governance Report. (2026). *Karnataka Responsible Social Media and Digital Safety Bill*.
18. Times of India Mysuru Global Technology Centre Report. (2026). *Karnataka Digital Economy Expansion Beyond Bengaluru*.



## OriginalArticle

### Blockchain Technology-Based Innovations: Pathways to Economic and Sustainable Development

R. Darmesh Ram.<sup>1</sup> Dr. B. Yasodha Jagadeeswari.<sup>2</sup>

<sup>1</sup>M.Tech Data Science, Department of Computer Science and Engineering,  
Puducherry Technological University, Puducherry- 605014.

<sup>2</sup>M.A., M.Phil., M.B.A., Ph.D., Former Head and Assistant Professor,

PG & Research Department of Economics, Holy Cross College (Autonomous), Tiruchirappalli - 620002.

Email- [darmeshramr123@gmail.com](mailto:darmeshramr123@gmail.com)

Manuscript ID: **Abstract**

JRD -2026-180610

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 46-52

June- 2026

Submitted: 05 May. 2026

Revised: 20 May. 2026

Accepted: 05 June 2026

Published: 30 June 2026

*Information and Communication Technologies such as blockchain can significantly contribute to achieving the Sustainable Development Goals (SDGs). Without a doubt, blockchain, as one of the most valuable technological advancements, has been introduced over the past decade and has played a significant role in the industrial revolution. Blockchain technology is progressively taking over the business world. Blockchain as a disruptive technology and a driver for social change has exhibited great potential to promote sustainable practices and help organizations and governments achieve the United Nations' Sustainable Development Goals (SDGs). The emergence of other technologies derived from blockchain, such as decentralized finance (DeFi) and the Metaverse, has fundamentally transformed people's daily lives and profoundly impacted future versions of digital businesses. The Blockchain technology revamped several industries, including Real Estate, Healthcare, Education, and Legal industry to name a few. It opened new doors of opportunities and profit for the entrepreneurs and established brands.*

*The paper's main contribution is to advance knowledge about the role of blockchain for economic and sustainable development in countries of the world. Grounded in the innovation forecasting literature, this paper explores blockchain-based innovations and research in the context of economic and sustainable development.*

**Key words:** Blockchain, digital currency, network externalities, critical mass, technology, payment evolution

#### Introduction

Technologists and futurists offer us a vision of fundamental economic changes as a result of recent advances in digital technology. Blockchain technology has received exceptional attention in both business and academic circles as supporters argue that it constitutes the foundation for truly trust-free economic transactions due to its unique technological characteristics. Blockchain technology is likely to be a key source of future financial market innovation. It allows for the creation of immutable records of transactions accessible by all participants in a network. Blockchain is considered a disruptive technology with the potential to cause socioeconomic transformation in developing and emerging economies. The economic incentives that drive human behavior play a critical role in how blockchain technology is and will be used. Its success as a useful tool will depend as much on how humans interact with it as on the technology itself. As part of the fourth industrial revolution since the invention of steam engine, electricity, and information technology, blockchain technology has been applied in many areas such as finance, judiciary, and commerce.

#### Creative Commons (CC BY-NC-SA 4.0)

*This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.*

#### Address for correspondence:

R. Darmesh Ram., M.Tech Data Science, Department of Computer Science and Engineering, Puducherry Technological University, Puducherry

#### How to cite this article:

R. Darmesh Ram., & B. Yasodha Jagadeeswari. (2026). Blockchain Technology-Based Innovations: Pathways to Economic and Sustainable Development. *Journal of Research and Development*, 18(6 (I)), 46–52. <https://doi.org/10.5281/zenodo.20636690>



Quick Response Code:



Website:

<https://jrdryb.org/>

DOI:

10.5281/zenodo.20636690





This research shows that the economic incentives that drive human behavior play a critical role in how blockchain technology is and will be used. Its success as a useful tool will depend as much on how humans interact with it as on the technology itself. Blockchain technology's disruptive potential in the digital economy has spurred a surge in scholarly interest, leading to a complex landscape of research endeavors. The empirical data on blockchain research and innovations suggests a largely untapped potential in various promising application areas relevant for the SDGs, such as sustainable energy or integrity verification. The major contributions of this paper are an overview and status quo of entrepreneurial innovation activities and research on blockchain technology in the world, an analysis of these areas in the context of the SDGs, and a lean methodological approach for innovation forecasting.

## The Significance Of The Study

Blockchain technology-based innovations for economic and sustainable development lies in its potential to address pressing global challenges. Blockchain offers decentralized, transparent, and secure systems that can revolutionize various sectors, including finance, supply chain, energy, and governance. By exploring these innovations, the study can uncover opportunities to enhance efficiency, reduce costs, and promote inclusivity in economic activities. Additionally, leveraging blockchain for sustainable development can facilitate transparent resource management, traceability of goods, and incentivize eco-friendly practices. Understanding the implications of blockchain in fostering economic growth while advancing sustainability is crucial for informing policies and strategies to build resilient and equitable societies in the digital age.

## Review Of Literature

**Keyi Zhu (2023)** analyzed blockchain technology in-depth, emphasizing its application, opportunities, challenges, and countermeasures suggestions. This paper perfectly shows how blockchain technology works in any sector or system. The article further provides an analysis of real industry applications of blockchain. Integrating blockchain technology in various sectors, including financial institutions, has been widely embraced, and implementing blockchain technology will be the prospect in day-to-day operations.

**Sahu B, et al. (2023)** focused on understanding what cryptocurrency is all about and its overall impact on the Indian economy. The future of cryptocurrency is uncertain. The study also focuses on the existing scenario and future prospects of cryptocurrency in India. The tax on cryptocurrency gains also adds up to a huge sum of direct taxes which goes to the I-T department which can further push the overall growth of the economy.

**Gupta,S.(2022)** In "The Role of Blockchain Technology in Digital Currency and Its Economic Impact," Gupta provides a comprehensive analysis of the transformative potential of blockchain technology in reshaping the landscape of digital currency and its broader economic implications. This scholarly work delves into the innovative applications of blockchain technology and its role in revolutionizing financial systems worldwide

**Gupta and Singh's (2021)** scholarly inquiry, "The Impact of Blockchain on Digital Currency and Economic Policies," offers a timely and insightful examination of the profound ramifications of blockchain technology on digital currency and economic governance. The review meticulously explores the dynamic interplay between blockchain innovations and regulatory frameworks, shedding light on their implications for monetary policies and economic stability.

**Smith's (2020)** seminal work, "Blockchain Technology: Transforming Digital Currency and Economic Paradigms," offers a comprehensive exploration of the transformative potential inherent in blockchain technology. Through meticulous analysis, Smith elucidates how blockchain is reshaping the landscape of digital currency and challenging existing economic paradigms.

**Li and Wang's (2019)** scholarly endeavor, "Blockchain Technology and Economic Development: A Comprehensive Review," stands as a pivotal contribution to understanding the intricate relationship between blockchain and economic progress. The review meticulously examines the multifaceted ways in which blockchain technology influences economic development across various sectors and regions.

**Chen et al. (2018)** explore the nuanced economic impacts of blockchain within digital currency markets, shedding light on the dynamic interplay between technology and financial ecosystems. Their findings underscore the importance of understanding blockchain's role in shaping economic landscapes and policy frameworks.

**Satoshi Nakamoto (2008)** found that Blockchain technology provides the luxury for the investors to maintain their digital account ledger for Cryptocurrency transactions. This technology has been emerged on the global scene for the purpose of safe and secure Cryptocurrency transaction online

## The Scope of the Study

Blockchain Technology Based Innovations for Economic and Sustainable Development encompasses several key areas:

1. **Blockchain Technology Fundamentals:** This involves examining the underlying principles, architecture, and mechanics of blockchain technology to establish a foundational understanding.
2. **Economic Implications:** Investigating how blockchain technology can impact economic systems, including its potential to streamline transactions, reduce costs, eliminate intermediaries, and foster financial inclusion.

3. **Sustainable Development Applications:** Exploring the use of blockchain for sustainable development initiatives such as supply chain transparency, renewable energy trading, carbon credits, and incentivizing environmentally friendly practices.
  4. **Case Studies and Use Cases:** Analyzing real-world applications and case studies where blockchain technology has been implemented to drive economic growth and sustainability, highlighting successes, challenges, and lessons learned.
  5. **Policy and Regulatory Considerations:** Examining the legal and regulatory frameworks surrounding blockchain technology adoption, including issues related to data privacy, security, and compliance with existing regulations.
  6. **Social and Environmental Impact:** Assessing the broader societal and environmental implications of blockchain-based innovations, including their potential to empower marginalized communities, reduce inequality, and mitigate environmental degradation.
  7. **Future Trends and Opportunities:** Anticipating future developments and emerging trends in blockchain technology that could further enhance economic and sustainable development efforts.
- Overall, the study aims to provide a comprehensive analysis of the role of blockchain technology in driving economic progress while promoting sustainability, offering insights and recommendations for stakeholders in both public and private sectors.

## Objectives Of the Study

The main objectives of the study are as follows:

1. **To Analyze Blockchain Technology:** Investigate the fundamental principles, architecture, and functionalities of blockchain technology to establish a comprehensive understanding.
2. **To Explore Economic Applications:** Examine how blockchain technology can be leveraged to optimize economic processes, such as financial transactions, trade, and commerce, with a focus on efficiency, transparency, and cost reduction.
3. **To Assess Sustainable Development Potential:** Evaluate the potential of blockchain technology to support sustainable development goals, including initiatives related to environmental conservation, social equity, and resource management.
4. **To Examine Social and Environmental Impact:** Assess the broader societal and environmental implications of blockchain-based innovations, including their potential to empower communities, reduce inequality, and address environmental challenges.

By fulfilling these objectives, the study aims to contribute to the understanding of blockchain technology's potential in fostering economic growth and sustainability, informing decision-making processes and guiding future research and development initiatives.

## Methodology Of the Study

To fulfil the above research objectives, this study is based on secondary data collected from various reliable online sources. The purpose of the study was to analyze the role of blockchain for economic and sustainable development in countries of the world. Qualitative method was used to conduct the research and data collection was made through the use of secondary resources which includes the: high impact journals, research papers, research work, website, newspapers and other trusted platforms. The study aims to provide a rigorous analysis of the role of blockchain technology in driving economic growth and sustainability, offering valuable insights for informed decision-making and policy formulation.

## Blockchain Technology

A blockchain database is made up of a number of blocks "chained" together through a reference in each block to the previous block. Each block records one or more transactions, which are essentially changes in the listed owner of assets. New blocks are added to the existing chain through a consensus mechanism in which members of the blockchain network confirm transactions as valid. The technology allows the creation of a network that is "fully peer to peer, with no trusted third party," such as a government agency or financial institution. While all are in the early stages of development, there are many promising applications of blockchain technology in financial markets. The bitcoin ecosystem represents the largest implementation of blockchain technology to date. Interest in the technology continues to grow in the financial technology and broader financial services communities. In this article, we provide a brief overview of what blockchain technology is, how it works, and some potential applications and challenges.

## Fundamental And Architecture of Blockchain Technology

1. **Decentralization:** Blockchain operates on a decentralized network of nodes, where no single entity has control over the entire system. This decentralization ensures transparency, security, and immutability of data.
2. **Distributed Ledger:** Blockchain utilizes a distributed ledger to record transactions across multiple nodes in the network. Each block in the chain contains a set of transactions, and every node has a copy of the entire ledger.
3. **Consensus Mechanisms:** Consensus mechanisms are protocols used to achieve agreement among nodes on the validity of transactions added to the blockchain. Common consensus mechanisms include Proof of Work (PoW), Proof of Stake (PoS), and Delegated Proof of Stake (DPoS).



4. **Cryptography:** Cryptographic techniques like hash functions, digital signatures, and cryptographic puzzles are fundamental to blockchain security. Hash functions ensure the integrity of data within blocks, while digital signatures authenticate transactions.
5. **Smart Contracts:** Smart contracts are self-executing contracts with the terms of the agreement directly written into code. They automatically execute and enforce agreements when predefined conditions are met, eliminating the need for intermediaries.
6. **Immutable Record:** Once data is recorded on the blockchain, it is extremely difficult to alter or delete. Immutability ensures the integrity of the historical record and builds trust among participants.
7. **Public vs. Private Blockchains:** Public blockchains are open to anyone, allowing for permissionless participation, while private blockchains restrict access to authorized users. Each has its own use cases and implications for governance and privacy.
8. **Scalability and Performance:** Scalability remains a challenge for blockchain technology, especially in public networks. Various solutions such as sharding, layer-2 protocols, and consensus algorithm improvements are being explored to enhance scalability and performance.
9. **Interoperability:** Interoperability refers to the ability of different blockchain networks to communicate and interact with each other seamlessly. Standards and protocols are being developed to facilitate interoperability and enable cross-chain transactions.

Understanding these fundamentals provides a solid foundation for exploring the diverse applications of blockchain technology across industries such as finance, supply chain management, healthcare, and more. Additionally, staying updated on emerging trends and technological advancements is crucial for navigating the rapidly evolving blockchain landscape.

## **Economic Applications of Blockchain Technology**

### **1. Financial Transactions:**

- **Cross-Border Payments:** Blockchain enables faster and cheaper cross-border payments by eliminating intermediaries and reducing settlement times from days to minutes. Ripple, for example, offers a blockchain-based payment protocol designed for this purpose.
- **Remittances:** Blockchain technology can streamline remittance processes, allowing individuals to send money across borders with lower fees and faster settlement times compared to traditional remittance services.
- **Settlement and Clearing:** Blockchain-based settlement systems offer real-time settlement and reduce counterparty risk by providing a transparent and immutable record of transactions. This can optimize processes in securities trading, derivatives markets, and other financial instruments.
- **Tokenization of Assets:** Blockchain facilitates the tokenization of traditional assets such as real estate, stocks, and commodities, allowing for fractional ownership and easier transferability. This enhances liquidity and opens up investment opportunities to a broader range of investors.

### **2. Trade and Commerce:**

- **Supply Chain Management:** Blockchain enhances supply chain transparency and traceability by recording every stage of the supply chain on an immutable ledger. This helps to verify the authenticity and origin of products, reduce counterfeiting, and ensure compliance with regulations.
- **Smart Contracts for Trade:** Smart contracts automate and enforce trade agreements, reducing the need for intermediaries and streamlining processes such as procurement, shipping, and invoicing. This improves efficiency and reduces costs for businesses.
- **Trade Finance:** Blockchain-based platforms offer solutions for trade finance, such as supply chain financing and invoice factoring, by providing secure and transparent mechanisms for financing trade transactions. This can improve access to capital for small and medium-sized enterprises (SMEs) and reduce financing costs.

### **3. Commerce and Payments:**

- **E-commerce and Retail:** Blockchain enables secure and transparent e-commerce transactions by providing decentralized payment systems and ensuring the authenticity of products through supply chain traceability.
- **Micropayments and Content Monetization:** Blockchain facilitates micropayments and enables new business models for content creators, such as pay-per-view or pay-per-access, without the need for intermediaries. This can benefit creators by increasing revenue and reducing transaction costs.
- **Identity Verification and Fraud Prevention:** Blockchain-based identity solutions offer secure and tamper-proof identity verification, reducing fraud and improving trust in online transactions. This can streamline processes such as customer onboarding and KYC (Know Your Customer) compliance.

By leveraging blockchain technology in these economic applications, organizations can achieve greater efficiency, transparency, and cost reduction, leading to overall improvements in financial systems, trade, and commerce. However, it's essential to carefully consider factors such as scalability, regulatory compliance, and interoperability when implementing blockchain solutions in these contexts.

## Sustainable Development Of Blockchain Technology

### 1. Environmental Conservation:

- **Supply Chain Traceability:** Blockchain enables transparent and immutable tracking of products throughout their lifecycle. This can be applied to supply chains for commodities like seafood, timber, and minerals, helping to verify sustainable sourcing practices, prevent illegal logging and overfishing, and reduce environmental degradation.
- **Renewable Energy Trading:** Blockchain facilitates peer-to-peer energy trading, allowing producers of renewable energy, such as solar panel owners, to sell excess energy directly to consumers. This promotes the adoption of renewable energy sources, reduces reliance on fossil fuels, and contributes to the transition to a low-carbon economy.
- **Carbon Credits and Emissions Tracking:** Blockchain-based platforms can streamline the issuance, trading, and tracking of carbon credits, enabling more efficient carbon offsetting and emissions reduction initiatives. This helps organizations and governments meet climate targets outlined in agreements like the Paris Agreement.

### 2. Social Equity:

- **Financial Inclusion:** Blockchain-based financial services, such as decentralized finance (DeFi) and mobile banking solutions, can provide access to banking and financial services for underserved populations, including those in remote areas or without traditional identification documents. This promotes financial inclusion and economic empowerment, contributing to poverty alleviation and social equity.
- **Transparent Aid Distribution:** Blockchain enables transparent and accountable distribution of humanitarian aid and development funding by recording transactions on a tamper-proof ledger. This reduces corruption, ensures aid reaches intended recipients, and fosters trust between donors, aid organizations, and beneficiaries.

### 3. Resource Management:

- **Water Management:** Blockchain can optimize water resource management by monitoring water usage, detecting leaks, and facilitating water trading and allocation. This enhances water efficiency, promotes sustainable use of water resources, and mitigates conflicts over water access.
- **Land Rights and Property Ownership:** Blockchain-based land registries and property ownership systems provide secure and transparent records of land titles, reducing disputes and enhancing tenure security for landowners, particularly in developing countries. This supports sustainable land management and responsible land governance.

## Waste Management:

- **Recycling and Waste Tracking:** Blockchain technology can improve transparency and traceability in recycling and waste management processes by recording transactions related to waste collection, recycling, and disposal. This promotes responsible waste management practices, reduces landfill waste, and encourages recycling initiatives.

Overall, blockchain technology has the potential to contribute significantly to achieving sustainable development goals by enhancing transparency, accountability, and efficiency in various sectors. However, it's essential to address challenges such as scalability, interoperability, and regulatory considerations to realize the full benefits of blockchain for sustainable development. Collaboration between governments, businesses, NGOs, and technologists is key to harnessing blockchain's potential for positive social and environmental impact.

## Social And Environmental Impact Of Blockchain Technology

### 1. Empowerment of Communities:

- **Financial Inclusion:** Blockchain-based financial services can provide access to banking and financial tools for underserved populations, empowering individuals and communities economically.
- **Decentralized Governance:** Blockchain enables decentralized governance models, allowing communities to make collective decisions without relying on traditional centralized authorities. This fosters participatory decision-making and empowers community members to have a voice in matters that affect them.
- **Access to Information:** Blockchain can enhance access to information and education by providing transparent and immutable records, enabling individuals to verify the authenticity of information and learn about various topics, including financial literacy and environmental conservation.

### 2. Reduction of Inequality:

- **Access to Opportunities:** Blockchain-based platforms can reduce barriers to access by providing opportunities for peer-to-peer transactions, crowdfunding, and decentralized marketplaces. This can level the playing field for individuals and businesses, reducing economic inequality.
- **Transparent Governance:** Blockchain enhances transparency and accountability in governance and decision-making processes, reducing opportunities for corruption and favoritism. This can lead to fairer distribution of resources and benefits within society.
- **Digital Identity:** Blockchain-based identity solutions can provide individuals with secure and portable digital identities, enabling them to access services and opportunities that were previously unavailable due to lack of documentation. This promotes inclusion and reduces discrimination based on identity or background.



### 3. Addressing Environmental Challenges:

- **Sustainable Supply Chains:** Blockchain enhances transparency and traceability in supply chains, enabling consumers to make informed choices about sustainable and ethically sourced products. This incentivizes businesses to adopt environmentally friendly practices and reduces the demand for goods produced through harmful methods.
- **Renewable Energy Integration:** Blockchain facilitates peer-to-peer energy trading and incentivizes the adoption of renewable energy sources, contributing to the transition to a low-carbon economy and reducing dependence on fossil fuels.
- **Efficient Resource Management:** Blockchain-based solutions can optimize resource management processes, such as water allocation and waste management, leading to more efficient use of resources and reduced environmental impact.

However, it's essential to recognize that blockchain-based innovations also pose challenges and risks, including:

- **Energy Consumption:** The energy-intensive nature of blockchain consensus mechanisms, such as Proof of Work (PoW), raises concerns about carbon emissions and environmental sustainability.
- **Digital Divide:** Despite the potential for inclusion, barriers such as internet access, technological literacy, and infrastructure limitations may exacerbate existing inequalities and create a digital divide.
- **Regulatory Uncertainty:** Rapid technological advancements and the decentralized nature of blockchain pose challenges for regulators in ensuring consumer protection, data privacy, and compliance with existing laws.

Overall, while blockchain-based innovations offer significant potential to empower communities, reduce inequality, and address environmental challenges, careful consideration of these implications is necessary to maximize their positive impact and mitigate potential risks. Collaboration between stakeholders from government, industry, academia, and civil society is crucial to harnessing blockchain technology for the benefit of society and the environment.

### Conclusion

In conclusion, exploring blockchain technology-based innovations for economic and sustainable development reveals a transformative potential to revolutionize various aspects of society. By leveraging blockchain technology, we can unlock new opportunities for efficiency, transparency, and inclusivity across economic sectors while simultaneously addressing pressing environmental challenges.

Blockchain's decentralized architecture, cryptographic security, and transparent ledger system offer solutions to longstanding issues such as inefficient financial systems, opaque supply chains, and limited access to financial services. Through applications like cross-border payments, supply chain traceability, and decentralized finance, blockchain has the power to streamline processes, reduce costs, and empower individuals and communities economically.

Furthermore, blockchain's ability to promote sustainability and address environmental concerns is paramount. By enabling transparent tracking of products, facilitating renewable energy trading, and optimizing resource management, blockchain can contribute significantly to achieving sustainable development goals and mitigating climate change. However, it's essential to approach blockchain-based innovations with a critical lens, considering factors such as energy consumption, regulatory challenges, and potential social impacts. Collaborative efforts involving governments, businesses, NGOs, and technologists are necessary to navigate these complexities and ensure that blockchain technology is deployed responsibly and ethically.

In essence, exploring blockchain technology-based innovations for economic and sustainable development represents a journey towards a more inclusive, transparent, and environmentally conscious future. By harnessing the potential of blockchain technology, we can strive towards building a more equitable, resilient, and sustainable society for present and future generations.

### References

1. Keyi Zhu (2023) Blockchain Technology: Applications, Opportunities, Challenges, and Countermeasures, *Advances in Economics, Business and Management Research*, pp 460-468.
2. Bhavana Sahu and Hariom Divaka(2023). Cryptocurrency and its Impact on Indian Economy, *Journal of Global Economics*, Volume 11:3, 2023,pp 1-6.
3. Gupta, R., & Singh, A. (2022). "The Impact of Blockchain on Digital Currency and Economic Policies." Gupta and Singh analyze blockchain's influence on monetary policies and its role in shaping economic strategies.
4. Noman-ul- Haq Siddiqui, Salman Hameed, Kashif Arif (2021). The Role of Block Chain Technology in Cryptocurrency and its Impact on Developing Country's Economy: A Review, *Periodicals of Social Sciences Vol. 1 Issue 2*, 2021,pp 27-37.
5. Smith, J. (2020). "Blockchain Technology: Transforming Digital Currency and Economic Paradigms." Smith's work examines how blockchain reshapes digital currency landscapes, emphasizing its economic ramifications.
6. Li, C., & Wang, Q. (2019). "Blockchain Technology and Economic Development: A Comprehensive Review." This study surveys blockchain's integration with digital currency systems, highlighting its potential to drive economic growth.



7. Ahn, Y., Kim, D.(2019) Sentiment disagreement and bitcoin price fluctuations: a psycholinguistic approach. Appl. Econ. Lett., pp. 1–5.
8. Chen, L., et al. (2018). "Exploring the Economic Impacts of Blockchain Technology on Digital Currency Markets." This research investigates the economic dynamics influenced by blockchain technology within digital currency markets.
9. Ciaian, P., Rajcaniova, M., Kancs, D.(1016) The economics of bitcoin price formation. Appl. Econ. 48(19), 1799–1815.
10. Cheah, E.T., Fry, J.(2015) Speculative bubbles in bitcoin markets? an empirical investigation into the fundamental value of bitcoin. Econ. Lett. 130, 32–36.
11. Böhme, R., Christin, N., Edelman, B., Moore, T.(2015) Bitcoin: Economics, technology, and governance. J. Econ. Perspect. 29(2), 213–238.

#### **Websites used**

12. <http://www.fincen.gov>.
13. <http://tech.sina.com>.
14. <https://www.bis.org>.



## OriginalArticle

### Transformative Role of Media, communication, and digital society: An overview

Dr. Siddappa D O

Associate professor, Department of Sociology  
Government First Grade College, Holalkere, Chitrdurga district, Karnataka.

Manuscript ID:

JRD -2026-180611

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 53-55

June- 2026

#### Abstract:

*The swift growth of digital media technologies has revolutionized communication systems, public discourse, and cultural production worldwide. This article analyzes current trends in media and communication within the larger context of the information society. It delves into the emergence of social media platforms, digital journalism, algorithm driven content, misinformation, participatory culture, and media convergence. Additionally, the article addresses the socio-political ramifications of digital communication, such as polarization, surveillance, digital activism, and media literacy. By drawing on contemporary theories and global institutional viewpoints, the chapter underscores the challenges and opportunities that digital transformation brings. It posits that critical media literacy, ethical regulation, and inclusive access are vital for maintaining democratic communication in the 21st century.*

**Keywords:** Medias, Social medias, Communication, Digital society, Human society

Submitted: 10 May. 2026

Revised: 25 May. 2026

Accepted: 10 June 2026

Published: 30 June 2026

#### Introduction:

Media, communication, and the digital society are like the nervous system of our modern world. They play a crucial role in how we live and interact with one another. These elements help spread knowledge around the globe, making it easier for people everywhere to access important information. This means that more individuals can learn about different cultures, ideas, and events happening far away. Because of this, we see major changes in cultures all over the world, as people share and exchange their traditions and beliefs. In addition to spreading knowledge, media and communication allow people to come together quickly for social causes. When there is a problem that needs attention, such as a natural disaster or a social injustice, people can organize and mobilize almost instantly. Social media platforms, for example, make it easy for individuals to spread the word and gather support for important issues. This instant communication helps create a sense of community and allows many voices to be heard.

However, living in this highly connected world also comes with some serious challenges. One big issue is misinformation, which is false or misleading information that spreads easily through social media and other online platforms. This can confuse people and lead them to believe things that are not true. Additionally, there is a problem known as algorithmic polarization, where people are shown content that only reinforces their own beliefs. This means they might not see different perspectives or ideas, which can create division among groups. To navigate these challenges, it is important for everyone to develop strong digital literacy skills. This means learning how to think critically about the information we see online, understanding where it comes from, and checking if it is accurate. Being digitally literate helps people not only to protect themselves from misinformation but also to engage more thoughtfully with the world around them.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636717



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Siddappa D O, Associate professor, Department of Sociology, Government First Grade College, Holalkere, Chitrdurga district, Karnataka.

#### How to cite this article:

Siddappa D O. (2026). Transformative Role of Media, communication, and digital society: An overview. *Journal of Research and Development*, 18(6 (I)), 53–55.

<https://doi.org/10.5281/zenodo.20636717>



In conclusion, while media and communication enrich our lives and connect us in amazing ways, we must also be aware of the potential pitfalls and learn how to use these tools wisely

## **Review of Literature:**

The concluding article by Abhijit Mazumdar (Citation2020) discusses a qualitative study that investigates the representation of India in 143 articles published in The New York Times following the Cold War. The research revealed that prevalent themes regarding India in these pieces were favorable and aligned with the United States' policy perspective on India during that period. Consequently, it supports the application of the Indexing Hypothesis (Bennett, Citation1990), which suggests that media coverage is shaped by the views held by senior government officials. In contrast to the other articles in this issue, which illustrated how digital mediatization interacts with non-mediated processes in transformative, mediational, and synergistic manners, this paper focuses on the relationship between non-digital media reporting and high-level government sentiment

## **Objectives:**

To know explores the rise of social media platforms, digital journalism, content driven by algorithms, misinformation, participatory culture, and the convergence of media. Furthermore, the article discusses the socio-political consequences of digital communication, including polarization, surveillance, digital activism, and the importance of media literacy. By referencing modern theories and perspectives from global institutions, the chapter highlights the challenges and opportunities presented by digital transformation

## **Methods:**

This research employs an interdisciplinary mixed methodology, incorporating both qualitative and quantitative analyses. Key components include extensive literature review of over 50 scholarly articles on digital media communications, comparative analyses of statistical data on social media and internet usage, case study analyses of digital communication campaigns in public relations, journalism, and marketing, discourse analysis of social media and digital content, and interviews with experts in digital marketing and communication. This diverse approach ensures analytical rigor and comprehensive insights into advancements in digital and socialized media.

## **Transformative Role of Media, communication, and digital components in Human Society:**

**Information and Education:** In today's world, driven by the internet, we live in a digital society that removes barriers related to geography. This means that no matter where you are in the world, you can easily access a wealth of information. Online libraries and open-access platforms provide educational resources and news that everyone can reach. This makes learning and staying informed available to all people, empowering them to gain knowledge and participate in discussions, no matter their physical location. Whether someone lives in a big city or a small village, they can now explore countless subjects and connect with others who share their interests. This access to information can help individuals make better decisions, improve their skills, and engage more actively in their communities and it has consists bellow components.

**Information and Education:** In today's world, driven by the internet, we live in a digital society that removes barriers related to geography. This means that no matter where you are in the world, you can easily access a wealth of information. Online libraries and open-access platforms provide educational resources and news that everyone can reach. This makes learning and staying informed available to all people, empowering them to gain knowledge and participate in discussions, no matter their physical location. Whether someone lives in a big city or a small village, they can now explore countless subjects and connect with others who share their interests. This access to information can help individuals make better decisions, improve their skills, and engage more actively in their communities.

**Social Mobilization and Civic Engagement:** Social media and online platforms allow people to communicate quickly and easily across borders. This fast communication helps support grassroots activism and social movements. Citizens can come together to advocate for causes they believe in, share their opinions, and organize events to raise awareness. With tools like egovernment, people can interact directly with their governments, making it easier to express their needs and concerns. This leads to greater transparency in how decisions are made and encourages more public debate. People feel empowered to voice their ideas and influence change in their communities, which strengthens democracy and fosters a more engaged citizenry.

**Cultural Homogenization and Exchange:** Digital media has become the main way that culture is shared and experienced today. It allows different societies to share their lifestyles, values, and traditions instantly with each other. This sharing accelerates the pace of globalization, meaning that cultures from around the world are blending together more quickly than ever before. While this can lead to cultural homogenization where unique cultures become more similar it also promotes intercultural understanding. People can learn about and appreciate different traditions, music, art, and ways of life, helping to create a more connected



and understanding world. As we share our stories and experiences online, we build bridges between cultures that can lead to cooperation and friendship

## **Critical Challenges of Media, communication, and digital components in Human Society**

The future of digital media brings with it both challenges and exciting opportunities. One of the most interesting developments is the rise of augmented reality (AR) and virtual reality (VR) technologies. These technologies can create immersive storytelling experiences that allow users to feel as if they are part of the story itself. Imagine putting on a headset that takes you to a different world or using your phone to see a character from a movie standing right in your living room. This kind of technology opens up new ways for people to experience stories and interact with content.

At the same time, artificial intelligence (AI) plays a big role in shaping the future of digital media. AI algorithms can help make content more personal and relevant for each user. For example, when you watch videos or listen to music online, AI can recommend things you might like based on what you've enjoyed in the past. This means that the more you use these platforms, the better they can get at suggesting new content that fits your interests.

As digital media keeps changing and growing, it will be very important to find a balance between new innovations and using technology responsibly. While these advancements can bring many benefits, we must also think about how they affect society and our values. It is essential to make sure that everyone can enjoy the advantages of digital connectivity and creativity. We need to ensure that these benefits are available to all people, without leaving anyone behind or causing harm to ethical standards. In conclusion, the future of digital media is bright, but it requires careful thought about how we use these powerful tools.

## **Conclusion**

Digital media has completely changed how we talk to each other, get information, and enjoy culture. Its effects can be seen everywhere in society, affecting how people behave, shaping stories in our culture, and shaking up traditional businesses. As we move through this digital world, it's important to deal with problems like false information and privacy issues. At the same time, we need to make the most of what digital media can do to create connections around the world, highlight different voices, and deepen our shared understanding of life on this planet. The growth of digital media shows how creative and smart humans can be. It started with simple images and basic sounds, and now we have amazing virtual realities that feel very real. This change not only shows how technology has improved but also how our ways of connecting, communicating, and sharing our thoughts have evolved in a world that is becoming more digital every day. Digital media has opened up new ways for us to interact and express ourselves, making it a crucial part of our lives. By understanding its impact, we can work together to make our digital experiences better and more meaningful for everyone.

## **References:**

1. Fill, A., & Penz, H. (Eds.). (2017). *The Routledge handbook of ecolinguistics*. London: Routledge.
2. Hernando Velasco, A., Matsumoto, M., Dominguez-Santos, S., & Lacasa, P. (2026). Digitalization of cultural industries: Evidence from the official Spider-Man movie TikTok account. *Convergence*, 32(1), 3-32.
3. Hjarvard S. The mediatization of society: A theory of the media as agents of social and cultural change. *Nordicom review*. 2008; 29(2): 105-134. 17.
4. Lambert J. Digital storytelling: Capturing lives, creating community. Routledge; 2013. 18. Hartley J. Story circle: Digital storytelling around the world. Wiley; 2009.
5. Gauntlett D. Creative explorations: New approaches to identities and audiences. Routledge; 2007. 20.
6. Bennett WL, Segerberg A. The logic of connective action: Digital media and the personalization of contentious politics. *Information, communication & society*. 2012; 15(5): 739-768. Doi:10.1080/1369118x.2012.670661
7. Tufekci Z. Twitter and tear gas: The power and fragility of networked protest. Yale University Press; 2017. 22.
8. Sunstein CR. Republic.com 2.0. Princeton University Press; 2007.
9. Pariser E. The filter bubble: How the new personalized web is changing what we read and how we think. Penguin; 2011.
10. Flaxman S, Goel S, Rao JM. Filter bubbles, echo chambers, and online news consumption. *Public* Doi:10.1093/poq/nfw006 *opinion quarterly*. 2016; 80(S1): 298-320.
11. Castells M. The rise of the network society. *Information, society and power*. 1996. 26.
12. Rifkin J. The zero marginal cost society: The internet of things, the collaborative commons, and the eclipse of capitalism. Palgrave Macmillan; 2014.
13. Srnicek N. Platform capitalism. *Polity*; 2017.



## OriginalArticle

### The Role of Artificial Intelligence in Accounting of Small Business Enterprises: An Empirical Study of Davanagere District, Karnataka

Dr. Venkatesh Babu S

Associate Professor, Department of Commerce  
Government First Grade College (GFGC), Davanagere, Karnataka  
E-Mail: [vbsdvg@gmail.com](mailto:vbsdvg@gmail.com)

Manuscript ID: **Abstract**

JRD -2026-180612

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 56-60

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*The rapid advancement of Artificial Intelligence (AI) has significantly transformed business operations worldwide. Accounting, being one of the most information-intensive functions, has witnessed remarkable changes through AI-enabled technologies such as machine learning, robotic process automation, predictive analytics, intelligent bookkeeping, and cloud-based accounting systems. Small Business Enterprises (SBEs), which constitute a major component of India's economic structure, are increasingly adopting AI tools to improve accounting efficiency and decision-making processes. The present study investigates the role of Artificial Intelligence in accounting practices among small business enterprises in Davanagere District, Karnataka. Primary data were collected from 100 small businesses operating in retail, manufacturing, service, hospitality, trading, and agro-based sectors. The study examines AI adoption levels, benefits derived from AI-based accounting systems, challenges encountered during implementation, and the impact on accounting performance. Statistical techniques including percentage analysis, mean score analysis, correlation, Chi-square test, and ANOVA were used to analyze the data.*

*The findings reveal that AI significantly improves accounting accuracy, reduces processing time, enhances compliance, and supports strategic financial decision-making. The study further identifies technological awareness, infrastructure availability, and managerial attitude as key determinants of AI adoption among small enterprises.*

**Keywords:** Artificial Intelligence, Accounting Automation, Small Business Enterprises, Financial Reporting, Digital Accounting, Davanagere.

#### Introduction

The twenty-first century has witnessed unprecedented technological developments that have fundamentally transformed business operations. Artificial Intelligence has emerged as one of the most disruptive technologies affecting accounting and financial management. AI refers to computer systems capable of performing tasks that traditionally require human intelligence, including learning, reasoning, problem-solving, and decision-making.

Accounting has traditionally involved extensive manual processing of financial transactions, preparation of reports, tax compliance, auditing, and financial analysis. With the emergence of AI-powered accounting systems, many of these activities have become automated. AI technologies can process large volumes of financial data quickly and accurately, reducing human intervention and improving organizational efficiency. Small Business Enterprises play a vital role in India's economy by contributing significantly to employment generation, entrepreneurship development, and regional economic growth. In Karnataka, particularly in Davanagere District, thousands of small businesses operate across diverse sectors. These enterprises often face challenges related to bookkeeping, compliance management, financial planning, and resource constraints. AI-based accounting solutions such as QuickBooks AI, Zoho Books, Tally Prime with AI functionalities, Xero, SAP Business One, and cloud accounting platforms offer opportunities for enhancing operational effectiveness.

#### Creative Commons (CC BY-NC-SA 4.0)

*This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.*

#### Address for correspondence:

Dr. Venkatesh Babu S , Associate Professor, Department of Commerce Government First Grade College (GFGC), Davanagere, Karnataka

#### How to cite this article:

Venkatesh Babu S. (2026). The Role of Artificial Intelligence in Accounting of Small Business Enterprises: An Empirical Study of Davanagere District, Karnataka. *Journal of Research and Development*, 18(6 (I)), 56–60. <https://doi.org/10.5281/zenodo.20636754>



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20636754





Understanding the extent and impact of AI adoption among local enterprises is therefore important for policymakers, educators, and business practitioners.

## Statement Of the Problem

Although AI-based accounting technologies have become increasingly accessible, adoption among small business enterprises remains uneven. Several enterprises continue to rely on traditional accounting methods due to lack of awareness, technological skills, financial resources, and concerns regarding data security.

The study seeks to investigate how AI is transforming accounting practices among small business enterprises in Davanagere District and whether these technologies contribute to improved accounting performance and business competitiveness.

## Significance Of the Study

The study contributes to the growing body of knowledge on digital transformation and accounting innovation. It is expected to:

- Provide insights into AI adoption among small businesses.
- Assist policymakers in promoting digital accounting.
- Help educational institutions design industry-relevant curricula.
- Support entrepreneurs in understanding the benefits of AI-based accounting.
- Contribute empirical evidence to accounting and management literature.

## Objectives Of the Study

1. To examine the level of Artificial Intelligence adoption in accounting practices among small business enterprises in Davanagere District.
2. To analyze the impact of AI on accounting efficiency, accuracy, and financial decision-making.
3. To identify challenges and barriers affecting AI implementation among small business enterprises.

## Research Hypotheses

### H01

There is no significant relationship between AI adoption and accounting efficiency.

### H02

There is no significant relationship between AI usage and financial reporting accuracy.

### H03

There is no significant difference in AI adoption across different sectors of small business enterprises.

## Conceptual Framework

### Independent Variable:

Artificial Intelligence Adoption

### Dimensions:

- Automated Bookkeeping
- Invoice Processing
- Payroll Automation
- Tax Compliance Automation
- Predictive Analytics
- Cloud Accounting

### Dependent Variables:

- Accounting Efficiency
- Financial Reporting Accuracy
- Cost Reduction
- Decision-Making Quality
- Business Performance

### Moderating Factors:

- Firm Size
- Owner Education
- Technology Readiness
- Employee Skills

## Review Of Literature

### 1. Sutton, Holt and Arnold (2016)

The authors argued that AI technologies have transformed accounting information systems by enabling automation and intelligent decision support.

### 2. Issa, Sun and Vasarhelyi (2016)



The study emphasized AI's potential in auditing and accounting analytics through automated pattern recognition and anomaly detection.

### 3. Kokina and Davenport (2017)

Researchers highlighted the growing adoption of robotic process automation in accounting functions and its influence on organizational efficiency.

### 4. Marshall and Lambert (2018)

The study reported that cloud-based AI accounting systems provide enhanced accessibility and cost savings for SMEs.

### 5. Moll and Yigitbasioglu (2019)

The authors examined digital transformation in accounting and observed substantial improvements in reporting quality.

### 6. Soni (2020)

The study found that Indian businesses increasingly utilize AI-powered accounting applications to improve financial operations.

### 7. Kroon et al. (2021)

Researchers demonstrated that AI adoption positively influences accounting productivity and organizational performance.

### 8. Gupta and Sharma (2022)

The authors concluded that AI technologies support compliance management and reduce accounting errors in SMEs.

### 9. Kumar and Prakash (2023)

The study highlighted the importance of AI-enabled accounting systems for sustainable business growth.

### 10. Ahmed and Khan (2024)

The researchers reported significant improvements in financial decision-making among businesses adopting AI-driven accounting software.

## 8. Research Methodology

### Research Design

Descriptive and analytical research design.

### Area of Study

Davanagere District, Karnataka.

### Sources of Data

#### Primary Data

Structured questionnaire.

#### Secondary Data

Books, journals, conference proceedings, government publications, and online databases.

### Sampling Method

Purposive Sampling.

### Sample Size

100 Small Business Enterprises.

### Sector Distribution

| Sector        | Respondents |
|---------------|-------------|
| Retail        | 30          |
| Manufacturing | 20          |
| Service       | 25          |
| Hospitality   | 10          |
| Trading       | 10          |
| Agro-Based    | 5           |
| <b>Total</b>  | <b>100</b>  |

## Data Analysis and Interpretation

Table 1: AI Adoption among Respondents

| Response    | Frequency | Percentage |
|-------------|-----------|------------|
| Adopted AI  | 68        | 68%        |
| Not Adopted | 32        | 32%        |
| Total       | 100       | 100%       |

## Interpretation

A majority of respondents (68%) have adopted AI-enabled accounting tools.

**Table 2: Mean Scores of AI Benefits**

| Benefit                | Mean Score |
|------------------------|------------|
| Time Saving            | 4.42       |
| Improved Accuracy      | 4.35       |
| Better Decision Making | 4.28       |
| Cost Reduction         | 4.10       |
| Compliance Management  | 4.05       |

## Interpretation

Time-saving and improved accuracy are perceived as the most significant benefits.

## 10. Reliability Analysis

### Cronbach's Alpha

| Variable                    | Alpha Value |
|-----------------------------|-------------|
| AI Adoption Scale           | 0.842       |
| Accounting Efficiency Scale | 0.866       |
| Financial Accuracy Scale    | 0.815       |

**Interpretation:** All values exceed 0.70, indicating acceptable reliability.

## 11. Correlation Analysis

| Variables                           | Correlation (r) |
|-------------------------------------|-----------------|
| AI Adoption & Accounting Efficiency | 0.721           |
| AI Adoption & Financial Accuracy    | 0.684           |
| AI Adoption & Decision Making       | 0.698           |

## Interpretation

Strong positive relationships exist between AI adoption and accounting outcomes.

## 12. CHI-SQUARE TEST

### Hypothesis H01

| Value      | Result |
|------------|--------|
| Chi-Square | 12.56  |
| p-value    | 0.003  |

## Decision

Since  $p < 0.05$ , H01 is rejected.

There is a significant relationship between AI adoption and accounting efficiency.

## 13. Anova Test

### Hypothesis H03

| Source          | F Value | Significance |
|-----------------|---------|--------------|
| Between Sectors | 4.321   | 0.008        |

## Decision

Since  $p < 0.05$ , H03 is rejected.

AI adoption differs significantly across sectors.

## 14. Findings

1. AI adoption among small businesses is steadily increasing.
2. AI significantly improves accounting accuracy.
3. Automated bookkeeping reduces manual workload.
4. AI supports faster preparation of financial reports.
5. Decision-making quality improves through predictive analytics.
6. Retail and service sectors exhibit higher adoption levels.
7. Lack of technical expertise remains a major challenge.
8. Data privacy concerns influence technology acceptance.
9. Training and awareness positively affect adoption rates.



10. AI contributes to business competitiveness and sustainability.

## 15. Suggestions

1. Government should promote digital accounting literacy programmes.
2. MSMEs should receive financial assistance for technology adoption.
3. Educational institutions should introduce AI-based accounting curricula.
4. Industry associations should organize awareness workshops.
5. Cybersecurity mechanisms should be strengthened.
6. Affordable AI accounting software should be developed for rural enterprises.

## 16. Conclusion

Artificial Intelligence has emerged as a transformative force in accounting practices among small business enterprises. The study demonstrates that AI adoption contributes significantly to accounting efficiency, financial accuracy, compliance management, and managerial decision-making. Although challenges such as implementation cost, skill shortages, and cybersecurity concerns persist, the future prospects of AI in accounting remain highly promising. For small business enterprises in Davanagere District, AI offers a strategic pathway toward enhanced competitiveness, operational excellence, and sustainable growth.

## References

1. Ahmed, R., & Khan, S. (2024). Artificial intelligence adoption and financial performance among SMEs. *Journal of Business Analytics*, 8(2), 45–61.
2. Davenport, T. H., & Kirby, J. (2016). *Only Humans Need Apply*. Harper Business.
3. Gupta, R., & Sharma, P. (2022). Artificial intelligence adoption in accounting practices of SMEs. *International Journal of Accounting Research*, 10(2), 45–58.
4. Issa, H., Sun, T., & Vasarhelyi, M. A. (2016). Research ideas for artificial intelligence in auditing. *Journal of Emerging Technologies in Accounting*, 13(2), 1–20.
5. Kokina, J., & Davenport, T. H. (2017). The emergence of artificial intelligence. *Journal of Emerging Technologies in Accounting*, 14(1), 115–122.
6. Kroon, N., Alves, M., & Martins, I. (2021). AI adoption and accounting performance. *International Journal of Business Information Systems*, 36(4), 421–438.
7. Kumar, S., & Prakash, R. (2023). AI applications in accounting and financial management. *Indian Journal of Commerce and Management Studies*, 14(1), 25–38.
8. Marshall, T., & Lambert, S. (2018). Cloud accounting and artificial intelligence. *Accounting and Finance Review*, 28(3), 77–91.
9. Moll, J., & Yigitbasioglu, O. (2019). The role of internet-related technologies in shaping accounting practices. *British Accounting Review*, 51(6), 100833.
10. Soni, V. D. (2020). Emerging role of artificial intelligence in accounting and finance. *International Journal of Innovative Research in Technology*, 7(4), 15–22.
11. Sutton, S. G., Holt, M., & Arnold, V. (2016). Artificial intelligence in accounting. *International Journal of Accounting Information Systems*, 22, 60–73.



## OriginalArticle

### Artificial Intelligence (AI) In Commerce and Business Development

Dr. Shamala K

Associate Professor of Commerce,  
Govt. First Grade Women's College Davanagere.

Manuscript ID: **Abstract**

JRD -2026-180613

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 61-65

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*Artificial Intelligence (AI) has become a powerful force driving innovation and transformation in commerce and business development. By integrating advanced technologies such as machine learning, predictive analytics, natural language processing, and automation, organizations are improving operational efficiency, enhancing customer experiences, and strengthening strategic decision-making. AI applications are increasingly utilized in customer relationship management, marketing and sales, e-commerce, supply chain management, financial services, human resource management, and business intelligence. These applications enable businesses to analyze large volumes of data, predict market trends, personalize services, and optimize resource utilization. The study examines the concept of AI in commerce, reviews relevant literature, and highlights its major applications, benefits, challenges, and future trends. While AI offers significant advantages in terms of productivity, innovation, scalability, and competitive advantage, organizations also face challenges related to data privacy, ethical concerns, skill shortages, regulatory compliance, and workforce displacement. The findings suggest that responsible and strategic adoption of AI can contribute substantially to sustainable business growth and economic development. As AI technologies continue to evolve, they are expected to play an increasingly central role in shaping the future of commerce and business ecosystems.*

**Keywords:** Artificial Intelligence (AI), Commerce, Business Development, Machine Learning, Predictive Analytics, E-Commerce, Customer Relationship Management (CRM), Supply Chain Management, Business Intelligence, Automation, Entrepreneurship, Digital Transformation, Competitive Advantage, Innovation, Sustainable Growth

#### 1. Introduction

The digital revolution has fundamentally transformed business operations across the globe. Among emerging technologies, Artificial Intelligence (AI) has become one of the most influential drivers of organizational change. AI refers to computer systems capable of performing tasks that typically require human intelligence, including learning, reasoning, problem-solving, decision-making, and language understanding.

Businesses today operate in highly competitive and data-intensive environments. Traditional decision-making approaches are increasingly being replaced by AI-driven analytics and automation systems. Organizations utilize AI to analyse customer behaviour, forecast market trends, automate routine processes, and improve operational efficiency. The integration of AI into commerce has led to significant innovations in online retailing, customer service, logistics, financial management, and marketing. AI-powered recommendation systems, virtual assistants, chatbots, predictive analytics, and automated supply chains have become common features of modern business operations. Research indicates that AI has become a strategic resource for achieving competitive advantage and fostering business growth.

This paper explores the significance of AI in commerce and business development, examines current applications, reviews existing literature, and discusses future opportunities and challenges.



Quick Response Code:



Website:

<https://jrdryb.org/>

DOI:

10.5281/zenodo.20636788



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Shamala K, Associate Professor of Commerce, Govt. First Grade Women's College Davanagere.

#### How to cite this article:

Shamala K. (2026). Artificial Intelligence (AI) In Commerce and Business Development. *Journal of Research and Development*, 18(6 (I)), 61–65. <https://doi.org/10.5281/zenodo.20636788>



## 2. Objectives of the Study

The major objectives are:

1. To understand the concept of AI in commerce and business development.
2. To review existing literature related to AI applications in business.
3. To identify major applications of AI in commerce.
4. To analyse the benefits and challenges of AI adoption.
5. To examine future trends and opportunities in AI-driven business development.

## 3. Research Methodology

This study is based on a qualitative and conceptual research design. Secondary data have been collected from academic journals, books, research papers, industry reports, and online databases.

The study employs descriptive and analytical approaches to evaluate the impact of AI on commerce and business development.

## 4. Review of Literature

**Agarwal et al. (2021)** conducted a comprehensive review of AI research in business and identified organizational impact, societal impact, AI systems, and AI methodologies as major research clusters. They highlighted AI's role in strategic decision-making and innovation.

**Bawack et al. (2022)** analyzed AI applications in e-commerce and found that recommendation systems, personalization, sentiment analysis, and customer trust are major themes in AI-enabled commerce. The study emphasized the growing importance of AI in enhancing customer experiences and operational efficiency.

**Rani and Kumar (2025)** performed a bibliometric analysis of AI in management and commerce and concluded that AI significantly improves decision-making, process optimization, and organizational innovation.

**Uriarte et al. (2025)** reviewed AI technologies in entrepreneurship and observed that AI creates new entrepreneurial opportunities while transforming business processes and innovation ecosystems.

**Paul (2025)** examined AI integration in e-commerce business models and found that machine learning, predictive analytics, dynamic pricing, and logistics automation contribute significantly to business performance and customer engagement.

**Chugh and Jain (2024)** investigated AI empowerment in e-commerce and highlighted product recommendations, customer support systems, and advanced analytics as critical research themes.

The literature collectively demonstrates that AI is increasingly becoming a strategic tool for enhancing competitiveness, innovation, and business growth.

## 5. Concept of Artificial Intelligence in Commerce

Artificial Intelligence refers to the ability of machines and software systems to simulate human intelligence and perform cognitive tasks.

In commerce, AI is used to:

Analyze large datasets.

Predict customer behavior.

Automate business processes.

Improve customer service.

Optimize supply chain operations.

Support strategic decision-making.

AI enables businesses to convert raw data into actionable insights, improving organizational performance and market responsiveness.

## 6. Applications of AI in Commerce and Business Development

### 6.1 Customer Relationship Management (CRM)

AI-powered CRM systems analyze customer interactions and preferences to deliver personalized experiences.

Benefits include:

Customer segmentation

Personalized recommendations

Improved customer retention

Enhanced customer satisfaction

Companies use AI algorithms to predict customer needs and provide targeted solutions.

### 6.2 Marketing and Sales

AI has transformed marketing through:

Predictive analytics

Programmatic advertising

Customer targeting

Dynamic pricing

Content personalization



AI systems analyse consumer behaviour and market trends to optimize marketing strategies and improve conversion rates.

### 6.3 E-Commerce

AI plays a critical role in modern e-commerce through:

Product recommendation engines

Virtual shopping assistants

Chabot's

Fraud detection

Inventory management

Major e-commerce platforms use AI to provide personalized shopping experiences and improve operational efficiency.

### 6.4 Supply Chain Management

AI helps organizations optimize supply chain operations by:

Demand forecasting

Route optimization

Warehouse automation

Inventory management

AI-driven supply chains reduce operational costs and improve delivery performance.

### 6.5 Financial Management

AI applications in finance include:

Credit risk assessment

Fraud detection

Automated trading

Financial forecasting

Robo-advisory services

These technologies enhance accuracy and efficiency in financial decision-making.

### 6.6 Human Resource Management

AI assists HR departments through:

- Recruitment automation
- Employee performance evaluation
- Workforce planning
- Training recommendations

AI-powered recruitment tools help organizations identify suitable candidates efficiently.

### 6.7 Business Intelligence and Analytics

AI enables businesses to transform large volumes of data into strategic insights.

Applications include:

- Market analysis
- Customer analytics
- Competitive intelligence
- Predictive modelling

Organizations use AI-driven analytics to support evidence-based decision-making.

## 7. Benefits of AI in Business Development

### 7.1 Enhanced Decision-Making

AI provides real-time insights that improve strategic and operational decisions.

### 7.2 Increased Productivity

Automation of repetitive tasks enables employees to focus on high-value activities.

### 7.3 Cost Reduction

AI reduces labour costs, minimizes errors, and improves resource utilization.

### 7.4 Improved Customer Experience

Personalized services increase customer satisfaction and loyalty.

### 7.5 Innovation and Competitive Advantage

AI enables organizations to develop innovative products, services, and business models.

### 7.6 Business Scalability

AI systems can manage growing volumes of data and transactions efficiently.

## 8. Challenges of AI Adoption

Despite its advantages, AI implementation faces several challenges.

### 8.1 Data Privacy and Security

Businesses must protect sensitive customer information from unauthorized access.

### 8.2 Ethical Concerns

Issues include:



Algorithmic bias

Transparency

Accountability

Organizations must ensure fair and responsible AI practices.

### 8.3 High Implementation Costs

AI adoption often requires substantial investments in infrastructure, software, and expertise.

### 8.4 Skill Gaps

Many organizations lack employees with AI-related skills and technical knowledge.

### 8.5 Regulatory Compliance

Businesses must comply with evolving legal and regulatory frameworks governing AI technologies.

### 8.6 Workforce Displacement

Automation may reduce demand for certain job categories, requiring workforce reskilling and adaptation.

## 9. AI and Entrepreneurship

AI has become a catalyst for entrepreneurial growth.

Entrepreneurs use AI for:

Business planning

Market research

Customer acquisition

Product development

Competitive analysis

AI-powered tools help start-ups reduce operational costs and improve innovation capabilities. Research suggests that AI is reshaping entrepreneurial ecosystems by creating new opportunities and transforming business models.

## 10. Future Trends in AI and Business Development

### 10.1 Generative AI

Generative AI technologies are expected to transform content creation, customer service, and product design.

### 10.2 Hyper-Personalization

Businesses will increasingly use AI to deliver highly customized customer experiences.

### 10.3 Autonomous Business Operations

AI systems will automate complex business processes with minimal human intervention.

### 10.4 AI-Powered Sustainability

Organizations will use AI to optimize energy consumption and support sustainable business practices.

### 10.5 AI and Internet of Things (IoT)

The integration of AI and IoT will enable intelligent and connected business ecosystems.

### 10.6 Ethical and Responsible AI

Future business strategies will emphasize transparency, fairness, accountability, and responsible AI governance.

## 11. Findings of the Study

1. AI is transforming commerce and business development across industries.
2. AI enhances decision-making through predictive analytics and data intelligence.
3. E-commerce, marketing, finance, and supply chain management are major beneficiaries of AI.
4. AI improves productivity, customer experience, and organizational competitiveness.
5. Challenges include ethical concerns, data privacy issues, skill shortages, and regulatory complexities.
6. Future business growth will increasingly depend on AI-driven innovation and responsible governance.

## 12. Suggestions

1. Businesses should invest in AI education and workforce training.
2. Organizations should establish ethical AI frameworks.
3. Governments should develop clear AI regulations.
4. Small and medium enterprises should adopt scalable AI solutions.
5. Companies should prioritize data security and privacy protection.
6. Continuous monitoring and evaluation of AI systems should be implemented.

## 13. Conclusion

Artificial Intelligence has emerged as a transformative technology that is reshaping commerce and business development worldwide. By enabling automation, predictive analytics, personalized customer experiences, and intelligent decision-making, AI provides organizations with unprecedented opportunities for growth and innovation. The integration of AI into marketing, finance, supply chain management, human resources, and e-commerce has significantly enhanced operational efficiency and competitive advantage.

Despite these benefits, organizations face challenges related to ethics, privacy, security, workforce adaptation, and regulatory compliance. Therefore, successful AI adoption requires a balanced approach that combines technological innovation with responsible governance and human-centered strategies.



As AI technologies continue to evolve, they will become increasingly central to business development and economic progress. Organizations that strategically embrace AI while addressing associated risks will be better positioned to thrive in the digital economy.

## References:

1. Agarwal, P., et al. (2021). Artificial intelligence in business: State of the art and future research agenda. *Journal of Business Research*, 129, 911–926.
2. Bawack, R. E., Wamba, S. F., Carillo, K. D. A., & Akter, S. (2022). Artificial intelligence in e-commerce: A bibliometric study and literature review. *Electronic Markets*, 32(1), 297–338.
3. Chugh, P., & Jain, V. (2024). Artificial Intelligence (AI) Empowerment in E-Commerce: A Bibliometric Voyage. *Vision: The Journal of Business Perspective*.
4. Paul, R. (2025). AI integration in e-commerce business models: Case studies on Amazon FBA, Airbnb, and Turo operations. SSRN Working Paper.
5. Rani, B., & Kumar, A. (2025). Mapping the impact of artificial intelligence on management and commerce: A bibliometric analysis. *International Journal of Business and Society*.
6. Uriarte, S., Baier-Fuentes, H., Espinoza-Benavides, J., & Inzunza-Mendoza, W. (2025). Artificial intelligence technologies and entrepreneurship: A hybrid literature review. *Review of Managerial Science*.
7. Dias, F. S., & Lauretta, G. A. (2024). The transformative impact of AI and deep learning in business: A literature review. arXiv.
8. Soni, N., Sharma, E. K., Singh, N., & Kapoor, A. (2019). Impact of artificial intelligence on businesses: From research, innovation, market deployment to future shifts in business models. arXiv.
9. Kusetogullari, A., Kusetogullari, H., Andersson, M., & Gorschek, T. (2025). GenAI in entrepreneurship: A systematic review of generative artificial intelligence in entrepreneurship research. arXiv.
10. Abbasi, M., Nishat, R. I., Bond, C., Graham-Knight, J. B., Lasserre, P., Lucet, Y., & Najjaran, H. (2024). A review of AI and machine learning contribution in predictive business process management. arXiv.



## Original Article

### Digital Transformation in Education Through Artificial Intelligence (AI)

Dr. Shambhulingappa. F. Nallanavar

Associate Professor, Department of Commerce, Govt. First Grade College Davangere, Dental College Road, MCC B Block, Vidyanagar, Davangere

Manuscript ID:

**Abstract**

JRD -2026-180614

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 66-69

June- 2026

Submitted: 10 May. 2026

Revised: 25 May. 2026

Accepted: 10 June 2026

Published: 30 June 2026

Digital transformation has emerged as a significant force in reshaping educational systems, with Artificial Intelligence (AI) playing a central role in enhancing teaching, learning, assessment, and administration. AI technologies such as machine learning, natural language processing, predictive analytics, and intelligent tutoring systems provide personalized learning experiences and improve educational effectiveness. This study examines the role of AI in driving digital transformation in education and explores its applications, benefits, challenges, and future prospects. AI-enabled tools support personalized learning, automated assessment, learning analytics, virtual assistants, content development, and administrative automation, thereby increasing efficiency and student engagement. Furthermore, AI contributes to inclusive education by facilitating assistive technologies, multilingual learning, adaptive instruction, and remote access to educational resources. Despite its numerous advantages, the adoption of AI in education faces challenges related to data privacy, algorithmic bias, the digital divide, teacher preparedness, ethical concerns, and implementation costs. The study emphasizes the importance of responsible and human-centered AI integration supported by strong governance frameworks and digital infrastructure. The findings indicate that AI has the potential to create more accessible, equitable, and future-ready educational systems while complementing the role of teachers in fostering meaningful learning experiences.

**Keywords:** Artificial Intelligence (AI), Digital Transformation, Education, Personalized Learning, Intelligent Tutoring Systems, Learning Analytics, Educational Technology, Inclusive Education, Automated Assessment, Virtual Assistants, Adaptive Learning, Digital Learning, Student Engagement, Educational Innovation, Human-Centered AI

#### 1.1 Introduction

The rapid advancement of digital technologies has transformed various sectors of society, including education. Educational institutions are increasingly integrating digital tools to improve teaching, learning, administration, and student engagement. Digital transformation in education refers to the adoption of digital technologies to redesign educational processes, enhance learning experiences, and improve institutional effectiveness. Artificial Intelligence (AI) has become one of the most influential technologies driving this transformation. AI refers to computer systems capable of performing tasks that typically require human intelligence, such as reasoning, problem-solving, learning, decision-making, and language understanding. In education, AI-powered systems analyze large volumes of data, identify patterns, and provide personalized learning experiences that improve educational outcomes. The COVID-19 pandemic accelerated the adoption of digital learning platforms and highlighted the importance of technology-enabled education. Educational institutions worldwide adopted online learning, virtual classrooms, and AI-driven tools to maintain educational continuity. As a result, AI has become increasingly important in creating flexible, adaptive, and inclusive learning environments.

This paper explores the role of AI in educational transformation, reviews scholarly literature, examines applications and benefits, discusses challenges, and suggests strategies for effective implementation.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Shambhulingappa. F. Nallanavar, Associate Professor, Department of Commerce, Govt. First Grade College Davangere, Dental College Road, MCC B Block, Vidyanagar, Davangere

#### How to cite this article:

Shambhulingappa. F. Nallanavar. (2026). Digital Transformation in Education Through Artificial Intelligence (AI). *Journal of Research and Development*, 18(6 (I)), 68–69. <https://doi.org/10.5281/zenodo.20636814>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636814





## 1.2 Objectives of the Study

1. To understand the concept of digital transformation in education through AI.
2. To examine major AI applications in educational settings.
3. To review existing literature on AI in education.
4. To analyze the benefits and challenges of AI adoption.
5. To evaluate the role of AI in inclusive education.
6. To provide recommendations for responsible implementation.

## 1.3 Concept of Digital Transformation in Education

Digital transformation in education involves integrating digital technologies into teaching, learning, assessment, administration, and communication processes. It represents a shift from traditional classroom-based instruction toward technology-enhanced and learner-centered education.

The primary goals of digital transformation include:

- Enhancing learning outcomes.
- Improving accessibility and flexibility.
- Supporting personalized learning.
- Increasing administrative efficiency.
- Promoting lifelong learning.

AI plays a central role in achieving these goals by enabling adaptive learning environments, predictive analytics, intelligent tutoring systems, and automated educational services.

## 1.4 Artificial Intelligence in Education

Artificial Intelligence refers to technologies that enable machines to perform cognitive tasks similar to human intelligence. AI applications in education utilize machine learning, natural language processing, computer vision, expert systems, and predictive analytics.

The educational AI ecosystem consists of:

- Students
- Teachers
- Educational institutions
- Learning management systems
- Educational content providers
- Government agencies

AI facilitates interactions among these stakeholders and contributes to more efficient and effective educational processes.

## 1.5 Review of Literature

**Luckin et al. (2016)** argued that AI has the potential to enhance learning outcomes through personalized learning experiences and intelligent support systems. Their study emphasized that AI should complement rather than replace teachers.

**Holmes, Bialik, and Fadel (2019)** explored the promises and implications of AI in education. The authors found that AI can improve teaching effectiveness, learner engagement, and assessment practices while raising concerns about ethics and privacy.

**Tuomi (2018)** highlighted the transformative impact of AI on educational systems. The study suggested that AI could reshape curriculum design, teaching methodologies, and institutional management.

**Zawacki-Richter et al. (2019)** conducted a systematic review of AI research in higher education. Their findings revealed increasing use of AI for student support, assessment, and administrative functions. However, they also identified a lack of research on ethical and social implications.

**Chen, Chen, and Lin (2020)** reviewed AI applications in education and concluded that AI technologies positively influence student engagement, achievement, and personalized learning. They emphasized the importance of teacher training and institutional readiness.

**UNESCO (2021)** advocated a human-centered approach to AI in education and stressed the importance of transparency, accountability, inclusion, and ethical governance.

The literature consistently demonstrates that AI offers substantial opportunities for educational innovation while highlighting the need for ethical safeguards and equitable access.

## 1.6 Applications of AI in Education

### I Personalized Learning

AI enables personalized learning by adapting content, pace, and instructional strategies according to individual learner needs. Adaptive learning systems analyze student performance and recommend appropriate learning materials.

### II. Intelligent Tutoring Systems

AI-powered tutoring systems provide individualized instruction and real-time feedback. These systems mimic one-to-one tutoring and support students outside classroom hours.



### III. Automated Assessment

AI can automate grading of quizzes, assignments, and examinations. Automated assessment reduces workload for teachers and provides immediate feedback to learners.

### IV. Learning Analytics

Learning analytics uses AI algorithms to analyze educational data and generate insights about student performance. Institutions can identify at-risk students and implement timely interventions.

### V. Virtual Assistants and Chatbots

Educational chatbots assist students by answering questions, providing reminders, and offering academic support 24/7.

### VI. Content Development

AI tools help educators create lesson plans, educational materials, assessments, and multimedia content efficiently.

### VII. Administrative Automation

Educational institutions use AI for admissions, scheduling, enrollment management, and resource allocation.

#### 1.7 Benefits of AI in Education

##### a. Improved Learning Outcomes

Personalized instruction enables students to learn at their own pace, resulting in improved academic performance.

##### b. Enhanced Student Engagement

Interactive AI tools increase learner motivation and participation.

##### c. Efficient Administration

Automation reduces repetitive administrative tasks and allows educators to focus on teaching.

##### d. Accessibility

AI supports students with disabilities through assistive technologies such as speech recognition and text-to-speech systems.

##### e. Data-Driven Decision Making

Educational leaders can use analytics to improve planning, curriculum development, and resource allocation.

##### f. Lifelong Learning

AI facilitates continuous learning by providing flexible and adaptive educational opportunities.

#### 1.8 AI and Inclusive Education

Inclusive education seeks to ensure equal educational opportunities for all learners regardless of their physical, social, economic, or geographical circumstances.

AI contributes to inclusive education through:

##### i. Assistive Technologies

Students with disabilities benefit from AI-powered tools such as:

- Speech recognition systems
- Text-to-speech applications
- Automated captioning
- Language translation tools

##### ii. Multilingual Learning

AI enables translation and language support for diverse student populations.

##### iii. Remote Education

AI-powered online learning platforms extend educational access to rural and underserved communities.

##### iv. Adaptive Learning

Adaptive systems accommodate diverse learning styles and abilities, promoting educational equity.

#### 1.9 Challenges of AI in Education

##### i. Privacy and Data Security

Educational institutions collect large amounts of student data, raising concerns about privacy and security.

##### ii. Algorithmic Bias

AI systems may generate unfair outcomes if trained on biased datasets.

##### iii. Digital Divide

Limited access to digital infrastructure can increase educational inequalities.

##### iv. Teacher Preparedness

Many educators require training to effectively integrate AI into teaching practices.

##### v. Ethical Concerns

Issues such as transparency, accountability, and explainability remain important challenges.

##### vi. Cost of Implementation

Developing and maintaining AI systems requires significant financial investment.

#### 1.10 Future Trends in AI and Education

Several emerging trends are expected to shape the future of education:



- Generative AI for content creation.
- AI-powered personalized learning companions.
- Integration of AI with Virtual Reality (VR) and Augmented Reality (AR).
- Predictive analytics for student success.
- Smart classrooms and intelligent campuses.
- Lifelong learning ecosystems supported by AI.

These innovations are expected to enhance educational quality, accessibility, and efficiency.

## 1.11 Recommendations

To maximize the benefits of AI in education, the following measures are recommended:

1. Develop comprehensive AI policies and governance frameworks.
2. Strengthen cybersecurity and data privacy protections.
3. Invest in digital infrastructure and internet connectivity.
4. Promote AI literacy among teachers and students.
5. Ensure equitable access to AI technologies.
6. Encourage ethical and transparent AI practices.
7. Support research and innovation in educational technology.
8. Establish continuous monitoring and evaluation systems.

## 1.12 Conclusion

Artificial Intelligence is transforming education by enhancing teaching, learning, assessment, and administration. AI-driven technologies provide personalized learning experiences, improve accessibility, support inclusive education, and increase institutional efficiency. Despite these benefits, challenges such as privacy concerns, ethical issues, digital inequality, and infrastructure limitations require careful attention.

The successful implementation of AI depends on balancing technological innovation with human-centered educational values. Teachers remain essential in guiding, mentoring, and supporting learners. By adopting ethical frameworks, investing in infrastructure, and promoting digital inclusion, educational institutions can leverage AI to create more equitable, efficient, and future-ready educational systems.

## References

1. Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264–75278.
2. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
3. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.
4. Tuomi, I. (2018). *The impact of artificial intelligence on learning, teaching, and education*. European Commission.
5. UNESCO. (2021). *AI and education: Guidance for policy-makers*. UNESCO Publishing.
6. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education*, 16(1), 1–27.



## OriginalArticle

### Green Account Management Practices in India: An Analysis of Selected Indian Banks

Fakiresh Jalihal <sup>1</sup> Dr. Ranjini M. L <sup>2</sup> Dr. Rajith Kumar H B <sup>3</sup>

<sup>1</sup>Research Scholar, S. S. Patil Research Foundation

(A Recognised Research Centre by University of Mysore)

B R Tambakad First Grade College and PG Studies, Hirekerur, Karnataka.

<sup>2</sup>Professor & Research Supervisor, Department of Commerce

S. S. Patil Research Foundation (A Recognised Research Centre by University of Mysore) B R Tambakad First Grade

College and PG Studies

Hirekerur, Karnataka

<sup>3</sup> Director, S. S. Patil Research Foundation, (A Recognised Research Centre by University of Mysore) B R Tambakad

First Grade College and PG Studies, Hirekerur, Karnataka

#### Manuscript ID: *Abstract:*

JRD -2026-180615

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 70-73

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*The phrase "Be Greens" is relevant in all areas of India these days. Thus, the keeping money section introduced the contemporary idea of green bank account management. The idea of "green managing an account" consists of two terms: "green" refers to environmental protection, and "managing an account" is defined as using a bank's services. As a result, "green keeping money" is thought to represent everything that connects the entire economy and the viewpoints associated with natural assurance. The bank will now switch from the traditional structure for keeping money to the modern one. In order to progress universally viable advancement, banks play a crucial role. A green banking is just a regular bank that takes into account all the natural and social factors that contribute to protecting the environment and conserving shared resources. By using online banking instead of departmental banking, green banking promotes eco-friendly practices and reduces carbon emissions. SBI focuses on its natural activities, such as providing loans at discounted rates for renewable energy projects, establishing advanced banking facilities, carrying out energy conservation initiatives like installing solar-powered ATMs throughout India, managing waste, reducing the use of paper and water, lowering nursery gas outflows, etc. During the year 2010, the HDFC Bank has focused on environmental issues and reduced the outflow of nursery gas. The bank is dedicated to using renewable energy in its business processes. This paper's main goal is to learn about the actions made by the Housing Development Finance Corporation (Indian Private Sector Bank) and SBI (Indian Public Division Bank) regarding green account management.*

**Keywords:** Green account management, cost reduction, SBI, and HDFC Bank.

#### Introduction:

The phrase "Be Greens" is now relevant for all Indian divisions. Thus, the underutilized idea of Green Storing money in banks was introduced by the account management division. The phrase "green" refers to the protection of the environment, whereas "managing an account" refers to the use of a bank's services. Green money management is thought to depict everything that connects the perspectives on natural security and the entire economy. The bank has now transitioned from traditional account management to state-of-the-art account management. Generally speaking, banks are essential to the advancement of economic progress. A green banking institutions is a regular bank that takes into account all the natural and social factors that contribute to protecting the environment and maintaining regular assets. Green banking promotes eco-friendly practices and reduces carbon emissions by using online account management instead of department banking.



Quick Response Code:



Website:

<https://jrdrv.org/>

DOI:

10.5281/zenodo.20636840



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Fakiresh Jalihal, Research Scholar, S. S. Patil Research Foundation (A Recognised Research Centre by University of Mysore) B R Tambakad First Grade College and PG Studies, Hirekerur, Karnataka.

#### How to cite this article:

Fakiresh Jalihal, Ranjini M. L., & Rajith Kumar H B. (2026). Green Account Management Practices in India: An Analysis of Selected Indian Banks. *Journal of Research and Development*, 18(6 (I)), 70–73. <https://doi.org/10.5281/zenodo.20636840>



## Objectives:

1. To consider State Bank of India and Housing Development Finance Corporation Bank's green account management practices.
2. To consider the conceptual framework and legal framework for greener account management in India.
3. To examine and contrast the various open and private Indian banks' attempts at green account management.

## Research Methodology:

It's a graphic-based ponder. The data is gathered via auxiliary information gathering techniques, such as writing surveys, distributing books, magazines, daily newspapers, articles, and the SBI and HDFC bank's 2023–2024 Maintainability and Supportability reports.

## Review Of Literature:

In the research study, Dr. B.S. Sevela (2020) A comparative analysis of eco-friendly hones through bank analyses has shown that, with the decline of paperless innovation advancement, its appearance has been highlighted with the presentation of biometrics acting as security measures for lockers in banks instead of locks and databases for the capacity of documents killing the enormous records for documents of past and future history, online passbook overhauls, etc. They follow natural standards for lending, which is a really wonderful idea that will encourage business owners to change their operations to be more environmentally friendly, which is fantastic for our future generations. In fact, banks are using other common assets to improve their operations without damaging the environment. Comfortable lives without resource waste are the result of green money management.

In their article "Green keeping funds Hones in India as a natural point of view," Prof. Olekar R.O. as well as Shailaja D. (2021) looked at SBI and ICICI and found that, despite the fact that account management is done online, green keeping money helps reduce both internal and external carbon emissions. Since everything in green banking is done online, reducing the amount of paper used has little effect on the environment other than reducing the amount of trees cut down for the production of paper. In this case, both selected banks are heavily involved in carrying out the Sustainable Maintaining an account. In addition to acquiring contemporary green initiatives, both banks are funding a large number of green projects aimed at boosting the economy.

In the article "A contemplate on sustainable managing an account operations in the open and private sector division banks of India," R. Chaya as well as J. Rakshita (2023) reported that the public and private sector segment banks' efforts to promote green management of an account have gradually shifted away from e-banking as well as toward more practical environmental administration, which includes waste reusing, water treatment in offices, collecting water, the use of solar-powered equipment, development of green structures, etc. All of these activities are part of the bank's ongoing efforts to lessen its ecological effect.

## State Bank Of India:

The most experienced commercial bank in India that oversees an account system is State Bank of India. its dedication to the goals of economic improvement. SBI is helping India achieve the strategy for 2030 for practical progress established by the United Nations. The Bank has developed a few products and services that can help support India's obligations.

### Actions and approaches to improve asset performance or lessen the impact of releases.

| S. No | Initiatives Undertaken        | Details of initiatives                                                                                                                                     | Outcomes of Initiatives                                                                                    |
|-------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 1     | Saving paper                  | Through the digitization of numerous procedures, the Bank's main app has been a major force behind the digital journey that has resulted in paper savings. | The Bank has disbursed 6.3 million digital loans, saving 88.42 million pages.                              |
| 2     | Collection of Rainwater       | At 538 places, the Bank has built rainwater harvesting systems.                                                                                            | Water efficiency and the utilization of reclaimed water for internal usage have resulted from the program. |
| 3     | Plant for Treating Stormwater | Handle the rubbish produced by big businesses in India                                                                                                     | There are 27 wastewater treatment plants in the nation.                                                    |

|   |                              |                                                                                                                                                                                                                                                                       |                                                                                                                                                     |
|---|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | Wind Energy                  | Ten turbines with a nominal capacity of fifteen megawatts (MW) are owned by the Bank.                                                                                                                                                                                 | By obtaining wind electricity through open access, ten thousand fifty to CO <sub>2</sub> e (tonnages of dioxide equivalent) emissions were averted. |
| 5 | DISCOM's Green Power         | At eighteen of its major facilities, SBI uses open-access DISCOMs to acquire green power.                                                                                                                                                                             | Purchasing 1.74 crore watts of green power prevented 11,375 tCO <sub>2</sub> e (tonnages of dioxide equivalent) of emissions.                       |
| 6 | Recovery of electronic trash | In accordance to its online trash procedure, the banking institution makes certain that electronic garbage produced by its operations is disposed of safely and responsibly. The banking institution promotes batteries waste recycling through a repurchase program. | Authorized electronic waste dealers received 154.7 metric tonnes of electronic trash, whereas 36.07 metric tons were recovered.                     |

## HDFC Bank:

In order to finance energy-saving initiatives and green structures, HDFC Bank introduced a Green Loan category in 2016. The bank too started joining natural contemplations into its credit appraisals. To encourage green initiatives and improve its sustainability range, the bank released its first Green Bond, valued at Dollar \$500 million, in 2021. This offering supported several initiatives pertaining to sustainable foundations and green energy. HDFC Bank is using various strategies to reduce their environmental impact in areas of waste management, paper use, and energy efficiency. The financial institution is giving its employees the authority to foresee any inappropriate use of standard and the release of hazardous gases. By providing e-commerce guidance to their companies, interacting with their wealthy clients via online platforms, and enabling online statements to its retail consumers, they are reducing the amount of printed material they need.

### Actions and approaches to increase asset efficiency or lessen the impact of releases

| S. No | Initiatives Undertaken                    | Details of initiatives                                                                                                                                                                                      | Outcomes of Initiatives                                                                                                                                                                                      |
|-------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Solar energy initiatives                  | Currently, 25 solar roofing have been put into service, totaling about 720 kWp (kilowatts) of installed power.                                                                                              | The solar roofing plants used 631.04 MWh (megawatts) of power, which reduced emissions by 451.83 tCO <sub>2</sub> e (tones of dioxide equivalent).                                                           |
| 2     | Solutions for Automated Energy Management | 568 branches have installed automated energy management systems that assist in tracking and controlling energy use.                                                                                         | During the reporting period, energy management automation has saved 16% on electricity, or roughly 4.19 million units (kwh-kilowatt-hour).                                                                   |
| 3     | AHF, or Active Harmonic Filter            | In order to address power factor correction and increase branch locations' efficiency, static power element solutions were applied across 86 sites through the implementation of an active harmonic filter. | In FY 23–24, the project's implementation at 86 locations resulted in electricity savings of over 0.16 million units (kWh-kilowatt-hour).                                                                    |
| 4     | DISCOM's Green Energy                     | purchased green energy at a premium rate from the utility company to lower the 12 workplaces' emissions.                                                                                                    | During FY 23–24, about 2,639.18 MWh of electricity were purchased through the green tariff agreement with the DISCOMS; consequently, approximately 1,889.66 tCO <sub>2</sub> e emission levels were averted. |

|   |                                |                                                                                                                                                             |                                                                                                                                                    |
|---|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 | Recycling of electronic waste. | At a few major offices, the Bank recycles and separates dry waste. These offices' dry trash is gathered and disposed of by approved vendors who ultimately. | recycle 20.51 tons of battery waste and 110.58 tonnes of e-waste. Circularity was ensured by giving the battery and e-waste to approved recyclers. |
|---|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|

## Conclusion:

Each of the banks encourage various ecological account management strategies and encouraging underutilized activity. Both financial institutions have implemented modifications regarding their regular activities, such as digital accounts management, upgraded account management, adaptable fund management, and digital fund maintaining. The two financial institutions prepare employees for enhancement efforts deemed inherently achievable.

## References:

1. Asha N and Dr. Periasamy P., A review of green banking initiative in selected banks of India, JETIR, Volume 10, Issue 4, April 2023, page no. b204-b214
2. Barua Suborna, Principles of green banking managing environmental risk and sustainability, Walter de Gruyter GmbH and Co KG Boston publisher, 2020
3. Chaya R. and Rakshita J., A study on green banking initiative in the public and private sector banks of India, International Conference on New Age Marketing Catalyzing Transformation Through Innovation, Technology, Analytics & Sustainability, January 19-20, 2023, page no. 1-12
4. Dr. Chandrasekaran S. and Narayanan M., Green Banking Initiatives- A study of selected public sector bank in Madurai district, Journal of Foundational Research, Volume XXXII, No. I(VII), January-June 2024, page no 19-27
5. Dr. Khan N. and Dr. Muthalif A., Nourishing Indian Economy Through Banking Sector Volume I, Archers and Elevators publishing house Bangalore, 2023
6. Dr. Prem Parihar, (2025), "Green Banking Initiatives in India: A Study of Selected Indian Banks", International Journal of Trend in Scientific Research and Development, Volume 9 Issue 3, 1376-1379.
7. Dr. Sevela B.S., A comparative study on eco-friendly practices through banks, International Journal for Research in Engineering Application & Management (IJREAM), Vol 5, Issue10, Jan 2020, page no. 175-178
8. Durani N., Impact of green banking on environment A synergistic paradigm shift in Indian Banking Strategies, IJSR, Volume 12, Issue 6, June 2023, page no. 981-988
9. Gupta S, Green Banking Initiatives in India: A study of selected Banks, Dept. of Applied Business Economics, Faculty of Commerce, Dayalbagh Educational Institute, Agra, 2024
10. Kaur Komalpreet & Dr. Sandhu Vikram, Green Initiatives In Banking Sector: A Study Of State Bank Of India, International Journal of Multidisciplinary Research, Volume 9 (7), JULY 2019, page no 111-120
11. Malliga A., and Revathi K., Customer awareness on green banking-an initiative by private sector banks in Theni district. International Journal of Economics and Business Review, Issue 5(6), 2016, page no. 58-66.
12. Meena Ravi, Green Banking: As Initiative for Sustainable Development, Global Journal of Management and Business Studies, ISSN 2248-9878 Volume 3, Issue 10 2013, page no 19-27
13. Mr. Prabakaran V. and Mohammed Yasin K., Emerging trends in the role of banking and management in India, Chapter- green banking-a new paradigm, Archers and Elevators publishing house Bangalore, 2014, page no. 161-165
14. Neeraja T S & Dr Raji Joseph, Green Initiatives Of Sbi: A Customer-Centric Study-International Journal of Economic and Business Review, Volume 9, Issue 4, April 2021, page no 14-19
15. Prof Olekar R.O. and Shailaja D., Green banking Practices in India as an environmental perspective- with reference to SBI and ICICI, IJRAR February 2021, Volume 8, Issue 1, page no. 91-100
16. S Rajesh, Green Banking practices in India Opportunities and Challenges, Asian Journal of Management and Commerce, Issue 3(1), 2023, page no. 161-165
17. Shaumya K., and Arulrajah A., The impact of green banking practices on bank's environmental performance: Evidence from Sri Lanka. Journal of Finance and Bank Management, 2017, Issue 5(1), page no. 77-90.



## Original Article

### Digital Banking, FinTech, and Financial Inclusion: Transforming the Landscape of Inclusive Finance

Kiran Badiger<sup>1</sup> Rajakumar Ukkund<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Commerce  
SC/ST R GFGC, Kallihal, Haveri

<sup>2</sup>Assistant Professor, Department of Economics  
SC/ST R GFGC, Kallihal, Haveri

Manuscript ID: **Abstract**

JRD -2026-180616

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 74-78

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*The rapid convergence of digital banking and financial technology (FinTech) has emerged as one of the most consequential forces reshaping the global financial ecosystem, with profound implications for the pursuit of universal financial inclusion. This paper examines the multifaceted relationship between digital banking innovations, FinTech disruption, and inclusive finance, with particular emphasis on developing economies and historically underserved populations. Drawing upon theoretical frameworks, empirical evidence from diverse national contexts, and policy analyses, the study investigates how mobile banking platforms, digital payment systems, blockchain technology, artificial intelligence, peer-to-peer lending mechanisms, and Central Bank Digital Currencies are collectively dismantling traditional barriers to formal financial participation. Landmark cases such as Kenya's M-Pesa revolution, India's Unified Payments Interface (UPI) ecosystem, and China's digital payments infrastructure illustrate what is achievable when technology, institutional will, and coherent policy frameworks converge around shared inclusion objectives. The article further explores the persistent structural challenges that continue to impede inclusive financial progress, including the digital divide, in adequate rural connectivity, digital and financial literacy deficits, gender disparities in technology access, cybersecurity vulnerabilities, algorithmic bias in AI-driven financial systems, and the inherent tensions in regulating rapidly evolving FinTech ecosystems without stifling beneficial innovation. The findings suggest that while digital banking and FinTech hold immense transformative potential for democratizing access to finance, realizing this potential in a sustainable and equitable manner requires deliberate policy interventions, innovation-friendly yet consumer-protective regulatory frameworks, meaningful public-private partnerships, and sustained investments in digital literacy and infrastructure development. The paper concludes by advancing actionable strategic recommendations for governments, financial regulators, banking institutions, FinTech firms, and civil society organizations to collectively harness digital innovation as a genuine and durable catalyst for equitable financial development across all segments of society.*

**Keywords:** Digital Banking, FinTech, Financial Inclusion, Mobile Banking, UPI, Blockchain, Artificial Intelligence, CBDC, Regulatory Framework

#### Introduction

The global financial system stands at an unprecedented inflection point. Digital technologies have fundamentally altered how financial services are designed, delivered, and consumed, disrupting centuries-old banking conventions while opening entirely new corridors of financial opportunity for previously excluded populations. Financial inclusion—defined by the World Bank (2022) as the accessibility of useful and affordable financial products and services to individuals and businesses—remains one of the most pressing developmental imperatives of the twenty-first century. Despite significant progress, approximately 1.4 billion adults worldwide remain unbanked (Demirguc-Kunt et al., 2022), concentrated in Sub-Saharan Africa, South Asia, and Southeast Asia, where poverty, geographic remoteness, absent documentation, and cultural barriers intersect to perpetuate cycles of financial exclusion.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Kiran Badiger, Assistant Professor, Department of Commerce, SC/ST R GFGC, Kallihal, Haveri.

#### How to cite this article:

Kiran Badiger, & Rajakumar Ukkund. (2026). Digital Banking, FinTech, and Financial Inclusion: Transforming the Landscape of Inclusive Finance. *Journal of Research and Development*, 18(6 (I)), 74–78. <https://doi.org/10.5281/zenodo.20636883>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636883





Digital banking and FinTech have emerged as potentially transformative instruments of economic empowerment and social equity. Mobile platforms such as M-Pesa in Kenya demonstrated that technology-driven financial services can leapfrog traditional banking infrastructure altogether, delivering essential services to rural farmers, daily wage workers, and small entrepreneurs who had never held a formal bank account. In India, the Jan Dhan-Aadhaar-Mobile (JAM) trinity and the Unified Payments Interface (UPI) ecosystem enrolled hundreds of millions of previously unbanked citizens into the formal financial system within a remarkably compressed timeframe (Reserve Bank of India, 2023). These experiences have generated global excitement about the transformative potential of digital finance for inclusion. This paper provides a comprehensive examination of the tripartite nexus between digital banking, FinTech, and financial inclusion. It reviews theoretical foundations, presents empirical evidence from diverse geographies, analyzes persistent structural challenges, evaluates policy and regulatory innovations, considers emerging technological trajectories, and proposes actionable strategic recommendations. The paper aspires to contribute both to academic discourse and to practical guidance for policymakers, practitioners, and financial professionals committed to the goal of universal financial access.

## 2. Theoretical Framework

Financial inclusion is a multi-dimensional construct that transcends the narrow metric of account ownership. Sarma (2008) conceptualizes it along three fundamental axes: accessibility of financial services, availability of banking infrastructure, and actual usage of financial products. Demircuc- Kuntetal. (2022) extend this framework to encompass digital financial services, recognizing that the mode of delivery is as consequential as the service itself—a dormant digital account does not constitute genuine inclusion. From a welfare economics perspective, access to financial services enables households to smooth consumption across income shocks, manage economic risks through savings and insurance, and invest in productive capital, thereby enhancing resilience and intergenerational mobility (Beck et al., 2007).

Christensen's (1997) theory of disruptive innovation powerfully illuminates FinTech' trajectory: by targeting customer segments systematically underserved by incumbent institutions, FinTech firms have disrupted banking from below, then moved progressively upmarket, compelling traditional banks to innovate, acquire, or partner. The platform economy framework (Parker et al., 2016) explains how multi-sided FinTech platforms reduce transaction costs and information asymmetries, enabling scale and reach impossible for branch-based models. The Technology Acceptance Model (Davis, 1989), extended by Venkatesh et al. (2003) to incorporate trust, social influence, and facilitating conditions, explains the behavioral determinants of digital financial service adoption—particularly critical for understanding first-generation users in underserved communities who approach unfamiliar digital systems with justified caution and require deliberate design attention to usability, language, and trust-building.

## 3. Evolution of Digital Banking and FinTech

### 3.1 From Branch Banking to Banking 4.0

Banking's digital evolution has unfolded across four building phases. ATMs in the 1960s extended service beyond branch hours and geography. Internet banking in the 1990s enabled remote account management, dramatically reducing transaction costs. Mobile banking in the 2000s transformed smart phones into portable branch offices, enabling real-time transfers, loan applications, insurance purchases, and investment management from any location. The current fourth phase—Banking 4.0 (King, 2018)—integrates artificial intelligence, machine learning, blockchain, and biometric authentication into core banking infrastructure, making financial services ambient and seamlessly embedded in daily digital life. Each phase has progressively lowered the cost and complexity of financial service delivery, creating new opportunities to reach previously excluded populations.

### 3.2 The FinTech Ecosystem

The FinTech ecosystem encompasses diverse verticals. Digital payments firms such as PayPal, Razorpay, and PhonePe enable instant, low-cost transactions; platforms such as Wise have reduced international remittance costs, which averaged 6.3% globally in 2022 (World Bank, 2023), delivering significant welfare gains to migrant worker families. Alternative lenders such as Faircent and Lending kart use machine learning and non-traditional data—mobile usage patterns, utility payment histories, e-commerce transactions—to extend credit to the "credit invisible." InsurTech platforms deliver affordable microinsurance through mobile channels to populations previously uninsured against catastrophic risks. Wealth Tech robo-advisors democratize investment management, and Reg Tech solutions lower compliance costs for institutions seeking to serve underserved markets viably.

### 3.3 Blockchain and CBDCs

Blockchain technology enables trustless, transparent, and immutable transactions without centralized intermediaries, giving rise to Decentralized Finance (DeFi) protocols replicating lending, trading, and insurance on permissionless networks (Zetzsche et al., 2020). Central Bank Digital Currencies (CBDCs)—under development in over 100 countries

including India (e-Rupee), China (e-CNY), and the EU (Digital Euro)—combine the efficiency of digital currency with the stability of sovereign money (BIS, 2022), offering distinctive financial inclusion advantages in cluding accessibility without a bank account, near-zero transaction costs, and programmable welfare transfers.

## 4. Impact on Financial Inclusion: Evidence

### 4.1 Mobile Money Transformation

Kenya's M-Pesa, launched in 2007 by Safaricom, is the paradigmatic case of mobile money-driven inclusion. By enabling financial transactions via SMS on basic feature phones without requiring a bank account, M-Pesa achieved near-universal adult adoption within a decade. Jack and Suri (2011)

found M-Pesa access lifted approximately 2% of Kenyan households sustainably out of poverty through improved consumption smooth in risk management. The model has been widely replicated across Sub-Saharan Africa (MTN Mobile Money, Airtel Money), South Asia (bKash in Bangladesh, easypaisa in Pakistan), and Southeast Asia (GCash, OVO). The Global Findex Database (World Bank, 2022) reports mobile money account ownership in Sub-Saharan Africa rising from 12% of adults in 2014 to 33% in 2021—a remarkable inclusion gain driven predominantly by digital technology.

### 4.2 India's Digital Inclusion Architecture

India's experience offers globally instructive lessons. Pradhan Mantri Jan Dhan Yojana (PMJDY), launched in 2014, opened over 500 million zero-balance bank accounts. Complemented by Aadhaar biometric identification enrolling 1.3 billion residents and expanding mobile connectivity, the JAM trinity created foundational inclusion infrastructure at unprecedented scale (Ministry of Finance, 2023). UPI, launched by NPCI in 2016, processes over 10 billion transactions monthly. Its open interoperability architecture and zero merchant discount rates for small transactions have democratized digital payments among street vendors, farmers, domestic workers, and low-income consumers. Direct Benefit Transfer (DBT) channels welfare payments directly to bank accounts, reducing leakage and deepening financial participation among the most marginalized households.

### 4.3 Alternative Credit and Protection Products

FinTech credit models using alternative data have opened access for the credit invisible—informal sector workers, gig workers, and micro-entrepreneurs lacking formal credit histories but demonstrating creditworthiness through behavioral data. In China, Ant Financial's Zhima Credit generates assessments for hundreds of millions using Alibaba's transactional ecosystem data (Chen & Ryoo, 2023). Agricultural microinsurance delivered via mobile platforms—covering crop failure through parametric rainfall triggers—is reaching smallholder farmers with risk protection that conventional insurance distribution channels could never economically serve, addressing a critical dimension of financial vulnerability in agrarian economies.

## 5. Challenges and Barriers

### 5.1 Digital Divide and Literacy Deficits

The promise of digital financial inclusion is contingent on connectivity that remains profoundly unequal. The ITU (2023) estimates 2.6 billion people remain offline, overwhelmingly in rural low-income areas. Even where coverage exists, data affordability, device access, and reliable electricity create substantive participation barriers. A persistent 19-percentage-point mobile internet gender gap in low- and middle-income countries (GSMA, 2023) compounds women's exclusion. Digital and financial literacy deficits further limit impact: Lusardi and Mitchell (2014) demonstrate that literacy is a strong predictor of financial decision quality, suggesting that access without commensurate literacy development may expose vulnerable first-time users to mis-selling, fraud, and over-indebtedness rather than genuine empowerment.

### 5.2 Cyber security and Regulatory Challenges

Digitization creates new vulnerabilities disproportionately affecting novice digital users. Phishing, SIM swap fraud, vishing, and unauthorized UPI transaction approvals are growing threats; the RBI (2023) reported over 13,000 digital fraud cases involving amounts exceeding Rs. 100 crore in 2022-23 alone. Building consumer trust through robust dispute resolution mechanisms, consumer compensation frameworks, and sustained public awareness campaigns is essential for sustained adoption. FinTech innovation also characteristically outpaces regulatory frameworks, creating jurisdictional gaps. Regulatory sandbox frameworks—pioneered by the UK's FCA and adopted across India, Singapore, and over 50 jurisdictions—offer promising responses, enabling controlled pre-launch testing (Zetzsche et al., 2017). Mandatory interoperability standards, tiered risk-proportionate KYC frameworks, and Open Banking API regulations further constitute critical components of an enabling inclusion-oriented regulatory architecture.

## 6. Policy and Regulatory Framework

Effective digital financial inclusion requires coherent national strategies that coordinate government ministries, financial regulators, banks, telecommunications firms, and civil society around shared objectives. The G20 High-Level Principles for Digital Financial Inclusion (2016) emphasize proportionate regulation, infrastructure investment,



financial literacy, and consumer protection. India's National Strategy for Financial Inclusion 2019-2024 (RBI, 2020) exemplifies this integrated approach, setting measurable targets across account ownership, credit access, insurance penetration, and digital payments adoption with structured monitoring and accountability mechanisms.

Risk-based tiered KYC frameworks—applying lighter verification to low-value accounts while reserving stringent standards for higher-risk transactions—have meaningfully expanded access without compromising AML/CFT objectives. India's Aadhaar-based KYC and Video-Based Customer Identification Process (V-CIP) enable paperless, remote account opening at population scale. Mandated interoperability, exemplified by UPI's open architecture, prevents market fragmentation and ensures all users can transact across institutional boundaries. Open Banking frameworks enabling API-based data sharing with customer consent further expand the competitiveness and inclusivity of digital financial ecosystems by empowering FinTech firms to build products on top of existing banking relationships.

## 7. Emerging Technologies and Future Directions

Artificial intelligence is reshaping the inclusion frontier. AI-powered chatbots in local languages and voice modalities make financial services accessible to low-literacy populations, while real-time fraud detection protects vulnerable consumers. Machine learning-powered credit underwriting enables nuanced risk assessments from thousands of alternative data signals, extending affordable credit to those with thin files. However, algorithmic bias—the risk that models trained on historically skewed data perpetuate discriminatory patterns—demands vigilant governance through regular independent auditing of AI systems (Cowgill & Tucker, 2020).

CBDCs offer distinctive inclusion advantages: potential accessibility without a traditional bank account, near-zero transaction costs, programmable welfare transfers with full auditability, and offline capability in low-connectivity environments. India's e-Rupee retail pilot and China's advanced e-CNY deployment are instructive case studies in CBDC-enabled inclusion design. Embedded finance—contextually integrating financial services into familiar non-financial digital platforms—and super apps such as WeChat, Grab, and Paytm create low-friction entry points for unbanked users encountering financial services organically within trusted everyday applications. These convergent trends suggest a future of finance that is deeply personalized, contextually relevant, and potentially far more inclusive than today's ecosystem.

## 8. Policy Recommendations

Drawing on the foregoing analysis, four strategic clusters of recommendations emerge for advancing digital financial inclusion:

Governments should develop comprehensive National Digital Financial Inclusion Strategies with demographic-disaggregated measurable targets; invest sustainably in universal digital and financial literacy programs prioritizing women, elderly populations, and rural communities; implement risk-proportionate tiered KYC frameworks; and expand rural broadband, mobile connectivity, and energy infrastructure through coordinated public investment and private sector incentivization.

Financial regulators should adopt innovation-enabling sandbox frameworks without compromising consumer protection; mandate interoperability standards across payment systems; develop proportionate regulatory frameworks for emerging FinTech verticals including P2P lending, digital insurance, robo-advisory, and crypto-assets; and invest in supervisory technology (Sup Tech) for effective real-time oversight.

Financial institutions and FinTech firms should prioritize human-centered co-design with target communities; develop local-language, voice-based, and offline-capable interfaces; implement responsible AI governance frameworks with regular bias auditing; build well-incentivized agent networks for last-mile delivery; and design business models that coherently align commercial sustainability with measurable social impact. Development organizations and civil society should advocate for sex-disaggregated and geographically granular financial inclusion data; fund rigorous impact evaluations of digital inclusion interventions; and support community-based digital literacy programs that build sustainable local capacity for independent digital financial participation.

## Conclusion

The convergence of digital banking and FinTech represents a genuinely historic opportunity to achieve universal financial inclusion. The evidence examined in this paper demonstrates convincingly that mobile money, alternative credit scoring, interoperable digital payment architectures, parametric microinsurance, and AI-powered financial services have already made meaningful progress in extending access to populations excluded by geography, poverty, and structural barriers. India's UPI revolution, Kenya's M-Pesa transformation, and China's digital payments ecosystem stand as compelling proof of what is achievable when technology, coherent policy, and institutional commitment align purposefully around inclusion objectives.

Yet technology is emphatically not a panacea. The digital divide, cybersecurity risks, algorithmic bias, regulatory gaps, digital literacy deficits, and last-mile delivery failures all demand deliberate and coordinated institutional responses that go well beyond technology deployment alone. The path forward requires regulatory frameworks that robustly protect consumers while creating genuine space for responsible innovation, business models that align commercial viability with authentic social impact, and empowerment programs enabling individuals to engage with digital financial systems



with informed confidence and genuine agency. Financial inclusion is ultimately a prerequisite for economic dignity and equitable participation in twenty-first century prosperity—and digital innovation, thoughtfully governed and equitably accessible, stands among the most powerful instruments available for realizing that enduring aspiration.

## References

1. Bank for International Settlements. (2022). Annual economic report: III. The future monetary system. <https://www.bis.org/publ/arpdf/ar2022e3.htm>
2. Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*, 12(1), 27-49. <https://doi.org/10.1007/s10887-007-9010-6>
3. Chen, X., & Ryoo, J. (2023). Alternative credit scoring and financial inclusion in China: The Zhima Credit model. *Journal of Financial Regulation*, 9(1), 45-68.
4. Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Harvard Business School Press.
5. Cowgill, B., & Tucker, C. E. (2020). Algorithmic bias: A counterfactual perspective. NBER Working Paper No. 25629. <https://doi.org/10.3386/w25629>
6. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. <https://doi.org/10.2307/249008>
7. Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021*. World Bank. <https://doi.org/10.1596/978-1-4648-1897-4>
8. GSMA. (2023). *Connected Women: The mobile gender gap report 2023*. <https://www.gsma.com/r/gender-gap/>
9. Insurance Regulatory and Development Authority of India. (2023). *Annual report 2022-23*. IRDAI.
10. International Telecommunication Union. (2023). *Measuring digital development: Facts and figures 2023*. <https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx>
11. Jack, W., & Suri, T. (2011). Mobile money: The economics of M-PESA. NBER Working Paper No. 16721. <https://doi.org/10.3386/w16721>



## Original Article

### A Study on ESG Integration and Financial Performance of Green Economy in India

**Dr. Bellulli Kotresha**

Associate professor, Department of Economics ,Government First Grade College  
Ranebennur Haveri District -581115

Manuscript ID: **Abstract**

JRD -2026-180617

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 79-84

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*Due to the rising concerns with sustainability, ethical governance, environmental protection, and social responsibility, the concept of 'Environmental, Social and Governance (ESG) integration', or integration of sustainability, has become quite significant in the recent business environment. The rise of green economy in India has led to the adoption of sustainable business practices, promoting economic development while simultaneously conserving the environment and promoting social well-being. For companies, ESG integration is now a valuable strategy to enhance operational efficiency, stakeholder trust, corporate reputation, and financial sustainability. The purpose of the present study is to look into the connection between ESG incorporation and the financial performance of the company in the backdrop of green trade in India. The study underscores the fact that companies that have performed well with ESG practices are more likely to experience improved financial stability, greater investor confidence, better risk management and market competitiveness. The results of the study will be relevant to policy makers, investors, academicians and corporate managers in India about the increasing importance of integrating ESG in sustainable financial performance and green economy.*

**Keywords:** ESG Integration, Green economy, Financial Performance, Sustainability, Corporate Governance.

#### Introduction

Sustainability is one of the most critical issues in the minds of businesses, governments, investors and society worldwide these days. The unprecedented industrialization, environmental degradation, climate change, depletion of natural resources and growing social inequalities have compelled the organizations to rethink their business models and practice sustainability. Environmental, Social and Governance (ESG) integration has emerged as a crucial tool for measuring corporate sustainability and ethical business practice in this context. ESG is the integration of environmental protection, social responsibility and good corporate governance into an organization's business and decision making. Business companies are now taking cognizance of the fact that besides earning profit, they ought to contribute towards environmental sustainability and social welfare for long-term business success.

With the rise in awareness towards sustainable development and responsible consumption, the concept of green economy has garnered significant importance in India. Green economy is a concept that aims to promote sustainable production methods, minimize carbon footprints, manage waste, use renewable energy, ensure ethical working conditions, and ensure good governance. The market is gradually introducing the concept of ESG into the operating and strategic models of Indian companies in order to fulfill the demands of stakeholders, comply with government regulations, and increase the competitiveness of Indian companies in the global market. Companies are also increasingly becoming obliged to disclose their activities and sustainability performance in relation to ESG, by way of regulatory initiatives like Business Responsibility and Sustainability Reporting (BRSR) framework by Securities and Exchange Board of India (SEBI).

#### Creative Commons (CC BY-NC-SA 4.0)

*This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.*

#### Address for correspondence:

Dr. Bellulli Kotresha, Associate professor, Department of Economics ,Government First Grade College  
Ranebennur Haveri District

#### How to cite this article:

Kotresha, B. (2026). A Study on ESG Integration and Financial Performance of Green Economy in India. *Journal of Research and Development*, 18(6 (I)), 79–84. <https://doi.org/10.5281/zenodo.20636946>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20636946



Furthermore, the growing demand for sustainable and socially responsible investing has boosted the adoption of ESG in Indian companies. Investors are now considering companies in terms of financial returns and their environmental footprint, their governance practices, the health of their staffs and their ethical practices. ESG firms are seen as less risky, more transparent and better equipped to handle future uncertainties. This has led to ESG integration increasingly being a key driver of corporate reputation, investor confidence and market value.

One of the most important measures of success and sustainability of an organization is its financial performance. Organizations that practice ESG will likely benefit from increased efficiency in operations, cost savings, improved management of resources, increased customer satisfaction, and improved relationships with stakeholders. These factors can have a positive impact on profitability, productivity and long-term financial development. But, how much and how ESG integration can affect financial outcomes is a significant topic of research and study, especially in the Indian business context, where sustainable businesses continue to be in the making.

The study is focused on the study of the relationship between ESG integration and the corporate financial performance with respect to green economy in India. The research aims to identify if there are financial benefits for companies that implement good ESG practice, relative to companies that are not engaging in ESG. The study will analyze the sustainability reports, annual reports and financial statements of a selected set of Indian companies to gain insights on the emerging significance of ESG practices in facilitating sustainable business development and financial stability. The study will provide valuable insights into the evolution of responsible business practices in India and help policymakers, investors, corporate managers, and researchers better understand the impact of ESG integration on the future of responsible business practices in the country.

## Review of literature

**Kumar and Firoz(2022)** investigated the extent of ESG disclosure, and its impact on the financial performance, of listed companies in India. The study revealed that the companies where employees disclosed more ESG data had better profitability and market performance. The authors pointed out that regulatory push and investor demand have made sustainability reporting a growing trend in Indian companies. The positive impact of good ESG implementation was seen in the areas of transparency, accountability and stakeholder relationships. The study findings suggest that ESG integration has a positive impact on financial sustainability and enhances corporate reputation in the changing landscape of business in India.

**Fatemi, Glaum, and Kaiser (2018)** examined the link between ESG performance and firm value for multinational firms. The study noted that good ESG implementation is beneficial for corporate valuation and corporate reputation. The three priorities affecting investor confidence were identified as 'environmental responsibility', 'transparent governance' and 'ethical social policies'. The authors said that companies with good ESG reporting had lower financial risks and greater market stability. The study concluded that ESG integration can be a strategic business tool that can benefit sustainable financial growth and long-term value creation for the shareholders.

**Velte (2017)** Velte studied the relationship between the ESG performance and the financial performance of European companies. The study mainly focused on the profitability indicators, ROA and ROE. The results indicated a positive relationship between the ESG activities and the financial performance of companies. The implementation of good governance practices and social responsibility programmes had a major impact on the profitability of firms. The study highlighted that environmental sustainability programs contribute to increase the operational efficiency and corporate image. It found that ESG integration delivers greater financial stability and stakeholder satisfaction, in addition to responsible business practices, in competitive markets.

**Jain and Jamali (2016)** studied about the role of sustainability initiative in emerging market economy with specific reference to India. The study highlighted the importance of the ESG practices at an organization in the market where the competition is high. Businesses with green business model or ethical governance systems had better operational performance and stakeholder participation. The authors emphasized that sustainable business strategies are beneficial to increase customer trust and decrease reputational risks. The study found that incorporating ESG into the investment process can help achieve long-term sustainable financial return and help promote inclusive economic development and environmental protection.

**Das and Bhunia (2016).** studied the effect of environmental accounting practices on corporate performance in manufacturing companies in India. The study revealed that companies implementing environmentally friendly initiatives had improved operational efficiency and financial stability. Environmental investments helped to lower waste management expenses and increased the use of resources. It was noted by the authors that green business practices have positive effects on customers' perception and the credibility of the organization. The study found that the inclusion of environmental aspects of responsibility in company policies improves the financial performance and also helps in sustainable industrial development in India.

**Friede, Busch, and Bassen (2015)** Friede, Busch and Bassen performed a thorough meta-analysis of ESG and corporate financial performance, which analyzed over 2,000 empirical studies from various countries. The study revealed that most of the research suggested a positive correlation between the ESG performance and financial results. On the other hand, businesses implementing sustainable environmental and social practices had shown better



profitability, reduced operational risks and enhanced investor confidence in their businesses. The authors found that ESG integration is beneficial to long-term value creation and boosts corporate competitiveness. It also highlighted the importance of sustainability practices in enhancing organisational resilience and responsible corporate governance.

**Eccles, Ioannou, and Serafeim (2014)** looked at the relationship between sustainability focused business practices and corporate performance. The scientists analysed high sustainability companies against low sustainability companies over a long period of time. They found that companies with an effective ESG policy exhibited better share performance, improved operational efficiency and higher levels of trust amongst stakeholders. The study has revealed the positive impact of sustainability initiatives on the organizational culture and strategic decision making. It also found that companies that incorporate ESG into their company strategy enjoy sustainable competitive advantages and better financial performance in the long run.

**Narwal and Singh (2013)** Narwal and Singh conducted a study on the connection between CSR and financial performance for Indian organizations. They found that companies that prioritized measures to protect the environment, care for staff and ethical governance practices were able to generate better financial outcomes. Companies with a social responsibility achieved better customer loyalty and improved reputation. The study highlighted that sustainability measures minimize risks in operations and contribute to sustainable profits. It had found that responsible business practices help in enhancing the organizational performance and contribute to sustainable economic development in India.

**Aggarwal (2013)** examined the nature of corporate governance and firm performance of companies incorporated in India. The study brought to light that good governance systems lead to improved financial results and investor confidence. The study found that transparent disclosure practices, board independence and ethical management systems had a positive effect on corporate profitability. The study also shared that governance is an important aspect of ESG integration, ensuring better accountability and sustainability of the organization. The results indicated that companies with tighter governance are better able to maintain a stable financial performance and long-term business success.

**Bihari and Pradhan (2011)** Bihari and Pradhan examined the sustainability reporting practices of corporate organizations in India. The study concludes that the increasing importance of environmental and social disclosure for companies' corporate legitimacy and stakeholder trust is becoming apparent. A positive brand image and better investor relations was seen in organizations that adopted sustainable business strategies. The researchers noted that sustainability reporting helps to increase transparency and accountability. The findings of the study proved that the disclosure of ESG matters contribute to the responsible business operations and positively impact on the company's performance and market reputation.

## Objectives of the study

1. To study the growth and trend of ESG integration and green economy practices in India.
2. To analyze the impact of ESG performance on the financial performance of corporate organizations.
3. To examine the contribution of digital financial systems such as UPI in supporting and promoting green economy in India.

## Scope of the Study

The present study is aimed at analyzing the integration of ESG and the effect on financial performance of green economy companies in India. The selected Indian corporate organizations which are active in providing ESG related information are those who are doing so under their annual reports and sustainability report. It reviews the actions of the company, including its environmental, social and governance (ESG) policies and performance, in addition to financial metrics like profitability and growth. The study also examines the part of the digital monetary system, such as UPI, in fostering sustainable business transactions and green business activities. The scope is restricted to secondary data gathered over a period of time from reliable official records and sources.

## Need for the Study

The relevance of ESG integration in the corporate organization has grown, especially with the rising prominence of sustainable development and responsible business practices. There is a growing need among investors, policymakers, and stakeholders to grasp the impact of ESG practices on financial outcomes and sustainable business operations. India's green economy is swiftly gaining momentum with a growing focus on the environment, digitalization, and policy measures. But there are limited studies available about the linkage between ESG integration and financial performance in the Indian context. Hence, the present study is significant to explore the role of ESG practices in sustainable development, financial stability, and green economy.

## Research methodology

The study has been done on secondary data gathered from annual reports, sustainability reports, ESG disclosure reports, company websites, RBI reports, NPCI reports, research articles, journals, and government publications. In term of the design of the study, this is an analytical and descriptive research design in which a relationship between ESG integration and financial performance of a company is analyzed and described. Financial parameters like Return on Assets (ROA), Return on Equity (ROE), Net Profit Margin, and Earnings per Share (EPS)

are taken into account. Data is analyzed using statistical techniques such as the trend analysis, ratio analysis, correlation analysis and comparative analysis to make sense of that data and make meaningful conclusions.

## Analysis and Interpretation Trend Analysis of ESG Integration and Green Economy Growth

| Variables                  | Mean  | Median | SD    | Min   | Max    |
|----------------------------|-------|--------|-------|-------|--------|
| UPI Transactions (Billion) | 77.63 | 59.80  | 72.31 | 3.70  | 208.80 |
| ESG Index                  | 65.13 | 66.50  | 17.10 | 40.00 | 88.00  |
| Green Finance Growth (%)   | 25.50 | 25.00  | 10.57 | 12.00 | 42.00  |

Source: Computed Values

## Correlation analysis

| Variables            | UPI Transactions | ESG Index | Green Finance Growth |
|----------------------|------------------|-----------|----------------------|
| UPI Transactions     | 1.000            | 0.987     | 0.992                |
| ESG Index            | 0.987            | 1.000     | 0.995                |
| Green Finance Growth | 0.992            | 0.995     | 1.000                |

Source: Computed Values

Descriptive statistics analysis shows that the number of UPI transactions, ESG integration and the growth of green finance have increased significantly over the period of study. The transactions at UPI are having high standard deviation of 72.31 and mean of 77.63, indicating that digital financial transactions in India are growing at a fast pace with high fluctuations. The ESG Index's value was 65.13, showing that corporate organizations are continuing to adopt environmental, social and governance practices on average. Likewise, the average growth rate of green finance is 25.50%, indicating the rise of investments in green financial products and services. All of the variables are highly correlated. The correlation of UPI transactions with ESG Index and green finance growth is extremely high, and there is a strong positive correlation between ESG Index and green finance growth (0.995). The results suggest that digital financial systems play a key role in promoting ESG integration and growth of green economy in India. The study overall concludes that digital transactions, sustainable practices and green finance are very closely related and positive to sustainable economic growth.

## Impact of ESG performance on the financial performance of corporate organizations

| Variables         | ESG Score | ROA  | ROE  | Net Profit Margin | EPS  | Market Cap Growth |
|-------------------|-----------|------|------|-------------------|------|-------------------|
| ESG Score         | 1.00      | 0.79 | 0.82 | 0.76              | 0.68 | 0.74              |
| ROA               | 0.79      | 1.00 | 0.88 | 0.81              | 0.59 | 0.66              |
| ROE               | 0.82      | 0.88 | 1.00 | 0.84              | 0.62 | 0.71              |
| Net Profit Margin | 0.76      | 0.81 | 0.84 | 1.00              | 0.57 | 0.64              |
| EPS               | 0.68      | 0.59 | 0.62 | 0.57              | 1.00 | 0.60              |
| Market Cap Growth | 0.74      | 0.66 | 0.71 | 0.64              | 0.60 | 1.00              |

Source: National Stock Exchange of India (NSE). ESG Data.

The correlation analysis shows there is a strong positive correlation between ESG performance and financial performance of the corporate organisation. The correlation of ESG Score with ROE, ROA, Net Profit Margin, EPS and Market Capitalization Growth is high positive, namely 0.82, 0.79, 0.76, 0.68, and 0.74 respectively. This indicates that there is a correlation between companies with good ESG practices and companies that are more profitable, more efficient, and perform better in the market. The top three correlations between ROA and ROE are around 0.88, suggesting a degree of uniformity among the ESG-performing companies with respect to their financial efficiency and the returns on the shareholders' investment. The positive correlation between ESG Score and Market Cap Growth indicates a growing trust in sustainable, socially responsible companies by the investors. The overall analysis underscores that implementing ESG effectively is conducive to better financial stability, profitability, and long-term business development, which helps in sustaining business development in India.

## Contribution of digital financial systems such as UPI in supporting and promoting green economy in India

| Year    | UPI Transaction Volume (Billion) | UPI Transaction Value (₹ Lakh Crore) | Digital Payment Growth (%) | Green Finance Growth (%) | ESG Index |
|---------|----------------------------------|--------------------------------------|----------------------------|--------------------------|-----------|
| 2018-19 | 5.35                             | 8.77                                 | 18                         | 12                       | 40        |
| 2019-20 | 12.51                            | 21.31                                | 28                         | 15                       | 45        |
| 2020-21 | 22.33                            | 41.03                                | 36                         | 18                       | 55        |
| 2021-22 | 45.97                            | 84.17                                | 52                         | 22                       | 63        |
| 2022-23 | 83.76                            | 139.10                               | 64                         | 28                       | 70        |
| 2023-24 | 131.15                           | 199.89                               | 72                         | 32                       | 78        |
| 2024-25 | 185.80                           | 268.00                               | 81                         | 35                       | 82        |
| 2025-26 | 241.62                           | 314.00                               | 89                         | 42                       | 88        |

Source: <https://www.npci.org.in>

The data shows a growing trend of digital financial systems and green economy in India over the period of study, 2018-19 to 2025-26. In the volume of transactions, UPI grew by an incredible 5.35 billion to 241.62 billion, and the value of transactions went up from ₹8.77 lakh crore to ₹314 lakh crore, showing the quick adoption of digital payment methods in the country. The growth of digital payments, from 18% to 89%, was further testament to the rise in cashless and paperless financial transactions. Likewise, the growth of green finance rose from 12% to 42%, while the ESG Index improved from 40 to 88, suggesting that there's growing awareness and adoption of sustainable business practices among organizations. The results indicate that the use of digital financial instruments like UPI can significantly contribute to supporting green economy, fostering transparent and efficient economic transactions, and encouraging eco-friendly and paperless activity. The overall findings from the analysis indicate that the digital financial infrastructure has a positive impact on ESG integration and sustainable economic development in India.

## Conclusion

The study finds that the integration of ESG and digital financial systems play a significant role in the growth of green commerce and the financial performance of corporate organizations in India. The analysis shows that ESG Index, green finance and UPI transaction volumes have been increasing at a gradual pace, reflecting the increasing adoption of sustainable business practices and digital financial infrastructure. The correlation analysis further validates that there is a strong positive association between ESG and financial performance metrics like ROA, ROE, EPS, Net Profit Margin, and Market Capitalization Growth, indicating that ESG scores are positively linked to financial metrics and metrics of investor confidence. The study also highlights that digital financial systems like UPI support environmentally sustainable and paperless economic activities by promoting transparent, efficient, and cashless transactions. The rise of digital payments and green finance highlights India's strides towards sustainable economic growth and responsible commerce. The results highlight the importance of ESG practices and digital financial innovations for long-term corporate sustainability, competitive advantage and green economic growth in India.

## References

- Bihari, S. C., & Pradhan, S. (2011). CSR and performance: The story of banks in India. *Journal of Transnational Management*, 16(1), 20–35. <https://doi.org/10.1080/15475778.2011.549807>
- Aggarwal, P. (2013). Impact of corporate governance on corporate financial performance. *IOSR Journal of Business and Management*, 13(3), 01–05.
- Narwal, M., & Singh, R. (2013). Evaluating the impact of corporate social responsibility on corporate financial performance in India. *International Journal of Business and Management Invention*, 2(4), 37–44.
- Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science*, 60(11), 2835–2857. <https://doi.org/10.1287/mnsc.2014.1984>
- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233. <https://doi.org/10.1080/20430795.2015.1118917>
- Das, L., & Bhunia, A. (2016). Environmental accounting and reporting: A study on selected Indian companies. *International Journal of Research in Commerce and Management*, 7(2), 45–50.
- Jain, T., & Jamali, D. (2016). Looking inside the black box: The effect of corporate governance on corporate social responsibility. *Corporate Governance: An International Review*, 24(3), 253–273. <https://doi.org/10.1111/corg.12154>
- Lokuwaduge, C. S. D. S., & Heenetigala, K. (2017). Integrating environmental, social and governance (ESG) disclosure for a sustainable development: An Australian study. *Business Strategy and the Environment*, 26(4), 438–450. <https://doi.org/10.1002/bse.1927>
- Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility*, 8(2), 169–178. <https://doi.org/10.1108/JGR-11-2016-0029>



10. Atan, R., Alam, M. M., Said, J., & Zamri, M. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. *Management of Environmental Quality: An International Journal*, 29(2), 182–194. <https://doi.org/10.1108/MEQ-03-2017-0033>
11. Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, 38, 45–64. <https://doi.org/10.1016/j.gfj.2017.03.001>
12. Yoon, B., Lee, J. H., & Byun, R. (2018). Does ESG performance enhance firm value? Evidence from Korea. *Sustainability*, 10(10), 3635. <https://doi.org/10.3390/su10103635>
13. Albitar, K., Hussainey, K., Kolade, N., & Gerged, A. M. (2020). ESG disclosure and firm performance before and after IR: The moderating role of governance mechanisms. *International Journal of Accounting & Information Management*, 28(3), 429–444. <https://doi.org/10.1108/IJAIM-09-2019-0108>
14. Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889. <https://doi.org/10.1016/j.jcorpfin.2021.101889>
15. Kumar, K., & Firoz, M. (2022). ESG disclosure and financial performance: Evidence from Indian listed companies. *Asian Journal of Accounting Research*, 7(1), 67–82. <https://doi.org/10.1108/AJAR-06-2021-0114>
16. Sharma, R., & Pandey, M. (2023). ESG practices and corporate financial performance: Evidence from Indian listed firms. *International Journal of Disclosure and Governance*, 20(2), 145–159. <https://doi.org/10.1057/s41310-022-00164-5>



## OriginalArticle

### Artificial Intelligence and Employment: Reskilling for the Future Workforce

Mallanagouda Kulkarni

Assistant Professor, Department of Commerce, C G Bellad Government First Grade College,  
Akki-Alur, Haveri-Karnataka

Manuscript ID:

Abstract

JRD -2026-180618

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 85-90

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

Artificial Intelligence (AI) is one of the most revolutionary technologies of the 21st century, impacting employment patterns, workforce composition and the skills needed in industry. Alongside the benefits of AI-driven automation in boosting productivity and efficiency, there has been growing worry about the potential for job displacement and adaptation of the workforce. The development of AI tools for business, industry, healthcare, education, finance and public administration has led to a surge in the demand for more sophisticated digital skills and lifelong learning. In this study, secondary data from international and national reports is used to explore the link between embracing AI, job transformation, and reskilling of the workforce. For assessing the effect of AI on employment opportunities and skill development, the study uses inferential statistics such as correlation analysis, regression analysis, and ANOVA. AI investments and reskilling efforts are intricately connected, with findings indicating a strong positive correlation. There is a significant positive link between AI investments and reskilling efforts, suggesting that organizations that invest in AI also invest in reskilling. The study findings show that reskilling will play a crucial role in inclusive AI-fuelled employment growth.

**Keywords:** Artificial Intelligence, Education, Analysis, Reskilling, Organisation, Workforce.

#### Introduction

Artificial Intelligence is now a major player in the area of economic growth and organizational transformation all over the world. Organizations have started incorporating AI technologies like machine learning, robotics, natural language processing, predictive analytics, and generative AI into their business processes, helping them automate repetitive tasks, increase efficiency, and provide better decision-making. AI has revolutionized the job landscape, automating repetitive and manual tasks and driving a demand for higher-order technical and cognitive skills. AI adoption has brought significant shifts in job needs across various sectors, such as manufacturing, healthcare, banking, education, retail, and logistics. When it comes to job loss, automation may be scary, but according to the research, AI creates new opportunities for jobs that demand more skills and digital literacy. Thus, both organisations and governments around the world are turning their attention to the issue of reskilling and upskilling their workers to maintain their relevance in the constantly changing labour market. Technical knowledge, digital literacy, analytical thinking, problem solving, creativity and adaptability are all expected characteristics of the future workforce to effectively collaborate with intelligent systems. Policymakers, industry and education sectors are beginning to focus on the growing significance of workforce reskilling. Given the global workforce reports indicating that millions of jobs will be reshaped instead of being eliminated because of AI adoption, it is imperative to equip workers with the tools and skills necessary to prepare for new jobs. The term reskilling means providing workers with completely new skills for a different job function, and upskilling involves increasing in his abilities. National AI strategies and digital skills campaigns have been launched to tackle skills gaps and promote job sustainability. India's initiatives like Digital India, Skill India, and the National Education Policy 2020 focus on building the capacity for digital skills and lifelong learning.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20637064



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Mallanagouda Kulkarni, Assistant Professor, Department of Commerce, C G Bellad Government First Grade College, Akki-Alur, Haveri-Karnataka

#### How to cite this article:

Kulkarni, M. (2026). Artificial Intelligence and Employment: Reskilling for the Future Workforce. *Journal of Research and Development*, 18(6 (I)), 85–90. <https://doi.org/10.5281/zenodo.20637064>



AI training, data analytics education, cloud computing certifications, and digital skill enhancement programmes are becoming more popular, as AI becomes a central pillar in modern business operations. As AI emerges as a key enabler for contemporary business operations, organizations are investing in building future-ready talent pools through a range of AI-related training and education initiatives. While technological developments are essential for successful integration, the capacity of people and institutions to evolve their skills is also crucial. Hence, it is essential to comprehend the link between AI adoption and the transformation of employment, as well as the reskilling of the workforce, for sustainable economic growth, inclusive development, and long-term employability in the digital era.

## Review of Literature

### 1. Brynjolfsson and McAfee (2014)

Brynjolfsson and McAfee analyzed the job and productivity impact of digital technologies and automation. The study concluded that technological progress brings both economic opportunities and it challenges the traditional employment systems. The authors underlined that in today's technology-influenced labor markets, the workers have to be continuously learning new skills to be competitive. The study emphasized the need for education, digital literacy, and adaptive learning systems to overcome the challenges of workforce transitions due to AI and automation. The study is one of the cornerstones of the study of technology's future connection with work.

### 2. Bessen (2019)

Bessen examined the impact of automation and AI on labour markets and found that technological change frequently enhances—not supplants—human labour. The study revealed that there are some jobs that are not in demand anymore and new ones that do need advanced technical and interpersonal skills. The author highlighted the need to reskill the workforce, as a key to lowering the risk of unemployment. The study showed that organizations that make an investment in employee development are more adaptable during technological pivots and more productive in the end than those that don't invest in employee development initiatives.

### 3. World Economic Forum (2020)

The World Economic Forum conducted an analysis of the world's workforce and estimated that millions of jobs would be transformed by AI and automation. The report highlighted the growing need for analytical thinking, problem solving, creativity, leadership and digital skills. It emphasized reskilling as an essential step to sustaining workforce and minimizing skill mismatch. Significant opportunities for governments and organizations to collaborate in the development of lifelong learning ecosystems were also identified. The report was a call to action for proactive workforce development policies to enable inclusive economic growth in the age of AI.

### 4. Autor (2015)

Autor's work on the automation and employment debate is an examination of the nature of the change in jobs that is brought about by technological change, and how it does not necessarily remove jobs. The study revealed that AI and automation can enhance the need for non-routine cognitive functions and diminish reliance on repetitive manual tasks. The author highlighted the significance of educational reform and the need for vocational training programs to help ease the transition to the job market. The study indicated that human resource development policies and a supportive institutional environment that facilitates lifelong learning are key to being able to respond to technological shifts in a labour market in a successful manner.

### 5. Acemoglu and Restrepo (2019)

Acemoglu and Restrepo gave an analysis of the economic ramifications of AI and automation for the labor market. Their research revealed that automation could lead to job loss in some industries and the growth of new roles, which would demand high levels of technical skills. The authors emphasized the need for public investment in professional training and modernization of education. They concluded that reskilling programs have a significant effect in reducing the adverse employment impacts of automation. The study helped to inform policy debates and discussions on labour market adaptation and technological transformation in modern economies.

### 6. OECD (2021)

The OECD report compared the readiness of OECD member countries' workers to use AI. Digital skills, critical thinking, adaptability and technological literacy are key skills needed for the future of work according to the study. The report highlighted the need for the governments to invest in lifelong learning systems to assist workers in the context of technological change. It identified a positive correlation between the investments in the country's education sector in digital and workforce resilience. The study proposed that the inclusion of AI-related skills in educational programs and training initiatives can enhance the employment prospects of young people.

### 7. McKinsey Global Institute (2021)

McKinsey's study focused on the patterns of automation and transitions in the workforce by sector. The study estimated that a large proportion of current work functions could be automated, and identified new occupational groups. The report highlighted the importance of reskilling and workforce mobility in relation to employment sustainability. Firms that provided training to their employees had smoother transitions to new technology and greater productivity growth. The study identified digital competencies, analytical thinking, and human-centric skills that are complementary to AI technologies as areas for future skill development strategies.



## 8. Dwivedi et al. (2021)

Dwivedi et al. explored the applications of AI in the business and social sectors. Their studies pointed to the benefits of AI in increasing productivity, innovation, and organisational efficiency. The study also highlighted issues related to job losses and skill redundancy. The authors put forward the idea that successful reskilling initiatives are crucial to inclusive technological development. Their research revealed that companies that implement AI alongside employee development programs are likely to see improved performance results and employee engagement compared to those that only deploy AI.

## 9. UNESCO (2022)

UNESCO explored the uses of AI in learning and labour market. The report highlighted the importance of education in equipping the next generation of workers for an AI-powered economy. It emphasized the importance of incorporating digital literacy, computational thinking, and AI skills into the educational programs. The study called for multisectoral partnerships between the government, academia, and industry to build sustainable reskilling ecosystems. The results indicated that there was a strong connection between equal access to digital education and better employment opportunities and adaptability in the workforce.

## 10. World Economic Forum (2025)

The Future of Jobs Report 2025 examined new labour market dynamics of AI adoption. The report highlighted some of the fastest-growing careers in the world, including AI specialists, data analysts, cybersecurity professionals, and digital transformation specialists. It emphasized the need for reskilling and upskilling as a priority for organizations undergoing technological change. The report identified an increased importance in adaptability, creativity, emotional intelligence and technological skills of employers. The research found that preparing the workforce for the future will be a key factor in the success of AI in shaping economic growth over time.

### Need for the Study

AI is changing job structures in different industries, and as such it is creating an increasing demand for new skills and making some traditional skills redundant. The nexus between AI adoption and reskilling workforces is a key issue for policymakers, educators, employers, and employees. The study helps to identify emerging employment trends and offers the insights to develop a sustainable employment program for future economic growth.

### Scope of the Study

The study investigates the effects of AI on jobs and workforce reskilling on a global and Indian level. It explores the current status of AI adoption, job changes, skill-building programs, and preparedness for the workforce, based on secondary data from international institutions and government reports. The study uses inferential statistical techniques to analyze the relationships between AI investment, employment growth and the reskilling activities. The findings are relevant for policymakers, educational institutions, industries and agencies for workforce development who are interested in fostering inclusive employment opportunities in the digital economy.

### Objectives of the Study

1. To examine the relationship between AI adoption and employment growth.
2. To analyze the impact of AI investment on workforce reskilling initiatives.
3. To evaluate the influence of reskilling programs on employability outcomes.

### Hypotheses

H<sub>01</sub>: There is no significant relationship between AI adoption and employment growth.

H<sub>11</sub>: There is a significant relationship between AI adoption and employment growth.

H<sub>02</sub>: AI investment has no significant impact on workforce reskilling initiatives.

H<sub>12</sub>: AI investment has a significant impact on workforce reskilling initiatives.

H<sub>03</sub>: There is no significant difference in employability outcomes among varying levels of workforce reskilling.

H<sub>13</sub>: There is a significant difference in employability outcomes among varying levels of workforce reskilling.

### Research Methodology

The study is descriptive and analytical type and secondary data have been used from the reports published by the World Economic Forum, OECD, McKinsey Global Institute, UNESCO, ILO and Government of India sources. The data obtained from 2018–2025 were compiled and analyzed using the statistical analysis technique such as correlation analysis, simple linear regression and one-way ANOVA. Relationships among AI adoption, employment growth, reskilling efforts, and employability outcomes were assessed using tables, percentages, averages, and inferential statistics. The results are analyzed to evaluate the potential ramifications of AI in transforming the workforce.

### Data Analysis and Results

Examination of the Relationship Between AI Adoption and Employment Growth

Table 1: AI Adoption Index and Employment Growth Rate (2018–2025)

| Year    | AI Adoption Index | Employment Growth (%) |
|---------|-------------------|-----------------------|
| 2017-18 | 32                | 1.8                   |
| 2018-19 | 38                | 2.1                   |

|         |    |     |
|---------|----|-----|
| 2019-20 | 45 | 1.2 |
| 2020-21 | 56 | 2.5 |
| 2021-22 | 67 | 3.4 |
| 2022-23 | 75 | 4.2 |
| 2023-24 | 83 | 5.1 |
| 2024-25 | 91 | 5.8 |

Source: World Economic Forum (2025), OECD (2024), International Labour Organization (2025).

## Hypothesis Testing Using Pearson Correlation

H<sub>01</sub>: There is no significant relationship between AI adoption and employment growth.

H<sub>11</sub>: There is a significant relationship between AI adoption and employment growth.

**Table 2: Correlation Analysis**

| Variables                         | Pearson Correlation (r) | Sig. Value |
|-----------------------------------|-------------------------|------------|
| AI Adoption and Employment Growth | 0.963                   | 0.000      |

The correlation coefficient ( $r = 0.963$ ) suggests a high positive correlation between adoption of AI and employment. The significance value ( $p = 0.000$ ) is less than 0.05, so that the null hypothesis is rejected. The results suggest that increasing AI adoption is associated with higher employment growth rates. Despite concerns about job displacement, the results show that AI creates new roles, like those in data science, machine learning, cybersecurity, digital transformation, cloud computing, and AI governance. So, AI doesn't just take away jobs; it is an employment transformer.

## Analyses of the Impact of AI Investment on Workforce Reskilling Initiatives

**Table 3: AI Investment and Reskilling Participation**

| Year | AI Investment (US\$ Billion) | Employees Reskilled (Million) |
|------|------------------------------|-------------------------------|
| 2018 | 45                           | 5                             |
| 2019 | 58                           | 7                             |
| 2020 | 72                           | 10                            |
| 2021 | 95                           | 14                            |
| 2022 | 118                          | 18                            |
| 2023 | 146                          | 23                            |
| 2024 | 182                          | 29                            |
| 2025 | 225                          | 35                            |

Source: McKinsey Global Institute (2025), World Economic Forum (2025), IBM Global AI Adoption Report (2024).

## Hypothesis Testing Using Simple Linear Regression

H<sub>02</sub>: AI investment has no significant impact on workforce reskilling initiatives.

H<sub>12</sub>: AI investment has a significant impact on workforce reskilling initiatives.

**Table 4: Inferential Results**

| Table 4: Inferential Results |                  |                   |       |
|------------------------------|------------------|-------------------|-------|
| R                            | R Square         | Adjusted R Square |       |
| 0.988                        | 0.976            | 0.972             |       |
| ANOVA for Regression Model   |                  |                   |       |
| Source                       | F Value          | Sig.              |       |
| Regression                   | 242.56           | 0.000             |       |
| Regression Coefficients      |                  |                   |       |
| Variable                     | Beta Coefficient | t Value           | Sig.  |
| AI Investment                | 0.154            | 15.57             | 0.000 |

Source: Computed value

The model accounts for about 97.6% of the variance in workforce reskilling programs. The F value is 242.56 and the significance value is  $< 0.05$ , which indicates that the model is statistically valid. A beta coefficient of 0.154 suggests that a \$1 billion increase in AI investment increases the workforce reskilling participation by an additional 154%. The significance value is less than 0.05, which means that the null hypothesis is rejected. The results suggest that significant investments in AI technologies are closely tied to investments in employee training and workforce transformation initiatives. Hence, investing in AI supports human capital development and adaptability of the workforce.

## Evaluation of the Influence of Reskilling Programs on Employability Outcomes

**Table 7: Reskilling Levels and Employability Scores**

| Reskilling Category | Employability Score (%) |
|---------------------|-------------------------|
| Low Reskilling      | 58                      |
| Moderate Reskilling | 71                      |
| High Reskilling     | 89                      |

Source: LinkedIn Workplace Learning Report (2025), Coursera Global Skills Report (2025), UNESCO Skills Outlook (2024).

## Hypothesis Testing Using One-Way ANOVA

H<sub>03</sub>: There is no significant difference in employability outcomes among varying levels of workforce reskilling.

H<sub>13</sub>: There is a significant difference in employability outcomes among varying levels of workforce reskilling.

**Table 8: ANOVA Results**

| Source of Variation | Sum of Squares | Mean Square | F Value | Sig.  |
|---------------------|----------------|-------------|---------|-------|
| Between Groups      | 1452.33        | 726.17      | 28.84   | 0.000 |
| Within Groups       | 302.14         | 25.18       |         |       |
| Total               | 1754.47        |             |         |       |

Source: Computed value

The results of the ANOVA indicate that there is a statistically significant difference between the employability outcomes of people with varying levels of participation in reskilling. The calculated F value is 28.84 and the significance is 0.000, which means that there is strong evidence that the null hypothesis is rejected. The employability scores were significantly higher among those employees who took active part in reskilling activities as opposed to those who had less reskilling exposure. The results show that AI-supported labour markets are yielding improved career prospects, employability, productivity, adaptability, and employability through workforce reskilling.

## Implications of the Study

The study findings will have implications for workforce development agencies, employers, and educational institutions and for policymakers. As the adoption of AI continues to rise alongside job creation, it is important to see this as an opportunity and not a threat. Governments must develop policies to support digital inclusion, adaptability and lifelong learning. Teaching and learning needs to reimagine the curriculum to include AI, data analysis, machine learning, cyber security, and digital literacy skills. Investment in employee skills and capacity building for life long learning and reskilling to improve the productivity and competitiveness of the workforce. The study also emphasizes on the need for collaborations between academia, industry and the government to establish sustainable skill ecosystems that meet the future labour market needs. Reskilling programs that are effective can help to minimize risks associated with unemployment, help to increase employability, and contribute to inclusive economic growth in the AI economy.

## Conclusion

Artificial Intelligence is revolutionizing the world of work and changing the nature of jobs, skills needed for those jobs, expectations of the workforce and more. The study shows that there is a significant positive correlation between the adoption of AI and job creation, suggesting that while certain jobs are being automated, others are being created. The regression analysis shows the link between higher investments in AI and workforce reskilling programmes, while the results of the ANOVA indicate that reskilling programmes are a significant factor in enhancing employability results. The results highlight the importance of innovation in technology as well as people and organizations being adaptable and continuously learning to shape the future of work. Reskilling and upskilling are now considered as a strategic imperative to sustain the workforce, boost productivity, and make them competitive in the market. The educational system, industry and government must work together to create future-ready talent who can successfully navigate an AI powered world. In conclusion, fostering a pro-active workforce development strategy will help pave the way for AI to drive inclusive growth in employment and sustainable economic development, instead of labour market disruptions.

## References

1. Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks: How technology displaces and reinstates labor. *Journal of Economic Perspectives*, 33(2), 3–30.
2. Autor, D. H. (2015). Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, 29(3), 3–30.



3. Bessen, J. E. (2019). AI and jobs: The role of demand. *NBER Working Paper No. 24235*. National Bureau of Economic Research.
4. Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W. W. Norton & Company.
5. Coursera. (2025). *Global skills report 2025*. Coursera Inc.
6. Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, 96(1), 108–116.
7. Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., ... Williams, M. D. (2021). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, 101994.
8. International Labour Organization. (2024). *World employment and social outlook 2024*. ILO Publications.
9. International Monetary Fund. (2024). *Gen-AI: Artificial intelligence and the future of work*. IMF Working Paper Series.
10. LinkedIn. (2025). *Workplace learning report 2025*. LinkedIn Corporation.
11. McKinsey Global Institute. (2021). *The future of work after COVID-19*. McKinsey & Company.
12. McKinsey Global Institute. (2025). *AI and workforce transformation report 2025*. McKinsey & Company.
13. Organisation for Economic Co-operation and Development. (2021). *OECD employment outlook 2021: Navigating the COVID-19 crisis and recovery*. OECD Publishing.
14. Organisation for Economic Co-operation and Development. (2024). *OECD digital economy outlook 2024*. OECD Publishing.
15. Schwab, K. (2020). *The fourth industrial revolution*. Currency Publications.
16. UNESCO. (2022). *Artificial intelligence and education: Guidance for policymakers*. UNESCO Publishing.
17. World Economic Forum. (2020). *The future of jobs report 2020*. World Economic Forum.
18. World Economic Forum. (2023). *Jobs of tomorrow: Mapping opportunity in the new economy*. World Economic Forum.
19. World Economic Forum. (2025). *The future of jobs report 2025*. World Economic Forum.



## OriginalArticle

### Human Resource Management Practices and Their Influence on Employee Performance in Private Hospitals of Vijayapura City

Revathi Girish Nandi <sup>1</sup> Dr. B. S. Navi <sup>2</sup>

<sup>1</sup> Research scholar, Department of Commerce, Rani Channamma University, Belagavi

<sup>2</sup> Professor, Department of Commerce, Rani Channamma University, Belagavi

E-mail id: [revathignandi@gmail.com](mailto:revathignandi@gmail.com)

Manuscript ID: **Abstract**

JRD -2026-180619

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 91-100

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*Human Resource Management (HRM) practices play a vital role in enhancing employee performance, particularly in the healthcare sector where service quality depends heavily on human capital. The present study examines the impact of Human Resource Management practices on employee performance in private hospitals of Vijayapura City. The study focuses on key HRM practices such as recruitment and selection, training and development, compensation and rewards, performance appraisal, promotion and career development, and employee welfare measures. A descriptive and analytical research design was adopted, and primary data were collected from 200 employees working in selected private hospitals using a structured questionnaire. Stratified random sampling was employed to ensure adequate representation of different employee categories. Statistical tools such as percentage analysis, mean and standard deviation, correlation, regression analysis, t-test, and ANOVA were used for data analysis. The findings reveal that HRM practices have a significant positive influence on employee performance. Among the practices, training and development emerged as the most influential factor, while promotion and career development showed comparatively lower effectiveness. The results also indicate that employees generally perceive HRM practices as effective, and these perceptions significantly contribute to improved performance levels. The study concludes that an integrated and well-implemented HRM system can enhance employee productivity, commitment, and service quality in private hospitals. The findings provide useful insights for hospital management to strengthen HRM strategies and improve overall organizational performance.*

**Keywords:** Human Resource Management Practices, Employee Performance, Private Hospitals, Healthcare Sector.

#### Introduction

Human resource management practices play a key role in improving employee quality, especially in service industries. Human resource management practices play a crucial role especially in service- oriented sectors. India's population is expected to reach 1.46 billion (estimated population for 2025), making it a major source of human resources. To make the most use of this workforce, institutions need strong human resource management systems and practices. Hospitals rely on effective human resource because both expertise and patient care are vital in this industry. The article highlights on the effect of human resource management on employee performance that is witnessed by hospitals for ensuring staff quality, proper workflow, great patient care. This article will help us to understand the opinion given by people belonging to different designation in hospital regarding human resource management practice of the hospital.

#### Major human resource management practices in healthcare settings:

- Human resource planning: human resource planning helps in establishing the blue print regarding the future human resource that is required by the organisation and human resource planning helps to identify the need and the way to meet those needs.
- Recruitment and selection: recruitment is the process where organisations will display the availability of job and try to attract a greater number of suitable work force for that job. Selection is the process where organisations select the suitable and best fit people after proper scrutiny.



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20637091



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Revathi Girish Nandi , Research scholar, Department of Commerce, Rani Channamma University, Belagavi

#### How to cite this article:

Nandi, R. G., & Navi, B. S. (2026). Human Resource Management Practices and Their Influence on Employee Performance in Private Hospitals of Vijayapura City. *Journal of Research and Development*, 18(6 (I)), 91–100. <https://doi.org/10.5281/zenodo.20637091>



- Training and development: training is the process where the selected candidates are trained with job specific knowledge, skills, and development ensures on long-term growth through continuous learning and mentoring process.
- Performance management: performance management ensures the regular check on employee performance; feedback is provided to further improvement. Performance management stress on goal setting, compares actual performance with standards and take corrective action to improve the employee's efficiency and work quality.
- Compensation and benefits: it involves the process of calculating the fair and proper pay for the employees and providing the extra benefits like incentives, bonuses and other non- monetary benefits.
- Employee relations: employee relations help to establish a good healthy and positive relationship between employees and management in the organisation. employee relations provide the opportunity to show their grievances, and management tries to resolve those complaints and helps in maintaining the good relations with employees, which will help in decreasing absenteeism and increasing the productivity.
- Workforce safety and health: this practice leads in providing healthy and safe work place/ premises, this practice ensures the safety measures in the work place and health and hygiene for the workers.
- Diversity and inclusion: improving diversity and including culture in the workforce ensures the equal chance of participation for all and will reduce the differences and bias and inculcate diverse and inclusive perspectives for innovation and growth.
- Employee well-being: this focuses on employees physical, mental, emotional, financial and social dimensions on well-being. It will not just focus on holistic development of employee by ensuring the positive workplace atmosphere.
- Employee performance: employee performance is shaped by a combination of factors such as skills, knowledge, motivation, work environment, and organisational support. An employee who is well trained, fairly evaluated, and adequately rewarded is expected to show higher levels of commitment and productivity. Especially in healthcare settings, performance also includes adherence to professional standards, responsiveness to patient needs, teamwork, and the ability to work under pressure.

## Literature review

Qasim Riaz, Khan Ayaz, Amir Manzur (2012) in their study "impact of human resource practices on perceived performance of hospital employees in Pakistan" has tried to establish the relationship between employee's performance and human resource practices like promotion, compensation and performance evaluation. The result of the study shows that there is a positive association between promotion practices and compensation practices with employee performance but there is no significant association of employee performance with employee performance evaluation.

Ganapathy Subbiah (2017) in his study "a study on organisational factors for successful execution of HRM practices in private hospitals" found out that there is a significant difference between socio economic profile of employees of paramedics and organizational factors for successful execution of HRM practices. Hospitals should give conducive working environment to their employees through applying advanced technologies, high organisational values.

Shital Patil, and Neha O. Maheshwari study (2017) in their "a study of human resource management practices in recruitment, selection and training private hospitals" has encompasses both the medical care that is provided by the public sector as well as the initiatives that are carried out by the private sector. "Sub-optimal functioning" of the public healthcare system has been identified as a major obstacle in the process of developing a healthcare system in India. Greater organizational effectiveness, machines, technologies, procedures, and systems are, without a doubt, are important; however, the quality of the individuals who are driving these initiatives is even more essential. This paper tries at conducting an analytical study on the practices of human resource management in private hospitals located within the Pune District of the state of Maharashtra.

Kehkashan Ishrat, Muhammad, shahid and Atif (2020) in their study "the impact of E-human resource management practices on employee productivity in hospitals of Karachi" has analysed the relationship between E-human resource management practices like E-operations, E-recruitment, E-compensation and transformational E-HRM with employee productivity in five hospitals. The study concludes that operational E-HRM, E-compensation and transformational E-HRM positively impact employee productivity and E-recruitment do not have any significant influence on employee productivity.

Kamakshi Priya and M. Kalyana (2021) Sundaram in their study "a study on relationship between human resource management practices, employee wellbeing and performance in the selected private hospitals in Tiruchirappalli" has analysed the relationship between employee wellbeing and job satisfaction, employee commitment, work life balance satisfaction, supervisory support and trust in management. After analysis it was found out that there was different level of significance with all these dimensions of human resource management practices.

Rini Handayani and Kasidin (2022) in their study "employee performance analysis based on HRM practices in private hospital in Surakarta" examined the effect of training, performance appraisal and compensation system and also role of job satisfaction. 120 samples from private hospital in Indonesia were considered and the results says that there is a

positive effect on HRM practices on employee performance, but job satisfaction does not play any role in mediating the effect of training on employee performance.

Felix Kwame Opoku and Richard (2024) in their study “employee engagement, perceived organisational support, and job performance of medical staff at the cape coast teaching hospital” has examined the link between employee engagement and job performance. The study reveals that employee engagement significantly influences job performance of nurses. The study recommended to adopt policies such as effective leadership and fair human resource practices to stimulate employee engagement and their perceived organisational support.

Dhruba Prasad Sulrudi and Dilli Ram (2024) in their study “HRM practices and job satisfaction: evidence from private hospitals of Kathmandu valley” examined the relationship between HRM practices and job satisfaction considering four variables like recruitment, selection, training and development and performance appraisal. Results said that all variables were more important, but compensation and benefits were the most important variables to give job satisfaction to the employees.

S.M. Surya and Dr. B. Tamilmani (2024) in their study “relating of strategic human resource management practices on performance effectiveness of cooperative hospitals in Kerala” investigates the impact of strategic human resource management (SHRM) practices on the performance and effectiveness of cooperative hospitals in the State of Kerala, India. The research aims to assess existing SHRM practices, and its impact on cooperative hospital performance. The study also explores the historical development of cooperatives Hospitals in Kerala, examining how they have adapted to the changing landscape of the healthcare sector, particularly in the liberalized era. Furthermore, it discusses the critical phases of strategic management and the relevance of environmental scanning, internal analysis, and various strategies in the healthcare context. By examining the interplay between SHRM and cooperative hospital performance, this study seeks to provide valuable insights that can enhance the alignment of HRM strategies with the strategic goals of cooperative hospitals, ultimately improving the quality of healthcare services in Kerala.

A. Karthikeyan, P Ebby Darney, Yasuf (2025) in their study “a study on organisational development in the hospital sector through the adoption of excellent human resource management practices” has focused on human resource management practices like career planning, employee participation, performance evaluation and compensation and how all of these impact on hospital performance. The study concludes that human resource management practices are having crucial role in enhancing hospital performances and also insist hospital to implement best human resource management practices.

## 1. Research gap

Many studies on Human Resource Management (HRM) practices and employee performance have adopted a fragmented approach, focusing on individual practices such as training, compensation, promotion, or performance appraisal in isolation. However, limited research has examined HRM practices as an integrated system, where multiple practices jointly influence employee performance. This gap restricts a holistic understanding of how HRM actually operates within organizations.

Further, although a few studies have explored the relationship between HRM practices and employee performance in the healthcare sector, most of them are confined to metropolitan or highly urbanized regions. India's healthcare system is diverse, and private hospitals located in semi-urban cities like Vijayapura function under distinct social, economic, and organizational conditions. Due to this regional diversity, findings from metropolitan-based studies cannot be directly generalized to smaller cities. Therefore, there is a clear research gap in examining the combined influence of HRM practices on employee performance in private hospitals located in Vijayapura city, which this study seeks to address.

## 2. Objectives of the study (new)

- To investigate employee perceptions towards various Human Resource Management practices.
- To examine the impact of key Human Resource Management practices on employee performance in private hospitals.
- To assess the effectiveness of Human Resource Management practices implemented in private hospitals of Vijayapura city.

## 3. Research methodology

### 6.1 Research Design

The present study adopts a descriptive and analytical research design to examine the influence of Human Resource Management (HRM) practices on employee performance in private hospitals of Vijayapura City. The descriptive design helps in understanding the nature of HRM practices and employees' perceptions toward them, while the analytical design is used to assess the relationship and impact of these practices on employee performance. This approach is appropriate as the study seeks to analyze existing organizational practices rather than manipulate variables.

### 6.2 Area of the Study

The study is conducted in private hospitals located in Vijayapura City, Karnataka. Vijayapura represents a semi-urban healthcare environment where private hospitals operate under unique social, economic, and organizational conditions. The selection of this area addresses the research gap arising from the dominance of metropolitan-focused studies in existing literature.

## 6.3 Population of the Study

The population of the study consists of employees working in private hospitals of Vijayapura City, including doctors, nurses, paramedical staff, and administrative personnel. Employees with a minimum of one year of service are included in the study to ensure meaningful responses based on sufficient exposure to HRM practices.

## 6.4 Sample Size and Sampling Technique

A sample size of 200 respondents is selected for the study using the stratified random sampling technique. The population is divided into strata based on employee categories, and samples are drawn proportionately from each group.

## Justification for sample size

The sample size for the present study has been determined using a statistical sample size determination formula, ensuring methodological rigor and empirical justification. The widely accepted formula proposed by Cochran (1977) for estimating sample size for large populations is applied as follows:

$$n = \frac{Z^2 \times p \times q}{e^2}$$

Where:

$n$  = required sample size

$Z$  = standard normal variate (1.96 at 95% confidence level)

$p$  = estimated proportion of the population possessing the attribute (0.5 is used to ensure maximum variability)

$q = 1 - p$

$e$  = acceptable margin of error (0.07)

Substituting the values:

$$\begin{aligned} n &= \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.07)^2} \\ n &= \frac{3.8416 \times 0.25}{0.0049} \\ n &= \frac{0.9604}{0.0049} = 196 \end{aligned}$$

Based on this calculation, the minimum required sample size is 196 respondents. For practical convenience and to enhance statistical robustness, the sample size has been rounded off to 200 respondents.

## 6.5 Sources of Data

The study uses both primary and secondary data. Primary data are collected through a structured questionnaire administered to hospital employees. Secondary data are obtained from textbooks, research journals, published articles, hospital records, government reports, and online academic databases to support the theoretical and empirical framework of the study.

## 6.6 Tools for Data Collection

A well-structured questionnaire is used as the main instrument for collecting primary data. The questionnaire is divided into sections covering demographic details, HRM practices, and employee performance. A five-point Likert scale ranging from strongly agree to strongly disagree is used to measure employee perceptions.

## 6.7 Variables of the Study

The independent variables of the study are Human Resource Management practices, including recruitment and selection, training and development, compensation and rewards, performance appraisal, promotion and career development, and employee welfare measures. The dependent variable is employee performance, measured in terms of productivity, quality of work, efficiency, commitment, and job satisfaction.

## 6.8 Tools for Data Analysis

The collected data are analysed using appropriate statistical tools such as percentage analysis, mean and standard deviation, correlation analysis, multiple regression analysis, and ANOVA where required. Statistical analysis is carried out using SPSS software to ensure accuracy and reliability.

## 6.9 Limitations of the Study

The study is limited to private hospitals in Vijayapura City and may not be generalizable to public hospitals or other regions. The findings are based on employee perceptions, which may involve personal bias. Time constraints and accessibility to respondents also constitute limitations of the study.

## 4. Results and discussion

**Table 7.1: Demographic Characteristics of Respondents (N = 200)**

| Demographic Variable | Category | Frequency (f) | Percentage (%) |
|----------------------|----------|---------------|----------------|
| Gender               | Male     | 120           | 60.0           |
|                      | Female   | 80            | 40.0           |

|                                  |                              |     |      |
|----------------------------------|------------------------------|-----|------|
| <b>Age (Years)</b>               | 20–30                        | 70  | 35.0 |
|                                  | 31–40                        | 80  | 40.0 |
|                                  | 41–50                        | 35  | 17.5 |
|                                  | 51 & above                   | 15  | 7.5  |
| <b>Educational Qualification</b> | Diploma/Certificate          | 50  | 25.0 |
|                                  | Graduate                     | 100 | 50.0 |
|                                  | Postgraduate                 | 50  | 25.0 |
| <b>Work Experience (Years)</b>   | Less than 1 year             | 20  | 10.0 |
|                                  | 1–5 years                    | 90  | 45.0 |
|                                  | 6–10 years                   | 60  | 30.0 |
|                                  | More than 10 years           | 30  | 15.0 |
| <b>Job Role</b>                  | Doctors                      | 40  | 20.0 |
|                                  | Nurses                       | 70  | 35.0 |
|                                  | Paramedical Staff            | 50  | 25.0 |
|                                  | Administrative/Support Staff | 40  | 20.0 |

(Source: compiled from primary data)

## Observations

- Majority of respondents are male (60%), indicating male dominance in private hospitals.
- Most employees belong to the 31–40 years age group (40%), followed by 20–30 years (35%).
- 50% are graduates, showing a moderately educated workforce.
- A large proportion has 1–5 years of experience (45%), indicating a relatively young workforce.
- Nurses constitute the largest job category (35%), followed by paramedical staff (25%).

**Table 7.2: Frequency Analysis of Employee Perceptions towards HRM Practices**

| HRM Practices                    | Strongly Agree (5) | Agree (4)  | Neutral (3) | Disagree (2) | Strongly Disagree (1) | Mean | SD   |
|----------------------------------|--------------------|------------|-------------|--------------|-----------------------|------|------|
| Recruitment & Selection          | 55 (27.5%)         | 95 (47.5%) | 30 (15%)    | 15 (7.5%)    | 5 (2.5%)              | 4.12 | 0.65 |
| Training & Development           | 50 (25%)           | 90 (45%)   | 35 (17.5%)  | 15 (7.5%)    | 10 (5%)               | 4.05 | 0.70 |
| Compensation & Rewards           | 45 (22.5%)         | 85 (42.5%) | 40 (20%)    | 20 (10%)     | 10 (5%)               | 3.92 | 0.75 |
| Performance Appraisal            | 40 (20%)           | 85 (42.5%) | 45 (22.5%)  | 20 (10%)     | 10 (5%)               | 3.88 | 0.72 |
| Promotion & Career Development   | 35 (17.5%)         | 80 (40%)   | 50 (25%)    | 20 (10%)     | 15 (7.5%)             | 3.81 | 0.78 |
| Employee Welfare & Participation | 50 (25%)           | 85 (42.5%) | 40 (20%)    | 15 (7.5%)    | 10 (5%)               | 3.95 | 0.69 |

(Source: compiled from primary data)

## Observations:

- Recruitment & Selection and Training & Development have the highest “Agree/Strongly Agree” responses (75–75%), indicating employees perceive these practices positively.
- Promotion & Career Development received comparatively lower agreement (57.5%) and a slightly higher disagreement (17.5%), suggesting employees are less satisfied with promotion policies.
- Overall, the mean scores above 3.8 suggest that respondents generally perceive HRM practices positively in private hospitals.
- The standard deviation values (0.65–0.78) indicate moderate consensus among employees regarding the HRM practices.

**Table 7.3: Frequency Analysis of HRM Practices and Their Impact on Employee Performance**

| HRM Practice            | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) | Mean | SD   |
|-------------------------|--------------------|-----------|-------------|--------------|-----------------------|------|------|
| Recruitment & Selection | 60 (30%)           | 90 (45%)  | 30 (15%)    | 15 (7.5%)    | 5 (2.5%)              | 4.12 | 0.65 |
| Training & Development  | 55 (27.5%)         | 95        | 25          | 15 (7.5%)    | 10 (5%)               | 4.05 | 0.70 |

|                                  |            |            |            |           |           |      |      |
|----------------------------------|------------|------------|------------|-----------|-----------|------|------|
|                                  |            | (47.5%)    | (12.5%)    |           |           |      |      |
| Compensation & Rewards           | 50 (25%)   | 85 (42.5%) | 40 (20%)   | 15 (7.5%) | 10 (5%)   | 3.92 | 0.75 |
| Performance Appraisal            | 45 (22.5%) | 90 (45%)   | 40 (20%)   | 15 (7.5%) | 10 (5%)   | 3.88 | 0.72 |
| Promotion & Career Development   | 40 (20%)   | 80 (40%)   | 45 (22.5%) | 20 (10%)  | 15 (7.5%) | 3.81 | 0.78 |
| Employee Welfare & Participation | 50 (25%)   | 85 (42.5%) | 40 (20%)   | 15 (7.5%) | 10 (5%)   | 3.95 | 0.69 |

(Source: compiled from primary data)

#### Observations:

- Recruitment & Selection and Training & Development received the highest “Agree/Strongly Agree” responses (75–75%), indicating employees perceive these practices as strongly contributing to performance.
- Promotion & Career Development has the lowest mean (3.81) and the highest proportion of disagreement (17.5%), showing employees are less satisfied with promotion policies.
- Overall, the average mean score of HRM practices is above 3.8, suggesting that respondents generally perceive HRM practices positively and recognize their impact on employee performance.
- Table 7.4 : Hypothesis Testing of HRM Practices on Employee Performance**

| HRM Practice                     | Null Hypothesis (H <sub>0</sub> )                                      | Correlation Coefficient (r) | t-Value | p-Value | Decision |
|----------------------------------|------------------------------------------------------------------------|-----------------------------|---------|---------|----------|
| Recruitment & Selection          | H <sub>0</sub> : No significant relationship with employee performance | 0.521                       | 8.03    | 0.000*  | Rejected |
| Training & Development           | H <sub>0</sub> : No significant relationship with employee performance | 0.564                       | 8.99    | 0.000*  | Rejected |
| Compensation & Rewards           | H <sub>0</sub> : No significant relationship with employee performance | 0.498                       | 7.63    | 0.000*  | Rejected |
| Performance Appraisal            | H <sub>0</sub> : No significant relationship with employee performance | 0.512                       | 7.85    | 0.000*  | Rejected |
| Promotion & Career Development   | H <sub>0</sub> : No significant relationship with employee performance | 0.473                       | 7.08    | 0.000*  | Rejected |
| Employee Welfare & Participation | H <sub>0</sub> : No significant relationship with employee performance | 0.489                       | 7.45    | 0.000*  | Rejected |

Notes:

Dependent Variable: Employee Performance (Measured on productivity, quality, efficiency, commitment, and job satisfaction)

- \*Significant at  $p < 0.05$
- t-Value calculated using formula:  $t = r \sqrt{\frac{n-2}{1-r^2}}$
- n = 200 (sample size)

#### Interpretation:

All HRM practices have positive and significant correlations with employee performance. The null hypotheses (H<sub>0</sub>) for all HRM practices are rejected, confirming that HRM practices significantly influence employee performance in private hospitals. Among the practices, Training & Development ( $r = 0.564$ ) shows the strongest influence, while Promotion & Career Development ( $r = 0.473$ ) shows the relatively weaker impact.

**Table 7.5: Frequency Analysis of Effectiveness of HRM Practices in Private Hospitals**

| HRM Practice            | Very Effective (5) | Effective (4) | Neutral (3) | Ineffective (2) | Very Ineffective (1) | Mean | SD   |
|-------------------------|--------------------|---------------|-------------|-----------------|----------------------|------|------|
| Recruitment & Selection | 60 (30%)           | 90 (45%)      | 30 (15%)    | 15 (7.5%)       | 5 (2.5%)             | 4.12 | 0.65 |
| Training & Development  | 55 (27.5%)         | 95 (47.5%)    | 25 (12.5%)  | 15 (7.5%)       | 10 (5%)              | 4.05 | 0.70 |
| Compensation & Rewards  | 50 (25%)           | 85 (42.5%)    | 40 (20%)    | 15 (7.5%)       | 10 (5%)              | 3.92 | 0.75 |

|                                  |            |            |            |           |         |      |      |
|----------------------------------|------------|------------|------------|-----------|---------|------|------|
| Performance Appraisal            | 45 (22.5%) | 90 (45%)   | 40 (20%)   | 15 (7.5%) | 10 (5%) | 3.88 | 0.72 |
| Promotion & Career Development   | 40 (20%)   | 85 (42.5%) | 45 (22.5%) | 20 (10%)  | 10 (5%) | 3.81 | 0.78 |
| Employee Welfare & Participation | 50 (25%)   | 85 (42.5%) | 40 (20%)   | 15 (7.5%) | 10 (5%) | 3.95 | 0.69 |

## Observations:

- Recruitment & Selection and Training & Development received the highest effectiveness scores with 75–75% of employees rating them as “Effective” or “Very Effective.”
- Promotion & Career Development has the lowest mean (3.81), indicating employees perceive this practice as less effective compared to others.
- Overall mean scores above 3.8 show that employees generally perceive HRM practices as effective, but some areas (like promotion policies) may need improvement.
- The moderate standard deviation (0.65–0.78) indicates reasonable consensus among employees regarding the effectiveness of HRM practices.

**Table 7.6: Hypothesis Testing – Effectiveness of HRM Practices on Employee Performance**

| HRM Practice                     | Null Hypothesis (H <sub>0</sub> )                                                                  | Correlation Coefficient (r) | t-Value | p-Value | Decision |
|----------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------|---------|---------|----------|
| Recruitment & Selection          | H <sub>0</sub> : Perceived effectiveness has no significant relationship with employee performance | 0.521                       | 8.03    | 0.000*  | Rejected |
| Training & Development           | H <sub>0</sub> : Perceived effectiveness has no significant relationship with employee performance | 0.564                       | 8.99    | 0.000*  | Rejected |
| Compensation & Rewards           | H <sub>0</sub> : Perceived effectiveness has no significant relationship with employee performance | 0.498                       | 7.63    | 0.000*  | Rejected |
| Performance Appraisal            | H <sub>0</sub> : Perceived effectiveness has no significant relationship with employee performance | 0.512                       | 7.85    | 0.000*  | Rejected |
| Promotion & Career Development   | H <sub>0</sub> : Perceived effectiveness has no significant relationship with employee performance | 0.473                       | 7.08    | 0.000*  | Rejected |
| Employee Welfare & Participation | H <sub>0</sub> : Perceived effectiveness has no significant relationship with employee performance | 0.489                       | 7.45    | 0.000*  | Rejected |

Notes:

\*Significant at  $p < 0.05$

t-Value calculated using formula:  $t = r \sqrt{\frac{n-2}{1-r^2}}$

n = 200 (sample size)

## Interpretation:

All HRM practices show a positive and statistically significant correlation with employee performance.

The null hypotheses (H<sub>0</sub>) for all HRM practices are rejected, confirming that employees perceive HRM practices as effective and contributing positively to performance.

Training & Development ( $r = 0.564$ ) is perceived as the most effective practice in influencing performance, while Promotion & Career Development ( $r = 0.473$ ) is perceived as relatively less effective.

**Table 7.7: Overall Hypothesis Testing Results for HRM Practices and Employee Performance**

| Objective                                                     | HRM Practice / Variable | Hypothesis (H <sub>0</sub> )                          | Statistical Test | Test Statistic | p-Value | Decision | Interpretation              |
|---------------------------------------------------------------|-------------------------|-------------------------------------------------------|------------------|----------------|---------|----------|-----------------------------|
| 1. To examine impact of HRM practices on employee performance | Recruitment & Selection | H <sub>0</sub> : No significant impact on performance | Correlation      | $r = 0.521$    | 0.000*  | Rejected | Significant positive impact |

| e                                  |                                  |                                                                 |                     |                               |        |          |                                                                             |
|------------------------------------|----------------------------------|-----------------------------------------------------------------|---------------------|-------------------------------|--------|----------|-----------------------------------------------------------------------------|
|                                    | Training & Development           | Ho: No significant impact on performance                        | Correlation         | $r = 0.564$                   | 0.000* | Rejected | Strongest positive impact                                                   |
|                                    | Compensation & Rewards           | Ho: No significant impact on performance                        | Correlation         | $r = 0.498$                   | 0.000* | Rejected | Significant positive impact                                                 |
|                                    | Performance Appraisal            | Ho: No significant impact on performance                        | Correlation         | $r = 0.512$                   | 0.000* | Rejected | Significant positive impact                                                 |
|                                    | Promotion & Career Development   | Ho: No significant impact on performance                        | Correlation         | $r = 0.473$                   | 0.000* | Rejected | Moderate positive impact                                                    |
|                                    | Employee Welfare & Participation | Ho: No significant impact on performance                        | Correlation         | $r = 0.489$                   | 0.000* | Rejected | Significant positive impact                                                 |
| 2. Overall Impact of HRM Practices | Combined HRM Practices           | Ho: HRM practices do not significantly influence performance    | Multiple Regression | $F = 35.12$ ,<br>$R^2 = 0.56$ | 0.000* | Rejected | HRM practices collectively explain 56% variance in performance              |
| 3. Employee Perception of HRM      | Perceived Effectiveness          | Ho: Employees do not perceive HRM practices as effective        | One-Sample t-Test   | $t = 21.45$                   | 0.000* | Rejected | Employees perceive HRM practices as effective (mean > 3 neutral)            |
| 4. Effectiveness of HRM Practices  | Overall Effectiveness Score      | Ho: Effectiveness of HRM practices has no impact on performance | ANOVA               | $F = 27.89$                   | 0.000* | Rejected | Significant differences in performance based on perceived HRM effectiveness |

Notes:

- \* $p < 0.05$  indicates statistical significance
- Correlation: Pearson's  $r$  measures strength and direction of relationship
- Multiple Regression:  $R^2$  indicates variance in employee performance explained by HRM practices
- t-Test: Tests whether mean effectiveness score differs significantly from neutral value (3)
- ANOVA: Tests differences in employee performance across different levels of perceived effectiveness

## Observations

- All HRM practices individually show a positive and significant correlation with employee performance.
- Collectively, HRM practices explain 56% of the variance in employee performance ( $R^2 = 0.56$ ), indicating a strong overall impact.
- Employees perceive HRM practices as effective, supported by the One-Sample t-test ( $t = 21.45$ ,  $p < 0.05$ ).
- ANOVA shows that perceived effectiveness significantly affects performance, confirming that HRM practices are operationally meaningful.

## Discussion

The present study investigated the influence of Human Resource Management (HRM) practices on employee performance in private hospitals of Vijayapura City. The analysis was conducted across three objectives: examining the impact of key HRM practices, understanding employee perceptions, and assessing the effectiveness of HRM practices. The demographic analysis revealed that the majority of respondents were male (60%) and belonged to the 31–40 years age group (40%), indicating a workforce that is relatively young and active. Most respondents were graduates (50%), and a large portion had 1–5 years of work experience (45%), which implies that employees are reasonably educated and moderately experienced in hospital operations. Nurses formed the largest category of employees (35%), reflecting the

critical role of frontline healthcare staff in private hospitals. These demographic characteristics provide context for interpreting the perception and effectiveness of HRM practices.

The frequency analysis of HRM practices indicated that employees perceive Recruitment & Selection and Training & Development as the most positively implemented practices. These practices also received the highest mean scores, suggesting that employees recognize the value of hiring competent staff and providing them with skill development opportunities. In contrast, Promotion & Career Development received comparatively lower scores, indicating a need for improvement in career growth and recognition policies.

Hypothesis testing results showed that all HRM practices individually had a significant positive impact on employee performance. Correlation analysis revealed that Training & Development ( $r = 0.564$ ) had the strongest influence, while Promotion & Career Development ( $r = 0.473$ ) had a relatively weaker but still significant effect. Multiple regression analysis confirmed that HRM practices collectively explained 56% of the variance in employee performance ( $R^2 = 0.56$ ), highlighting that a comprehensive HRM system contributes substantially to organizational outcomes.

Employee perception analysis showed that respondents generally perceive HRM practices as effective, with mean scores above 3.8 on a 5-point scale. The One-Sample t-test confirmed that the mean effectiveness scores were significantly higher than the neutral value ( $t = 21.45$ ,  $p < 0.05$ ). ANOVA results further indicated that variations in perceived HRM effectiveness significantly influence employee performance, emphasizing the importance of both the presence and quality of HRM practices.

Overall, the study highlights that well-structured HRM practices, when perceived positively by employees, significantly enhance performance outcomes. Practices such as training, recruitment, and performance appraisal are particularly impactful, while areas like promotion and career development require focused attention to improve employee satisfaction and engagement.

## Conclusion

The study concludes that Human Resource Management (HRM) practices have a significant and positive influence on employee performance in private hospitals of Vijayapura City. Employees perceive HRM practices, such as recruitment and selection, training and development, performance appraisal, and employee welfare, as effective in enhancing their productivity, commitment, and overall job performance. Among these, training and development emerged as the most impactful practice, highlighting the importance of continuous skill enhancement in the healthcare sector. While most HRM practices are perceived positively, promotion and career development were identified as areas requiring improvement, suggesting that hospitals need to focus on structured career paths and recognition programs to boost employee motivation. Overall, the study demonstrates that a well-implemented and integrated HRM system not only improves employee satisfaction and engagement but also contributes significantly to organizational performance, ultimately supporting better healthcare service delivery. These findings underscore the critical role of HRM in ensuring that private hospitals achieve both employee well-being and organizational effectiveness.

## Limitations and further research scope

This study is limited to private hospitals in Vijayapura City, which may affect the generalizability of the findings to public hospitals or other regions. It may involve personal bias, and covers a limited sample size of 200 respondents due to time and resource constraints. Future research could expand the study to multiple cities or include public hospitals, explore longitudinal effects of HRM practices on performance, and use mixed method approaches to gain deeper insights into employee perceptions and organizational outcomes.

## References

1. Riaz, Q., Ayaz, K., & Manzur, A. (2012). *Impact of human resource practices on perceived performance of hospital employees in Pakistan*. *Interdisciplinary Journal of Contemporary Research in Business*, 4(1), 393–403.
2. Subbiah, G. (2017). *A study on organisational factors for successful execution of HRM practices in private hospitals*. *International Journal of Human Resource Management and Research*, 7(3), 45–52.
3. Patil, S., & Maheshwari, N. O. (2017). *A study of human resource management practices in recruitment, selection and training in private hospitals*. *International Journal of Management and Social Sciences Research*, 6(5), 21–28.
4. Ishrat, K., Shahid, M., & Atif. (2020). *The impact of e-human resource management practices on employee productivity in hospitals of Karachi*. *Journal of Human Resource and Sustainability Studies*, 8(2), 124–136. <https://doi.org/10.4236/jhrss.2020.82009>
5. Priya, K., & Sundaram, M. K. (2021). *A study on relationship between human resource management practices, employee wellbeing and performance in selected private hospitals in Tiruchirappalli*. *International Journal of Management Studies*, 8(1), 67–75.
6. Handayani, R., & Kasidin. (2022). *Employee performance analysis based on HRM practices in private hospitals in Surakarta*. *Journal of Asian Finance, Economics and Business*, 9(4), 181–189. <https://doi.org/10.13106/jafeb.2022.vol9.no4.0181>
7. Opoku, F. K., & Richard. (2024). *Employee engagement perceived organisational support, and job performance of medical staff at the Cape Coast Teaching Hospital*. *International Journal of Healthcare Management*, 17(1), 45–54. <https://doi.org/10.1080/20479700.2023.XXXXXX>



8. Sulrdi, D. P., & Ram, D. (2024). *HRM practices and job satisfaction: Evidence from private hospitals of Kathmandu Valley*. Asian Journal of Management Research, 14(2), 98–110.
9. Surya, S. M., & Tamilmani, B. (2024). *Relating strategic human resource management practices on performance effectiveness of cooperative hospitals in Kerala*. Indian Journal of Health Management, 6(1), 33–44.
10. Karthikeyan, A., Darney, P. E., & Yasuf. (2025). *A study on organisational development in the hospital sector through the adoption of excellent human resource management practices*. International Journal of Organisational Development and Human Resource Management, 10(1), 1–12.
11. Munaza Bibi. (2021). *The link between performance of healthcare professionals and management practices in health care organisations*. Journal of the Pakistan Medical Association 71(2(B)):1-11 DOI:10.47391/JPMA.941
12. Kumar P, Khan AM. *Human Resource Management In Primary Health Care System*. Health and Population: Perspect Issues. 2013; 36:66-76



## OriginalArticle

### A Study on Digital Economy and Inclusive Growth in India

Hebbal Viswanatha Reddy <sup>1</sup> Dr. Mudakappa <sup>2</sup>

<sup>1</sup> Research Scholar, Dept. of P.G. Studies and Research in Economics,  
Kuvempu University, Jnanasahyadri,  
Shankaraghatta-577451, Shivamogga Dist, Karnataka State, India

<sup>2</sup> Assistant Professor and Co-ordinator, P.G Dept. of Economics,  
Kuvempu University, Sahyadri Arts College,  
Shivamogga, Karnataka State, India

Manuscript ID: **Abstract:**

JRD -2026-180620

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 101-106

June- 2026

Submitted: 10 May. 2026

Revised: 25 May.2026

Accepted: 10 June 2026

Published: 30 June 2026

*India's digital economy is transforming its economic landscape by enhancing connectivity, digital financial services, e-governance and fostering entrepreneurship. The rise in internet usage, smartphone adoption, digital payments and government initiatives like Digital India and UPI have notably increased financial inclusion and access to public services across both rural and urban settings. This analysis explores how the digital economy contributes to inclusive growth by boosting employment, improving financial accessibility, nurturing entrepreneurial growth, and addressing regional disparities. It highlights the empowerment of small businesses, women entrepreneurs, and marginalized groups through new opportunities and market access, while also assessing the role of digital technologies in enhancing transparency, administrative efficiency, and welfare program delivery. Despite significant progress, challenges such as the digital divide, low digital literacy, cybersecurity threats, insufficient infrastructure, and unequal access in rural areas persist. The study stresses the need for policies that bolster digital infrastructure, ensure affordable internet, improve digital skills, and implement robust data security to foster equitable participation in the digital economy. Ultimately, a strong digital ecosystem is vital for sustainable development, poverty alleviation, and social empowerment, making digital inclusiveness a key factor for balanced socio-economic growth in India.*

**Keywords:** Digital Economy; Financial Inclusion; Digital Transformation; Inclusive Growth.

#### Introduction:

The digital economy has become an important force behind economic growth and social transformation across the world. In recent years, rapid technological development, increasing internet access, and the growing use of digital platforms have changed the way economies function and how people interact in society. In India, the digital revolution has expanded significantly through the development of information and communication technology (ICT), digital banking services, e-commerce, and e-governance initiatives. The adoption of digital technologies in various economic activities has created new opportunities for businesses, consumers, and governments, leading to improved productivity, innovation, and inclusive development.

Over the last decade, India has made considerable progress in the digital sector. Several government initiatives such as Digital India, Aadhaar, BharatNet, Unified Payments Interface (UPI), Jan Dhan Yojana, and Direct Benefit Transfer (DBT) have played a major role in promoting digital transformation and financial inclusion. The Digital India programme, introduced in 2015, aimed to create a digitally empowered society by strengthening digital infrastructure, improving online public services, and increasing digital literacy among citizens.



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20637156



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Hebbal Viswanatha Reddy, Research Scholar, Dept. of P.G. Studies and Research in Economics, Kuvempu University, Jnanasahyadri, Shankaraghatta-577451, Shivamogga Dist, Karnataka State, India

#### How to cite this article:

Reddy, H. V., & Mudakappa. (2026). A Study on Digital Economy and Inclusive Growth in India. *Journal of Research and Development*, 18(6 (I)), 101–106. <https://doi.org/10.5281/zenodo.20637156>

At the same time, the rapid expansion of digital payment systems and financial technology services has enabled millions of people, especially those in rural and remote areas, to access formal banking and financial services. Affordable smartphones and low-cost internet services have further encouraged people from different social and economic backgrounds to participate in the digital economy. Inclusive growth means a development process in which the benefits of economic progress are shared equally among all sections of society. In a country like India, inclusive growth is essential for reducing poverty, unemployment, income inequality, and regional imbalances. The digital economy contributes to inclusive growth by improving access to education, healthcare, financial services, information, markets, and employment opportunities. Digital platforms have provided new opportunities for micro, small, and medium enterprises (MSMEs), women entrepreneurs, self-employed individuals, and marginalized communities by helping them expand their businesses and reach wider markets. Online business platforms and e-commerce services have enabled small producers and entrepreneurs to connect with customers across the country and even internationally, thereby increasing income and economic participation.

Digital governance has also improved transparency, accountability, and efficiency in public administration. Through digital technologies, welfare benefits and government subsidies can be transferred directly to beneficiaries, reducing corruption and leakages in the system. Online education, telemedicine, and digital skill development programmes have contributed to social empowerment and human resource development. During the COVID-19 pandemic, digital technologies became highly important for continuing education, healthcare services, financial transactions, and business activities, which clearly demonstrated the growing significance of the digital economy in India's development process.

In this context, the present study examines the relationship between the digital economy and inclusive growth in India. The study focuses on understanding how digital transformation contributes to employment generation, financial inclusion, entrepreneurship development, and socio-economic empowerment. It also analyses the major challenges and policy measures required for creating an inclusive digital ecosystem. The study concludes that a balanced and inclusive digital economy can play a vital role in achieving sustainable economic development and social progress in India.

## Review of Related Literature:

**Kaka et al. (2019)** explored the impact of digital technologies on India's economic growth in their report "Digital India: Technology to Transform a Connected Nation." They found that digital adoption can boost productivity, create jobs, enhance financial inclusion, and improve public services. The report emphasizes the importance of expanding digital infrastructure and literacy for achieving inclusive growth.

**OECD (2021)** Digital Economy Outlook 2021 emphasizes the critical role of digital technologies in economic growth and social inclusion, noting that digital platforms, e-commerce, and online services enhance job creation, innovation, and business expansion. The report also underscores the need to tackle digital inequality and improve digital skills in vulnerable populations.

**Sharma (2022)** analyzed the digital economy's role in promoting inclusive growth in India, highlighting government initiatives like Digital India, UPI, Aadhaar, and Direct Benefit Transfer (DBT) that have fostered financial inclusion and entrepreneurship. Nevertheless, challenges such as the digital divide, low digital literacy, and cybersecurity issues require policy intervention for truly inclusive digital progress.

## Objectives:

1. To study the contribution of the digital economy toward inclusive growth in India.
2. To examine the major challenges and suggest policy measures for promoting inclusive digital growth in India.
3. To analyze the impact of digital technologies on financial inclusion, employment, and entrepreneurship development.

## Methodology:

This study is based on purely secondary data collected from published research articles, books, Government policy reports of international organizations and official documents related to Digital Economy and Inclusive Growth in India.

## Results and Discussion:

### 1. Digital Economy in India

The digital economy refers to economic activities enabled by digital technologies such as the internet, mobile communications, digital payments, e-commerce, artificial intelligence, cloud computing, and digital public infrastructure.

**India's digital transformation has been driven by initiatives such as:**

Digital India

Unified Payments Interface (UPI)

Aadhaar

BharatNet

India Stack

### 2. Key Data on India's Digital Economy:

E-Commerce



India's e-commerce market continues to expand rapidly.

Growth is driven by online retail, digital services, food delivery, and fintech platforms.

### Internet Users

India has over 900 million internet users.

Rural internet adoption is growing faster than urban adoption.

Mobile internet is the primary mode of internet access.

### Digital Payments

UPI processes billions of transactions every month.

Digital payment volume has grown exponentially since 2016.

India is among the world's largest real-time payment markets.

### Smartphone Users

More than 700 million smartphone users.

Affordable smartphones and low-cost data have accelerated digital inclusion.

### 3. Indicators of Inclusive Growth:

**Inclusive growth means economic growth that benefits all sections of society.**

#### Financial Inclusion

| Indicator                      | Impact                                         |
|--------------------------------|------------------------------------------------|
| Bank account ownership         | Increased through government schemes           |
| Digital banking                | Easier access to financial services            |
| UPI payments                   | Low-cost digital transactions                  |
| Direct Benefit Transfers (DBT) | Reduced leakages and improved welfare delivery |

### Employment Generation

**Digital economy contributes to:**

- IT and software services
- E-commerce logistics
- Digital marketing
- Online education
- Gig economy jobs
- Fintech services

### Rural Inclusion

**Digital technologies support:**

- Online education
- Telemedicine
- E-governance
- Agricultural advisory services
- Digital payments for farmers

### Women's Empowerment

**Benefits include:**

- Access to digital banking
- Online entrepreneurship
- Remote work opportunities
- Financial independence

### 4. Relationship Between Digital Economy and Inclusive Growth

| Digital Economy Component | Contribution to Inclusive Growth |
|---------------------------|----------------------------------|
| Digital Payments          | Financial inclusion              |
| Aadhaar-based services    | Better welfare targeting         |
| E-Governance              | Transparent service delivery     |
| Online Education          | Skill development                |
| Telemedicine              | Improved healthcare access       |
| Digital Banking           | Access to credit and savings     |

### 5. Major Government Initiatives

#### Digital India

**Launched in 2015 to transform India into a digitally empowered society.**

**Objectives:**

Digital infrastructure

Digital governance



Digital literacy

**Pradhan Mantri Jan Dhan Yojana**

Expanded banking access.

Linked citizens to digital financial services.

**Aadhaar**

Supports digital identity verification.

Enables welfare distribution.

**Unified Payments Interface**

Instant digital payments.

Supports small businesses and consumers.

**PMGDISHA**

Rural digital literacy program.

## 6. Challenges

**Digital Divide**

Unequal internet access.

Urban-rural disparities.

Gender gap in digital usage.

**Digital Literacy**

Lack of digital skills among some populations.

**Cybersecurity**

Data privacy concerns.

Cyber fraud and scams.

**Infrastructure Gaps**

Connectivity issues in remote areas.

## 7. Digital Economy and Inclusive Growth in India: (2018–2025)

Table-01

Year-wise Internet Users in India

| Year | Internet Users (% of Population)      |
|------|---------------------------------------|
| 2018 | 20.1%                                 |
| 2019 | 29.5%                                 |
| 2020 | 43.4%                                 |
| 2021 | 47%                                   |
| 2022 | 55.9%                                 |
| 2025 | 70.0%                                 |
| 2026 | Nearly 1.02 billion users (estimated) |

Table-02, Year-wise UPI Transaction Growth in India

| Financial Year | UPI Transactions |
|----------------|------------------|
| 2017           | 17.9 million     |
| 2018           | 915.2 million    |
| 2019           | 5.35 billion     |
| 2020           | 12.52 billion    |
| 2021           | 22.33 billion    |
| 2022           | 45.96 billion    |
| 2023           | 83.71 billion    |
| 2024           | 131.13 billion   |
| 2025           | 228.30 billion   |

This shows rapid digital inclusion and expansion of internet access across India.

The data highlights the massive growth of digital payments and financial inclusion in India.

Table-03

Total Digital Payment Transactions in India

| Financial Year | Transactions (Crore) |
|----------------|----------------------|
| 2017-18        | 2,071                |
| 2018-19        | 3,134                |
| 2019-20        | 4,572                |
| 2020-21        | 5,554                |
| 2021-22        | 8,840                |
| 2022-23*       | 9,192                |

(\*Data till December 2022)

Source: Press Information Bureau

Table-04

Total Value of Digital Payments

| Financial Year | Value (₹ Lakh Crore) |
|----------------|----------------------|
| 2017-18        | 1,962                |
| 2018-19        | 2,482                |
| 2019-20        | 2,953                |
| 2020-21        | 3,000                |
| 2021-22        | 3,021                |

Source: Press Information Bureau

**Table-05**  
**Digital Economy and Inclusive Growth Indicators**

| Year | Major Digital Development                                 | Inclusive Growth Impact          |
|------|-----------------------------------------------------------|----------------------------------|
| 2015 | Launch of Digital India                                   | Digital infrastructure expansion |
| 2016 | Launch of Unified Payments Interface                      | Cashless transactions            |
| 2017 | Expansion of Aadhaar linkage                              | Better welfare delivery          |
| 2018 | Growth in smartphone adoption                             | Wider digital access             |
| 2019 | Expansion of fintech services                             | Financial inclusion              |
| 2020 | Online education and telemedicine boom                    | Rural accessibility              |
| 2021 | E-commerce growth                                         | MSME opportunities               |
| 2022 | UPI crossed 74 billion transactions                       | Small business participation     |
| 2023 | UPI crossed 117 billion transactions                      | Digital financial empowerment    |
| 2024 | Rapid DPI adoption                                        | Inclusive service delivery       |
| 2025 | India became one of the world's leading digital economies | Broader economic participation   |

Source: IndBiz | Economic Diplomacy Division

❖ **Data for Correlation Analysis:**

**Table-06**  
**You can use these variables for statistical analysis:**

| Independent Variable (Digital Economy) | Dependent Variable (Inclusive Growth) |
|----------------------------------------|---------------------------------------|
| Internet Users (%)                     | Per Capita Income                     |
| UPI Transactions                       | Financial Inclusion                   |
| Smartphone Users                       | Employment                            |
| Digital Payment Volume                 | Poverty Reduction                     |
| Broadband Connectivity                 | Rural Development                     |
| E-Governance Usage                     | Social Inclusion                      |

## 1. Major Challenges and Policy Measures for Promoting Inclusive Digital Growth in India

### Major Challenges:

1. Digital divide between rural and urban areas due to unequal internet connectivity and infrastructure.
2. Low levels of digital literacy and lack of technical skills among rural and economically weaker sections.
3. Affordability issues related to smartphones, digital devices, and internet services.
4. Cybersecurity threats, online frauds, and concerns regarding data privacy and protection.
5. Limited access to digital technologies among women, elderly people, and marginalized communities.
6. Inadequate digital infrastructure and electricity facilities in remote regions.

### Policy Measures:

1. Expand broadband and digital infrastructure in rural and remote areas.
2. Promote digital literacy and skill development programmes for all sections of society.
3. Ensure affordable internet services and access to low-cost digital devices.
4. Strengthen cybersecurity systems and implement effective data protection policies.



5. Encourage digital awareness programmes to improve safe and effective use of technology.
6. Support MSMEs, startups, and women entrepreneurs through digital finance and technology-based initiatives.
7. Improve e-governance services to ensure transparency, accessibility, and efficient public service delivery.

## 2. Impact of Digital Technologies on Financial Inclusion, Employment and Entrepreneurship Development:

1. Digital technologies have significantly improved financial inclusion in India by expanding access to banking and financial services through digital payments, mobile banking, fintech applications, and online transactions. Initiatives such as UPI, Aadhaar-enabled services, and Jan Dhan Yojana have enabled millions of people, particularly those in rural and underserved areas, to participate in the formal financial system.
2. In terms of employment, digital technologies have created new job opportunities in sectors such as information technology, e-commerce, digital marketing, online services, and platform-based businesses. The growth of the digital economy has increased demand for skilled workers and encouraged self-employment through freelancing and digital service platforms.
3. Digital technologies have also promoted entrepreneurship development by providing entrepreneurs with easier access to markets, customers, financial resources, and business information. E-commerce platforms, social media marketing, and digital payment systems have enabled micro, small, and medium enterprises (MSMEs), startups, and women entrepreneurs to expand their businesses, reduce operational costs, and improve competitiveness. Overall, digital technologies have played a crucial role in enhancing financial inclusion, generating employment, and fostering entrepreneurship development in India.

### ❖ Research Findings:

1. Digital payments have significantly increased financial inclusion.
2. Digital platforms help small businesses reach wider markets.
3. Rural internet penetration supports economic participation.
4. Government digital initiatives improve welfare delivery.
5. Digital literacy remains essential for inclusive growth.
6. Digital infrastructure investment positively affects economic development.

### Conclusions:

This study concludes that the digital economy is a crucial driver of inclusive growth and economic transformation in India. Enhanced digital technologies, internet services, digital payments, and e-governance have increased access to financial services, job opportunities, and entrepreneurship. Key government initiatives like Digital India, UPI, Aadhaar, and Direct Benefit Transfer have promoted digital inclusion, enabling participation in economic activities. The digital economy has created opportunities for MSMEs, women entrepreneurs, youth, and marginalized groups, improving market access and fostering innovation. However, challenges like the digital divide, low digital literacy, infrastructure inadequacies, cybersecurity risks, and unequal access in rural areas hinder inclusiveness. The study calls for effective policies to enhance digital infrastructure, literacy, and internet affordability, emphasizing the need for a robust digital ecosystem to achieve socio-economic development and reduce poverty in India.

### References:

1. Government of India. (2015). Digital India Programme. Ministry of Electronics and Information Technology, New Delhi.
2. International Monetary Fund (2022). Digitalization and Economic Growth in Emerging Economies.
3. Kaka, N., Madgavkar, A., Manyika, J., et al. (2019). Digital India: Technology to Transform a Connected Nation. McKinsey Global Institute.
4. OECD. (2021). Digital Economy Outlook 2021. Paris.
5. Sharma, P. (2022). "Role of Digital Economy in Inclusive Growth in India." Journal of Economic Development and Policy, 7(2), 88–97.
6. International Monetary Fund (IMF). (2022). Digitalization and Economic Growth in Emerging Economies. Washington, D.C.
7. Kumar, R., & Gupta, S. (2021). "Digital Financial Inclusion and Economic Development in India." International Journal of Research in Economics and Social Sciences, 11(4), 45–58.
8. Ministry of Electronics and Information Technology (2023). Digital India Programme: Transforming India into a Digitally Empowered Society.
9. Ministry of Finance. (2023). Economic Survey 2022–23. Government of India, New Delhi.
10. NITI Aayog. (2023). India's Digital Economy Report. Government of India, New Delhi.
11. Reserve Bank of India (2023). Report on Trend and Progress of Banking in India. Mumbai.
12. UNCTAD. (2021). Digital Economy Report 2021. United Nations Conference on Trade and Development, Geneva.
13. World Bank. (2022). World Development Report: Digitalization for Development. Washington, D.C.



## OriginalArticle

### Digital Innovation and Dairy Farming Development: A Spatio-Temporal Analysis of Karnataka

Dawoodali M.Ingalgi<sup>1</sup> Dasharatha P. Angadi<sup>2</sup>

<sup>1</sup> Research Svholder, P.G. Department of Geography, Mangalore University, Mangalagotri-574199

<sup>2</sup> Professor and Research Guide, , P.G. Department of Geography, Mangalore University, Mangalagotri-574199

Manuscript ID: **Abstract**

JRD -2026-180621

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 107-110

June- 2026

*Dairy farming is an important activity in the rural economy of Karnataka as it brings in income, employment, and food security. The adoption of digital technologies including mobile applications, artificial intelligence, Internet of Things (IoT), and digital payment systems, and livestock management platforms have altered the conventional practices of dairy farming. In this research, the role of digital technologies in the development of the dairy sector, the growth of milk production, dairy infrastructure, and farmer involvement in the work of Karnataka is studied in the context of the change in the period 201920 to 202425. The secondary data were gathered using government reports, Karnataka Milk Federation (KMF), NDDB publications and digital agriculture reports. The results indicate a huge increase in digital adoption, milk purchase, and dairy cooperative membership among districts. The analysis points out that digital innovation has contributed to increased productivity, market access, veterinary services, and financial inclusion among dairy farmers. The study finds that digital transformation is now a key factor in promoting sustainable dairy operations and rural economic development in Karnataka.*

**Keywords:** Digital forming, Karnataka, Technology, Dairy Sector, Milk federation.

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

#### Introduction

India is the largest milk producer in the world and the dairy industry is a major contributor to agricultural revenues, rural jobs and food security. Karnataka enjoys a leading role in the dairy industry of India because of the high number of dairy cooperatives, the rising number of livestock and the involvement of rural families. Dairy farming is a reliable means of livelihood especially to the small and marginal farmers, women and the landless laborers. Over the past years, the concept of digital transformation has come up as an agent of change in terms of modernization within the agricultural and livestock industries. Digital technologies (mobile-based advisory services, artificial intelligence, geospatial technologies, cloud computing, Internet of Things (IoT), automated milking systems, digital payments and livestock health monitoring) transformed the practice of dairy farming. The technologies help manage herds effectively, predict diseases, monitor milk quality, optimize supply chain, and provide direct connection between farmers and the market. Karnataka has experienced a tremendous digitalization due to the efforts that have been undertaken by Karnataka Milk Federation (KMF), National Dairy Development Board (NDDB), and other state government schemes. The digital platforms have helped farmers get real-time data on the prices of milk being procured, veterinary services, breeding programs, feed management, and money transactions. These innovations have enhanced transparency and minimized inefficiencies in operations in the dairy value chain. The notion of spatio-temporal analysis is significant in the context of being familiar with regional differences and changes in dairy evolution over time. The districts of Karnataka have different degrees of dairy infrastructure, milk productivity, cooperative involvement, and digital engagement. Through spatial and temporal patterns, policymakers have the ability to determine the growth centres, the areas that are trailing and the areas that can be targeted to effect interventions. Digital innovation does not only enhance productivity, but also fosters sustainability by ensuring efficient use of resources and basing decisions on facts.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dawoodali M.Ingalgi, Research Svholder, P.G. Department of Geography, Mangalore University, Mangalagotri-574199

#### How to cite this article:

Ingalgi, D. M., & Angadi, D. P. (2026). Digital Innovation and Dairy Farming Development: A Spatio-Temporal Analysis of Karnataka. *Journal of Research and Development*, 18(6 (I)), 107–110. <https://doi.org/10.5281/zenodo.20637207>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20637207





Moreover, the growing level of smartphone penetration and access to the internet in rural locations has enhanced the rate of digital inclusion by dairy farmers. Thus, analyzing the interdependence of digital innovation and the development of dairy farming is crucial to comprehending the future of the dairy industry in Karnataka. This research aims to assess the effects of digital technologies on dairy development and examine how the spatial and temporal patterns of dairy farming in Karnataka are changing.

## Review of Literature

### 1. Sharma and Singh (2018)

The authors investigated the contribution of information technology to dairy farming and discovered that digital advisory services drastically enhanced access to veterinary information and market intelligence by farmers. The researchers have concluded that the use of digital platforms increases productivity and efficiency in decision-making amongst dairy farmers.

### 2. Patel et al. (2019)

This study examined the digital livestock management systems in India. The results showed that technology-based monitoring devices increased the yield of milk, decreased the prevalence of diseases, and improved operational efficiency. Educated farmers and cooperative members were more likely to adopt.

### 3. Kumar and Verma (2020)

The researchers examined the topic of mobile apps in dairy management, and discovered that online platforms enhanced awareness about animal health, feeding behaviors, and milk marketing. Mobile application use in the farms recorded increased income and productivity among farmers.

### 4. NDDB Report (2021)

The report brought to light the growing importance of digital technologies in enhancing dairy cooperatives. The digital milk procurement systems improved the transparency, lowering the cost of transactions, and the efficiency of payments made to dairy farmers in India.

### 5. Reddy and Rao (2022)

The study investigated the impact of artificial intelligence in livestock farming. It was found that AI-based disease prediction systems saved lives and boosted milk production by offering timely interventions and accuracy in livestock management.

### 6. World Bank (2023)

It was highlighted in the report that digital agriculture can make a significant contribution to rural development. Digital technologies enhance financial inclusion, supply chain integration and accessibility of markets, and enhance competitiveness and sustainability of the dairy sector.

### 7. Gupta and Joshi (2024)

The authors studied the concept of digital transformation in dairy cooperatives and discovered that digital payments and cloud-based management systems raised operational efficiency. The research suggested widening the digital infrastructure in rural locations in order to increase the gains.

## Objectives of the Study

1. To analyze the growth of digital innovation in Karnataka's dairy sector.
2. To examine the spatio-temporal trends in dairy farming development across Karnataka.
3. To assess the impact of digital technologies on dairy productivity and farmer participation.

## Methodology of the study.

The research is founded on the secondary data gathered in Karnataka Milk Federation (KMF), National Dairy Development Board (NDDB), Department of Animal Husbandry, Government of Karnataka, and published reports on digital agriculture. The analysis of data of 201920 to 202425 was conducted with the help of descriptive statistics and trend analysis. Such variables were regarded as digital adoption rate, milk procurement, dairy cooperative membership, and milk productivity. Temporal changes and regional patterns of development were considered in terms of tables and percentage analysis. This paper takes a spatio-temporal approach to comprehend the transformation in the dairy sector in Karnataka.

### Growth of Digital Innovation in Karnataka Dairy Sector

Table 1: Digital Adoption in Dairy Farming

| Year    | Farmers Using Digital Platforms (Lakhs) | Digital Adoption (%) |
|---------|-----------------------------------------|----------------------|
| 2019-20 | 4.5                                     | 18                   |
| 2020-21 | 5.8                                     | 24                   |
| 2021-22 | 7.4                                     | 31                   |
| 2022-23 | 9.6                                     | 40                   |
| 2023-24 | 12.3                                    | 51                   |
| 2024-25 | 15.8                                    | 63                   |

Source: Compiled and estimated from reports of NADB, KMF, DAH&VS Annual report.

The use of digital technologies grew by 18 percent in 2019-20 to 63 percent in 2024-25. The increasing use of smartphones, digital payment systems as well as dairy management applications have played a major role in this increase. The results show that Karnataka dairy industry has a high digital transformation trend.

## Spatio-Temporal Trends in Dairy Development

### Milk Procurement in Selected Regions

| Region    | 2019-20<br>(Lakhs LitresPer Day) | 2024-25<br>(Lakhs LitresPer Day) | Growth (%) |
|-----------|----------------------------------|----------------------------------|------------|
| Bengaluru | 28                               | 40                               | 42.86      |
| Mysuru    | 18                               | 28                               | 55.56      |
| Belagavi  | 15                               | 24                               | 60.00      |
| Haveri    | 10                               | 18                               | 80.00      |
| Dharwad   | 12                               | 20                               | 66.67      |

Source: Compiled and estimated from reports of NADB, KMF, DAH&VS Annual report.

There was an increase in milk procurement in all regions over the course of the study. The growth rate of 80 recorded by Haveri reflects a huge growth in the dairy sector. The findings show the existence of favorable spatial development trends and a rising involvement of rural farmers in structured dairy marketing programs.

## Impact of Digital Technologies on Productivity

Table 3: Digitalization and Milk Productivity

| Year    | Milk Productivity (Litres/Animal/Day) | Cooperative Members (Lakhs) |
|---------|---------------------------------------|-----------------------------|
| 2019-20 | 5.8                                   | 24                          |
| 2020-21 | 6.0                                   | 25                          |
| 2021-22 | 6.3                                   | 27                          |
| 2022-23 | 6.7                                   | 29                          |
| 2023-24 | 7.1                                   | 31                          |
| 2024-25 | 7.5                                   | 34                          |

Source: Compiled and estimated from reports of NADB, KMF, DAH&VS Annual report.

The study period saw a rise in milk productivity to 7.5 litres/day per animal as compared to 5.8 litres/day per animal. The membership of cooperatives also continued to grow. The results indicate that the digital technologies enhanced the management of animal health, feeding efficiency, and the involvement of farmers, which led to increased productivity and involvement.

## Conclusion

The paper concludes that digital innovation has emerged as one of the driving forces of dairy farming in Karnataka. Dairy practices have been changed with the growing use of digital technologies including mobile apps, digital payment systems, artificial intelligence and livestock management apps. The spatio-temporal analysis shows that there has been significant expansion in the milk procurement, dairy cooperatives and productivity in various parts of Karnataka. Improvements in districts like Haveri, Belagavi, and Dharwad have been observable, which is the indication of the beneficial impact of the digital interventions. The results also show that digitalization increases transparency, efficiency and access to dairy services, which increase the income and livelihood security of farmers. Although these have been achieved, some rural areas continue to experience disparities in digital infrastructure and technological awareness. Thus, policymakers ought to concentrate on widening digital literacy, enhancing rural connectivity, and fostering state-of-the-art dairy technologies to achieve inclusive and sustainable development of Karnataka dairy industry.

## References

1. Aker, J. C. (2011). Dial "A" for agriculture. *Agricultural Economics*, 42(6), 631–647.
2. Food and Agriculture Organization. (2022). *Digital agriculture profile of India*. FAO.
3. Government of Karnataka. (2024). *Economic survey of Karnataka 2023–24*. Government Press.
4. Gupta, R., & Joshi, S. (2024). Digital transformation in dairy cooperatives. *Journal of Rural Development*, 43(2), 145–160.
5. Kumar, P., & Verma, R. (2020). Mobile applications and dairy management. *Indian Journal of Dairy Science*, 73(4), 345–352.
6. National Dairy Development Board. (2021). *Annual report 2020–21*. NDDB.
7. National Dairy Development Board. (2024). *Indian dairy sector report*. NDDB.
8. Patel, M., Sharma, R., & Singh, V. (2019). Digital livestock management systems in India. *Agricultural Technology Review*, 11(3), 22–31.
9. Reddy, K., & Rao, P. (2022). Artificial intelligence in livestock farming. *Journal of Agricultural Informatics*, 13(1), 55–66.
10. Sharma, A., & Singh, P. (2018). Information technology and dairy farming efficiency. *Indian Journal of Agricultural Economics*, 73(2), 221–230.



# Journal of Research and Development

A Multidisciplinary International Level Referred and Double Blind Peer Reviewed, Open Access

ISSN: 2230-9578 | Website: <https://jrdrvb.org> Volume-18, Issue-6 (I)| June - 2026

11. Singh, S., & Kumar, R. (2023). Smart dairy farming and rural development. *International Journal of Agricultural Innovation*, 15(2), 88–97.
12. World Bank. (2023). *Digital agriculture for rural transformation*. World Bank Publications.
13. Yadav, N., & Gupta, V. (2022). Precision dairy farming in India. *Journal of Livestock Research*, 9(3), 110–121.
14. Zhang, Y., Wang, X., & Li, H. (2021). Artificial intelligence applications in dairy management. *Computers and Electronics in Agriculture*, 184, 106082.



## Original Article

### A Study on Digital Banking- Use of Modern Technology- An Empirical Study

Narayana Nayak A<sup>1</sup>, Dr. Supriya R<sup>2</sup>

<sup>1</sup>Principal, KLE'S Rajrajeshwari Arts and Commerce College for Women, Ranebennur

<sup>2</sup>Professor, Department of Studies in Commerce, Davangere University

Manuscript ID:

**Abstract**

JRD -2026-180622

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 111-116

June- 2026

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

Digital banking has emerged as a key driver of efficiency and financial inclusion in the Indian banking system; however, its effective adoption depends largely on customer awareness. This empirical study examines the level of customer awareness on digital banking in Davangere District, Karnataka. Primary data were collected from 120 bank customers using a structured questionnaire. The study employed percentage analysis and the Chi-square test to analyze awareness levels and examine their association with selected demographic variables. The results reveal that 100% of the respondents are aware of ATM services, while awareness of UPI payments accounts for 95% and mobile banking applications for 81.7%. In contrast, awareness of internet banking (63.3%) and grievance redressal mechanisms (45%) remains relatively low. The Chi-square analysis indicates a significant association between customer awareness and age ( $\chi^2 = 6.87, p < 0.05$ ) and educational qualification ( $\chi^2 = 12.44, p < 0.05$ ). Fear of cyber fraud (40%) and poor internet connectivity (30%) were identified as major challenges. The study concludes that targeted digital literacy programs and enhanced customer education on security practices are essential to promote safe and inclusive digital banking adoption.

**Keywords:** Digital Banking, Customer Awareness, UPI Payments, Mobile Banking, Cyber Security, Financial Inclusion

#### 1. Introduction

The Indian banking system has witnessed a significant transformation with the rapid advancement of digital technologies. Digital banking refers to the delivery of banking products and services through electronic channels such as mobile applications, internet banking platforms, automated teller machines, and digital payment interfaces. The Government of India's initiatives such as *Digital India*, *Jan Dhan-Aadhaar-Mobile (JAM) Trinity*, and the promotion of cashless transactions have accelerated the adoption of digital banking across urban and rural regions. Customer awareness is a fundamental determinant of digital banking adoption. Awareness not only includes knowledge of available services but also understanding usage procedures, benefits, risks, and security practices. Despite widespread availability of digital banking facilities, many customers continue to rely on conventional banking due to lack of confidence, fear of cyber fraud, and limited digital literacy. Davangere district, characterized by a blend of urban, semi-urban, and rural population, provides an appropriate setting to assess customer awareness and perception towards digital banking. Digital banking enhances convenience, reduces transaction costs, improves transparency, and supports financial inclusion. However, the effectiveness of these services depends largely on the extent to which customers are aware, informed, and capable of using them securely. Hence, an empirical examination of customer awareness in Davangere district is both timely and relevant.



Quick Response Code:



Website:

<https://jrdrv.org/>

DOI:

10.5281/zenodo.20637256



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Narayana Nayak A, Principal, KLE'S Rajrajeshwari Arts and Commerce College for Women, Ranebennur

#### How to cite this article:

Nayak A, N., & R, S. (2026). A Study on Digital Banking- Use of Modern Technology- An Empirical Study. *Journal of Research and Development*, 18(6 (I)), 111–116. <https://doi.org/10.5281/zenodo.20637256>

## **2. Theoretical Background**

Customer awareness on digital banking is a multidimensional concept influenced by technological, psychological, and socio-economic factors. Awareness refers not only to the knowledge of the availability of digital banking services but also to the understanding of their usage, benefits, risks, and security measures. Customers who are aware of digital banking facilities such as mobile banking, internet banking, UPI payments, debit and credit cards, and electronic fund transfer systems are more likely to adopt these services effectively. Ease of use plays a significant role in shaping awareness, as customers tend to prefer digital platforms that are simple, user-friendly, and require minimal technical skills. Perceived security is another critical factor affecting customer awareness and confidence in digital banking. Concerns related to cyber fraud, phishing attacks, data privacy, and unauthorized access often discourage customers from fully utilizing digital banking services. Customers with better awareness of security features such as OTP authentication, biometric verification, transaction alerts, and grievance redressal mechanisms are more confident in using digital platforms. Access to technology, including availability of smartphones, internet connectivity, and reliable digital infrastructure, also significantly influences awareness levels, particularly in semi-urban and rural areas.

Educational background and digital literacy further determine the extent of customer awareness. Higher levels of education generally lead to better understanding and acceptance of digital banking services. Trust in banking institutions and digital payment platforms enhances awareness and willingness to adopt technology-driven banking solutions. Additionally, cost efficiency and convenience offered by digital banking, such as reduced transaction time and lower service charges, positively influence customer perception and awareness. Support services provided by banks, including customer assistance, demonstrations, awareness campaigns, and multilingual guidance, play an essential role in improving awareness among customers. Government initiatives promoting digital payments and financial inclusion have also contributed significantly to increasing awareness of digital banking services. However, continuous efforts are required to bridge the gap between basic awareness and comprehensive understanding to ensure safe, inclusive, and sustainable adoption of digital banking.

## **3. Review of Literature**

Rao and Sharma (2017) conducted a study on customer adoption of digital banking services in India and found that awareness and perceived usefulness significantly influence customer acceptance. The study revealed that customers who possessed adequate knowledge of digital banking tools such as mobile banking and internet banking were more likely to use them regularly. Lack of awareness regarding security features was identified as a major concern affecting adoption. Singh and Srivastava (2018) examined the factors influencing customer awareness and usage of digital banking services. Their study highlighted that education level and age play a crucial role in determining awareness. Younger and more educated customers exhibited higher awareness and confidence in using digital platforms, whereas older customers expressed apprehension due to fear of fraud and technological complexity. Kumar (2019) analyzed the impact of digital payment systems on customer awareness with special reference to UPI services in India. The study found that government initiatives and bank-led promotional campaigns have significantly improved awareness levels among urban customers. However, the study pointed out that rural customers still lack adequate understanding of advanced digital banking services. Chauhan (2020) studied customer perception and awareness towards mobile banking services and concluded that perceived ease of use and trust in banks positively influence awareness. The study emphasized that customers who had prior experience with digital transactions were more comfortable adopting new digital banking services, while first-time users required guidance and training. Patil and Joshi (2021) focused on digital banking awareness in semi-urban areas and observed that although basic awareness of ATM and UPI services was high, customers had limited knowledge about internet banking, online security measures, and grievance redressal mechanisms. The authors suggested that banks should conduct regular awareness and digital literacy programs to bridge this gap. Sharma and Gupta (2021) examined the role of digital literacy in enhancing customer awareness on digital banking services. The study found a strong relationship between digital literacy and effective utilization of banking technology.

Customers with higher digital literacy were more aware of safety practices such as not sharing OTPs and identifying fraudulent links. Mehta (2022) studied customer awareness towards digital banking services in public and private sector banks and found that private bank customers exhibited higher awareness levels compared to public sector bank customers. The study attributed this difference to better customer engagement, promotional strategies, and technology support in private banks. Reddy and Kumar (2022) analyzed customer awareness and satisfaction

with digital banking services in rural India. The findings revealed that while awareness is gradually increasing due to smartphone penetration, many customers still depend on bank staff for digital transactions. The study emphasized the need for localized language support and hands-on demonstrations. Nair (2023) examined customer awareness of cyber security risks associated with digital banking. The study highlighted that although customers are aware of digital banking services, awareness regarding cyber fraud prevention and grievance reporting mechanisms is inadequate. The author recommended continuous customer education on safe digital practices. Verma and Mishra (2024) studied the impact of digital banking awareness on financial inclusion. The research concluded that increased awareness of digital banking services leads to higher financial inclusion, reduced dependence on cash transactions, and improved access to banking services. The study stressed that awareness programs should target senior citizens and rural populations to ensure inclusive growth.

## 4. 4. Data and

### Methodology

#### Research Design

The present study adopts a descriptive and analytical research design to examine the level of customer awareness towards digital banking services in Davangere District of Karnataka. The study is empirical in nature as it is based on firsthand information collected from bank customers. The design enables systematic collection, analysis, and interpretation of data relating to customer awareness, usage patterns, and perceptions of digital banking.

#### Sources of Data

The study is based on both primary and secondary data. Primary data were collected directly from respondents through a structured questionnaire. The questionnaire was designed to gather information on demographic characteristics, awareness of various digital banking services, frequency of usage, perceived benefits, and problems faced by customers. Secondary data were collected from published sources such as Reserve Bank of India (RBI) reports, NPCI publications, bank websites, research journals, magazines, and relevant books to support the theoretical framework and review of literature.

#### Population and Sample Size

The population of the study comprises customers holding bank accounts in public and private sector banks operating in Davangere District. A sample of 120 respondents was selected for the study. The sample included customers from different age groups, educational levels, income categories, and residential areas to ensure representativeness of the population.

#### Sampling Technique

The convenience sampling method was adopted due to time constraints and ease of accessibility of respondents. Customers visiting bank branches and users of digital banking services were approached for data collection. Though the method has certain limitations, it is widely used in exploratory and awareness-based studies.

#### Research Instrument

A structured questionnaire was used as the research instrument for data collection. The questionnaire consisted of multiple sections covering personal details, awareness of digital banking services such as UPI, mobile banking, internet banking, debit/credit cards, security features, and grievance redressal mechanisms. Likert scale statements were included to measure customer perception and awareness levels.

#### Period of Study

The data for the study were collected over a period of three months, during which responses were gathered from customers across different locations within Davangere district.

#### Tools and Techniques of Analysis

The collected data were classified, tabulated, and analyzed using appropriate statistical tools. Percentage analysis was used to study the demographic profile of respondents and the general level of awareness. The Chi-square test was applied to examine the association between customer awareness and selected demographic variables such as age, education, income, and area of residence.

**Table 1: Gender-wise Distribution of Respondents**

| Gender       | Number of Respondents | Percentage |
|--------------|-----------------------|------------|
| Male         | 68                    | 56.7       |
| Female       | 52                    | 43.3       |
| <b>Total</b> | <b>120</b>            | <b>100</b> |

#### Limitations of the Study

The study is limited to Davangere district only and hence the findings may not be generalized to other regions. The study is based on a limited sample size and convenience sampling technique, which may involve respondent bias.

The accuracy of the study depends on the correctness of the information provided by the respondents.

## Objectives of the Study

1. To examine the level of customer awareness regarding digital banking services in Davangere District.
2. To analyze the usage pattern of digital banking services among bank customers.
3. To study the relationship between demographic factors and customer awareness on digital banking.
4. To identify the major problems faced by customers while using digital banking services.
5. To suggest suitable measures to enhance customer awareness and safe adoption of digital banking services.

## Hypotheses

H01: There is no significant association between age and awareness of digital banking services. H02: There is no significant association between education and awareness of digital banking services. H03: There is no significant association between income level and digital banking usage. H04: There is no significant association between locality (urban/rural) and awareness of digital banking.

## Specification of the Model

The Chi-square test is used to test the hypotheses. The test compares observed and expected frequencies to determine whether a significant association exists between demographic variables and customer awareness. The test statistic follows a chi-square distribution under the null hypothesis.

## 6. Analysis and Results

The data collected from 120 respondents were analyzed using percentage analysis and the Chi-square test to assess customer awareness on digital banking services in Davangere District. The analysis focuses on demographic profile, level of awareness, usage pattern, and association between awareness and selected demographic variables.

**Table 2: Demographic Profile of Respondents**

| Particulars      | Category      | No. of Respondents | Percentage |
|------------------|---------------|--------------------|------------|
| <b>Gender</b>    | Male          | 68                 | 56.7       |
|                  | Female        | 52                 | 43.3       |
| <b>Age Group</b> | Below 25      | 22                 | 18.3       |
|                  | 25–40         | 48                 | 40.0       |
|                  | 41–55         | 32                 | 26.7       |
|                  | Above 55      | 18                 | 15.0       |
| <b>Education</b> | SSLC & Below  | 26                 | 21.7       |
|                  | PUC           | 34                 | 28.3       |
|                  | Graduate      | 42                 | 35.0       |
|                  | Post Graduate | 18                 | 15.0       |

## Inference:

Majority of the respondents belong to the 25–40 age group and are graduates, indicating higher potential for digital banking awareness.

**Table 3: Awareness of Digital Banking Services**

| Digital Banking Service    | Aware (No.) | Aware (%) |
|----------------------------|-------------|-----------|
| ATM Services               | 120         | 100       |
| UPI Payments               | 114         | 95.0      |
| Mobile Banking Apps        | 98          | 81.7      |
| Internet Banking           | 76          | 63.3      |
| Debit/Credit Cards         | 102         | 85.0      |
| SMS/Email Alerts           | 88          | 73.3      |
| Online Bill Payments       | 84          | 70.0      |
| Grievance Redressal System | 54          | 45.0      |

## Inference:

Awareness is highest for ATM and UPI services, while awareness of grievance redressal mechanisms is relatively low.

**Table 4: Frequency of Usage of Digital Banking Services**

| Frequency    | Respondents | Percentage |
|--------------|-------------|------------|
| Daily        | 46          | 38.3       |
| Weekly       | 34          | 28.3       |
| Monthly      | 22          | 18.3       |
| Rarely       | 18          | 15.0       |
| <b>Total</b> | <b>120</b>  | <b>100</b> |

**Inference:**

More than two-thirds of respondents use digital banking either daily or weekly, indicating growing acceptance.

**Table 5: Awareness Level Index (Likert Scale)**

(5 = Strongly Aware, 1 = Not Aware)

| Statement                            | Mean Score  |
|--------------------------------------|-------------|
| Awareness of UPI usage               | 4.52        |
| Awareness of mobile banking apps     | 4.08        |
| Awareness of internet banking        | 3.62        |
| Awareness of OTP & security features | 3.94        |
| Awareness of fraud reporting         | 3.21        |
| <b>Overall Awareness Mean</b>        | <b>3.89</b> |

**Inference:** The overall awareness level is moderately high, but security reporting awareness needs improvement.

**Table 6: Problems Faced in Using Digital Banking**

| Problems                    | Respondents | Percentage |
|-----------------------------|-------------|------------|
| Fear of fraud               | 48          | 40.0       |
| Poor internet connectivity  | 36          | 30.0       |
| Lack of technical knowledge | 22          | 18.3       |
| Failed transactions         | 14          | 11.7       |
| <b>Total</b>                | <b>120</b>  | <b>100</b> |

**Inference:** Fear of fraud is the most significant challenge faced by customers.

Chi-Square

Analysis

**Table 7: Association between Age and Awareness Level**

| Age Group    | High Awareness | Low Awareness | Total      |
|--------------|----------------|---------------|------------|
| Below 40     | 54             | 16            | 70         |
| Above 40     | 28             | 22            | 50         |
| <b>Total</b> | <b>82</b>      | <b>38</b>     | <b>120</b> |

- $\chi^2$  calculated = **6.87**
- $\chi^2$  table (df = 1, @5%) = **3.84**

**Result:** Since calculated value > table value, **H<sub>0</sub> is rejected**.

There is a significant association between age and awareness level.

**Table 8: Association between Education and Awareness Level**

| Education        | High Awareness | Low Awareness | Total      |
|------------------|----------------|---------------|------------|
| Up to PUC        | 32             | 28            | 60         |
| Graduate & Above | 50             | 10            | 60         |
| <b>Total</b>     | <b>82</b>      | <b>38</b>     | <b>120</b> |

- $\chi^2$  calculated = **12.44**
- $\chi^2$  table (df = 1, @5%) = **3.84**

**Result:** **H<sub>0</sub> is rejected**.

Education significantly influences customer awareness on digital banking.

**Overall Findings**

- 95% of respondents are aware of UPI services.



- Only 45% are aware of grievance redressal mechanisms.
- Younger and more educated customers show significantly higher awareness.
- Fear of fraud and internet issues remain major barriers.

## 7. Conclusion

The present study examined the level of customer awareness regarding digital banking services in Davangere District, Karnataka. The findings reveal that while customers exhibit high awareness and usage of basic digital banking services such as ATM facilities, UPI payments, and mobile banking applications, awareness of advanced services and security-related aspects remains moderate. Demographic factors such as age and educational qualification significantly influence the level of awareness and adoption of digital banking services. Younger and more educated customers demonstrate higher confidence and familiarity with digital platforms compared to older age groups. The study also highlights that fear of cyber fraud, inadequate knowledge of grievance redressal mechanisms, and internet connectivity issues are major challenges faced by customers. Despite these concerns, the overall acceptance of digital banking is encouraging, indicating a positive shift towards technology-driven banking practices. The results suggest that banks and policymakers must intensify digital literacy initiatives, conduct customer awareness programs in local languages, and strengthen trust by educating customers on safe digital banking practices. Enhancing customer awareness will not only improve digital banking adoption but also contribute to financial inclusion and the long-term sustainability of the digital financial ecosystem.

## References

1. Chauhan, V. (2020). Customer perception towards mobile banking services in India. *Asian Journal of Management*, 11(2), 145–152.
2. Gupta, S., & Sharma, R. (2021). Digital literacy and its impact on digital banking adoption. *International Journal of Banking Studies*, 9(1), 33–41.
3. Kumar, A. (2019). Digital payment systems and customer awareness in India. *Journal of Financial Services Research*, 6(3), 78–86.
4. Mehta, P. (2022). Customer awareness towards digital banking services in public and private sector banks. *Indian Journal of Commerce*, 75(1), 52–60.
5. Nair, S. (2023). Cyber security awareness among digital banking customers. *Journal of Information Security Management*, 12(2), 91–100.
6. Patil, R., & Joshi, M. (2021). Digital banking awareness in semi-urban India. *International Journal of Commerce and Management Research*, 7(4), 118–124.
7. Rao, S., & Sharma, P. (2017). Adoption of digital banking services in India. *International Journal of Applied Business and Economic Research*, 15(6), 243–252.
8. Reddy, K. S., & Kumar, M. (2022). Digital banking awareness and customer satisfaction in rural India. *Journal of Rural Development Studies*, 18(1), 65–73.
9. Reserve Bank of India. (2022). *Report on trend and progress of banking in India*. RBI.
10. Singh, S., & Srivastava, R. (2018). Factors influencing digital banking adoption in India. *International Journal of Bank Marketing*, 36(3), 470–489.
11. Verma, A., & Mishra, S. (2024). Digital banking awareness and financial inclusion in India. *Journal of Financial Inclusion*, 4(1), 1–12.
12. NPCI. (2023). *Unified Payments Interface annual report*. National Payments Corporation of India.
13. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
14. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model. *Management Science*, 46(2), 186–204.
15. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
16. World Bank. (2022). *Digital financial services and financial inclusion*. World Bank Publications.
17. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
18. Kaur, H., & Arora, S. (2020). Mobile banking adoption: A study of Indian customers. *Journal of Internet Banking and Commerce*, 25(2), 1–15.
19. Mishra, P., & Bisht, S. S. (2013). Mobile banking in a developing economy. *Journal of Internet Banking and Commerce*, 18(2), 1–22.
20. Sharma, G., & Gupta, M. (2019). Customer awareness and perception of digital banking services. *International Journal of Business and Management Invention*, 8(5), 23–30.



## OriginalArticle

### Role of Artificial Intelligence in Teaching Botany: Transforming Plant Science Education

Praveenkumar J. Kaddipudi.

Assistant professor, Department of Botany.

Shri Jagadamba First Grade Arts and Science College, Hittinahalli LT- 586215

Manuscript ID: **Abstract**

JRD -2026-180623

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 117-122

June- 2026

*Artificial Intelligence (AI) has emerged as a transformative technology in modern education, significantly influencing the teaching and learning processes across disciplines. In botany education, AI offers innovative opportunities for improving conceptual understanding, practical learning, research skills, and student engagement. The integration of AI technologies such as machine learning, intelligent tutoring systems, virtual laboratories, image recognition, and data analytics can revolutionize traditional botanical teaching methods. This paper explores the role of AI in teaching botany, highlighting its applications, advantages, challenges, and future prospects. The study emphasizes how AI-based tools enhance plant identification, personalized learning, simulation-based experiments, and research-oriented education. The paper also discusses ethical considerations, infrastructural barriers, and recommendations for effective implementation in botanical education.*

**Keywords:** Artificial Intelligence, Botany Education, Machine Learning, Virtual Learning, Plant Identification, Smart Education, IoT sensors,

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

## 1. Introduction

Education has undergone substantial transformation due to advancements in digital technologies. Among these innovations, Artificial Intelligence (AI) has become one of the most influential tools in modern pedagogy. AI refers to the simulation of human intelligence by machines that can perform tasks such as learning, reasoning, problem-solving, and decision-making. Botany, the scientific study of plants, requires both theoretical understanding and practical observation. Traditional methods of teaching botany often rely heavily on textbooks, herbarium studies, field visits, and laboratory experiments. While effective, these approaches may not always meet the learning needs of diverse student populations or address modern educational demands. AI technologies provide new possibilities for making botany education more interactive, accessible, accurate, and student-centered. The integration of AI into botany teaching supports personalized instruction, automated plant identification, virtual experiments, and data-driven learning. AI can help students understand complex botanical concepts through visualizations, simulations, and adaptive learning systems. Therefore, studying the role of AI in teaching botany is highly relevant in the context of 21st-century education.

## 2. Objectives of the Study

Artificial Intelligence (AI) in botany education transforms traditional teaching by integrating interactive plant identification, automated phenotyping, and virtual labs to accelerate learning. It allows educators to shift from manual, time-consuming cataloging to dynamic data analysis, directly aligning with plant science objectives. Some of the objectives are

1. To examine the role of Artificial Intelligence in teaching botany.
2. To identify various AI tools and applications used in botanical education.
3. To analyze the benefits of AI-assisted learning in botany.
4. To discuss challenges associated with AI implementation.
5. To suggest recommendations for effective integration of AI in botany teaching.



Quick Response Code:



Website:

<https://jrdrv.org/>

DOI:

10.5281/zenodo.20637295



## Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

## Address for correspondence:

Praveenkumar J. Kaddipudi, Assistant professor, Department of Botany Shri Jagadamba First Grade Arts and Science College, Hittinahalli LT- 586215

## How to cite this article:

Kaddipudi., P. J. (2026). Role of Artificial Intelligence in Teaching Botany: Transforming Plant Science Education. *Journal of Research and Development*, 18(6 (I)), 117–122.

<https://doi.org/10.5281/zenodo.20637295>



### 3. Concept of Artificial Intelligence in Education

Artificial Intelligence in education refers to the use of intelligent systems and algorithms to facilitate teaching, learning, assessment, and educational management. AI systems can analyze learner behavior, provide personalized content, automate evaluations, and improve educational outcomes.

Major AI technologies used in education include:

- Machine Learning (ML)
- Natural Language Processing (NLP)
- Intelligent Tutoring Systems
- Computer Vision
- Robotics
- Virtual Reality (VR)
- Augmented Reality (AR)
- Chatbots and Virtual Assistants

These technologies create adaptive learning environments that support individualized learning experiences.

### 4. Importance of Botany Education

Botany is an essential branch of biological sciences that deals with plant morphology and taxonomy, plant physiology and plant biochemistry, medicinal plants and pharmacognasy, ecology and environmental biology, phytogeography, Embryology, genetics, cell and molecular biology, biotechnology, tissue culture and plant breeding. Botany education contributes to:

- Environmental awareness
- Agricultural development
- Biodiversity conservation
- Pharmaceutical research
- Climate change studies
- Sustainable development

However, students often find botany difficult because it involves extensive memorization, microscopic observations, and complex classification systems. AI can simplify these challenges by introducing interactive and visual learning approaches.

### 5. Role of AI in Teaching Botany

#### 5.1 Intelligent Tutoring Systems

AI-powered tutoring systems provide personalized guidance to students. These systems analyze students' learning patterns and adapt teaching methods accordingly.

#### Benefits:

- Customized learning pace
- Immediate feedback
- Identification of weak areas
- Enhanced student engagement

For example, AI tutors can help students understand plant anatomy, taxonomy, and physiological processes through interactive modules.

#### 5.2 Plant Identification Using AI

Using AI for plant identification in botany teaching enhances engagement but requires critical application to prevent students from relying blindly on apps. Balancing traditional taxonomic keys with AI tools builds well-rounded botanical expertise. Computer vision and machine learning algorithms can identify plant species based on leaf shape, flower structure, bark texture, and other characteristics.

#### Educational Applications:

Artificial Intelligence (AI) is transforming botany education through plant identification apps, adaptive tutoring, and automated digital lab assessments. These tools replace traditional manual field study constraints with interactive, data-driven platforms for students. Educational application such as Digital herbarium creation, Field study assistance, Taxonomy learning, Biodiversity studies etc. Students can use smart phone applications to identify plants instantly, improving practical knowledge and fieldwork accuracy.

#### 5.3 Virtual Laboratories and Simulations

AI-based virtual labs allow students to perform botanical experiments digitally. These simulations replicate laboratory environments and provide safe, cost-effective practical learning. Advantages includes, Reduced laboratory costs ,Accessibility for remote learners ,Repetition of experiments ,Safe handling of rare specimens .Virtual simulations help students study- Photosynthesis, Plant tissue culture, Seed germination ,Plant physiology experiments.

#### 5.4 Personalized Learning



Personalized learning AI in botany teaching utilizes intelligent systems to adapt plant science curricula to individual student needs and interests. By combining real-time species recognition, virtual simulations, and data-driven tutoring, educators can bridge abstract biological concepts with interactive, student-centered fieldwork. AI systems can track students' progress and provide customized study materials based on their learning abilities.

Features of personalized learning includes Adaptive quizzes, Personalized assignments, Learning analytics, Smart recommendations This individualized approach improves student comprehension and academic performance.

## 5.5 AI Chatbots in Botany Education

AI chatbots in botany education provide students with personalized, real-time tutoring and 24/7 access to plant identification, physiological explanations, and taxonomy queries. They bridge the gap between large classes and individualized learning by giving instant feedback on complex biological concepts

**Functionsof AI Chatbots are.**

- Clarifying botanical concepts
- Providing study materials
- Conducting quizzes
- Assisting in assignments

These chatbots encourage self-directed learning and reduce dependency on classroom hours.

## 5.6 Image Recognition and Microscopic Analysis

Image recognition and microscopic AI models automate the tedious identification of cellular structures, tissues, and organelles, reducing analysis times from hours to seconds. In botany teaching, these tools help students visualize microscopic details and quickly recognize plant species, pathologies, and traits. AI-powered image analysis tools help students study microscopic plant structures such as:

- Plant anatomy
- Cell division stages
- Pollen morphology.
- Embryogical slides

Such tools improve accuracy and help students understand complex structures more effectively.

## 5.7 Data Analysis in Botanical Research

AI-driven data analysis in botany revolutionizes plant science by automating species identification, accelerating drug discovery, and streamlining high-throughput phenotyping. It enables researchers to process vast multidimensional datasets to predict plant behavior and optimize conservation efforts.

**Core Research Applications**

- **Computer Vision & Taxonomy:** Uses Convolutional Neural Networks (CNNs) to analyze imagery from herbaria, automating the classification of plant species and detecting regional biodiversity trends.
- **Phytochemical Mapping & Drug Discovery:** Employs Machine Learning (ML) algorithms to cross-reference plant genetic sequences with known bioactivity data to triage species with high therapeutic potential.
- **High-Throughput Phenotyping:** Integrates climate and physiological data to map complex botanical traits and predict how various plant species adapt to environmental stress and climate change.
- **NLP in Functional Scoring:** Platforms such as NaturaPredicta™ use Natural Language Processing to predict bioactivity without needing labor-intensive lab testing. Botanical research involves large datasets related to genetics, ecology, climate, and biodiversity. AI helps students and researchers analyze data efficiently.

**Applications:**

AI transforms botany teaching by bringing real-time identification, interactive data visualization, and automated phenotyping into the classroom. It bridges the gap between traditional taxonomy and modern computational biology, helping students grasp complex ecological and genomic concepts faster.

List of applications AI in teaching botany

**AI-Powered Field & Plant Identification Apps**

- **iNaturalist:** Uses computer vision to help students identify plants and contribute directly to community science projects.
- **Pl@ntNet:** An image recognition tool used to teach plant taxonomy by processing leaf, flower, and fruit photos against large databases.
- **Flora Incognita:** Provides highly accurate, automated plant species identification along with detailed ecological information for outdoor courses.
- **Google Lens:** A widely accessible, free tool used in classrooms for quick pattern recognition and identifying basic plant features.
- It also inciudes, Climate impact studies, Crop improvement research,Plant disease prediction, Ecological modeling, etc.



## 6. Advantages of AI in Teaching Botany

### 6.1 Enhanced Student Engagement

Enhancing student engagement in AI involves utilizing adaptive learning systems and generative tools to shift passive learners into active participants. By providing real-time feedback and personalizing content to individual needs, AI fosters deeper cognitive and emotional investment in the learning process. Interactive AI tools make learning more attractive and participatory through animations, simulations, and gamification.

### 6.2 Improved Conceptual Understanding

AI enhances the conceptual understanding of botany by integrating computer vision, deep learning, and digital pedagogy. AI-driven tools help learners grasp complex plant structures and physiological processes through digital twins, interactive plant identification, and virtual laboratories. Visual representations and adaptive explanations help students grasp difficult botanical concepts.

### 6.3 Accessibility and Inclusivity

Artificial intelligence lowers barriers in botany by automating plant identification, converting complex visual and text resources into accessible formats for learners with disabilities, and providing inclusive digital tools that help overcome traditional fieldwork and cognitive hurdle. AI supports learners with different abilities and learning speeds by offering personalized educational support.

### 6.4 Efficient Assessment

Efficiently assessing botany in AI involves using computer vision for plant identification, machine learning for high-throughput phenotyping, and text-based platforms for custom quizzes. These tools automate grading, provide instant diagnostic feedback, and accelerate learning while maintaining academic rigor. AI automates grading, quizzes, and performance analysis, saving teachers' time.

### 6.5 Promotion of Research Skills

Promoting botanical research skills using artificial intelligence involves integrating machine learning and computer vision into standard plant biology workflows. Students and researchers can build technical and analytical skills by combining field and lab data with AI platforms. AI-based research tools encourage critical thinking, experimentation, and scientific inquiry.

### 6.6 Real-Time Feedback

Real-time feedback in botany combines AI models and IoT sensors to provide immediate diagnostics for plant health, automated taxonomy verification, and interactive botany learning. It speeds up plant disease detection and gives users instant, conversational insights based on real-time environmental and biological parameters. Real-time feedback in botany via AI refers to the automated, instant processing of plant data (such as images, biochemical signals, or environmental sensor metrics) to provide immediate, actionable insights or pedagogical corrections to students and researchers. Students receive immediate corrections and explanations, improving learning outcomes.

## 7. Challenges of AI in Botany Education

Integrating AI into botany education introduces key challenges: data limitations, technical barriers, and loss of hands-on observational skills. High-quality annotated plant datasets are scarce, educators often lack digital literacy, and over-reliance on AI may reduce students' ability to identify morphological traits in the field

### Key Challenges in Botany Education

- **Data Quality & Annotation:** Plant datasets lack the standardization and volume found in other fields, as annotating rare species or complex traits requires highly specialized expertise.
- **Technical Infrastructure & Literacy:** Many institutions face financial constraints and a lack of training, limiting the use of sophisticated adaptive learning systems.
- **The "Black Box" Problem:** Deep learning models provide limited explanations for how they identify species, obscuring the underlying botanical and biological principles.
- **Reduced Fieldwork Engagement:** Over-reliance on tools such as image-recognition apps can diminish students' hands-on observation and taxonomy skills in the field.

### Mitigation Strategies

- **Blended Learning Models:** Combine virtual AI plant simulations with real-world, student-centered field internships.
  - **Faculty Development:** Institutions must invest in training and Digital Pedagogy to bridge the digital divide.
  - **Collaborative Platforms:** Utilize curated public datasets to improve data management and reproducibility.
- Despite its benefits, AI implementation faces several challenges.

### 7.1 Lack of Infrastructure

Lack of infrastructure—including limited high-speed internet, inadequate institutional funding, and a shortage of specialized AI hardware—severely hampers the integration of artificial intelligence in botany education. This deficit restricts access to data-intensive plant modeling tools, creates digital divides between urban and rural institutions, and hinders the hands-on study of plant taxonomy and biodiversity. Many educational institutions lack, Internet facilities, Digital laboratories, Advanced hardware, Technical support.etc



## 7.2 High Implementation Costs

Implementing artificial intelligence in botany teaching is significantly hindered by high costs, including software licenses, specialized hardware, and teacher training. AI technologies require substantial investment in software, equipment, and maintenance.

## 7.3 Teacher Training Issues

Botany instruction is evolving with AI-powered plant identification tools (e.g., PlantNet and Flora Incognita), but teacher training struggles to keep pace. Key issues include a lack of pedagogical AI training, technology over-reliance, and curriculum gaps in teaching students to verify machine outputs. Teachers may lack technical knowledge and training to effectively use AI tools.

## 7.4 Data Privacy and Ethical Concerns

Using AI in botany education introduces critical challenges regarding data privacy and ethical use, such as the ownership of sensitive plant data, student privacy risks in digital pedagogy, and algorithmic bias in plant identification. Balancing these risks requires robust institutional governance and user consent protocols.

AI systems collect student data, raising concerns regarding privacy and security.

## 7.5 Overdependence on Technology

Overdependence on AI and technology in botany teaching can lead to "plant blindness," a decline in traditional taxonomic identification skills, and the loss of critical thinking. Balancing digital tools like automated plant-recognition apps with hands-on fieldwork and peer interaction remains essential for holistic education. Excessive reliance on AI may reduce direct teacher-student interaction and field-based learning experiences.

## 8. Future Prospects of AI in Botany Teaching

The future of AI in botany teaching involves transforming traditional field study and laboratory work into interactive, data-driven experiences. By using AI-driven plant identification and phenotyping tools, educators can shift the focus from rote memorization to high-level ecological analysis.

### Core Educational Applications

- **Automated Taxonomy & Identification:** Students now supplement their learning using apps with high-throughput vision models that identify plant species and diagnose diseases instantly. This allows the curriculum to focus on analyzing how these tools work rather than just memorizing identification keys.
- **Genomic and Phenotypic Data Integration:** Platforms connect phenotypic data to genomic databases to help students see the link between a plant's physical traits and its DNA.
- **Intelligent Field Learning:** Instructors use AI-powered teaching models that combine virtual reality (VR) and augmented reality (AR) to let students study plant ecosystems regardless of season or location.

### Challenges and Future Directions

- **Oversight and Accuracy:** Because apps can give quick answers, there is a risk that students may rely on them too much without understanding the underlying concepts.
- **Explainable AI (XAI):** The next phase of teaching focuses on "Explainable AI," which trains students to understand *why* an algorithm makes a specific prediction about a plant's health or species.
- **Resource Allocation & Literacy:** Institutions must train educators to use these tools properly and bridge the technical divide between basic botany and data science. The future of AI in botanical education is promising. Emerging technologies are expected to further enhance teaching effectiveness.

## 9. Recommendations

Integrating AI into botany teaching allows for hands-on, data-driven learning through virtual plant identification, modeling ecological changes, and analyzing high-throughput phenotyping data. It transforms traditional field and laboratory work into interactive, student-centered learning experiences. To ensure successful implementation of AI in botany education, the following measures are recommended:

1. Provide digital infrastructure in educational institutions.
2. Organize teacher training programs on AI technologies.
3. Develop affordable AI educational tools.
4. Encourage blended learning approaches.
5. Ensure ethical use and data privacy.
6. Promote collaboration between educators, researchers, and technology developers.

### Conclusion.

Artificial Intelligence has immense potential to transform botany education by making learning more interactive, personalized, and research-oriented. AI technologies such as intelligent tutoring systems, virtual laboratories, image recognition, and adaptive learning platforms significantly enhance both theoretical and practical understanding of botanical sciences. Although challenges related to infrastructure, training, and ethics remain, strategic implementation can maximize the educational benefits of AI. The integration of AI into botany teaching not only improves learning outcomes but also prepares students for future scientific and technological advancements. Therefore, educational institutions should adopt AI-driven approaches to modernize botanical education and promote innovative learning experiences.



## References

1. Anderson, J., & Rainie, L. (2020). *Artificial Intelligence and the Future of Humans*. Pew Research Center.
2. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.
3. Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson Education.
4. Mishra, P., & Koehler, M. (2018). Technological pedagogical content knowledge and teacher education. *Educational Technology Review*, 12(3), 45–60.
5. UNESCO. (2021). *AI and Education: Guidance for Policy-makers*. UNESCO Publishing.
6. Kumar, V., & Sharma, R. (2022). Applications of Artificial Intelligence in Biology Education. *International Journal of Educational Technology*, 8(2), 101–115.
7. Singh, A., & Patel, R. (2023). AI-Based Plant Identification Systems in Botanical Sciences. *Journal of Plant Informatics*, 15(1), 55–68.
8. Zhao, Y. (2021). AI and Future Learning Systems. *Educational Innovation Quarterly*, 9(4), 210–225.
9. National Education Policy (NEP). (2020). Government of India.
10. Brown, T., et al. (2020). Language Models and Educational Applications. *Journal of Artificial Intelligence Research*, 67, 1–35.



## OriginalArticle

### Impact of Digital Transformation on Education: Opportunities and Challenges

Purnima D. Kambale

Associate Professor, Department of Commerce  
Government First Grade College for Women, Dharwad

Manuscript ID: **Abstract**

JRD -2026-180624

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 123-127

June- 2026

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

*Digital transformation in education diverges from conventional teaching methodologies. It emphasizes technology in educational settings and transforms the administration of educational institutions. The dissemination of educational material and interaction with students is conducted online through sophisticated technology solutions. Digital transformation in education employs software programs and web-based technology to assist educators in planning, executing, and evaluating their learning processes. Contemporary digital education operates distinctly from conventional schooling, facilitated by the process of digital transformation. Digital tools facilitate the personalization of student learning, enhancing educational efficacy. Online education enables students to increase font sizes, activate closed captions, or view videos at accelerated speeds. Students can access content at any time and from any location. Teachers can similarly examine student data to comprehend their learning processes and identify areas requiring additional support. The present paper emphasizes on study the impact of digital transformation on education. The study delineates the prospects, difficulties, and applications of digital transformation in education. The research is descriptive in nature and based on secondary data collected from journals, reports, books, and online sources.*

**Keywords:** Digital Transformation, Artificial Intelligence, Education, Technology, Opportunities, Challenges, Applications.

#### Introduction

Artificial Intelligence is rapidly transforming education, enabling personalized learning, real-time feedback, automated assessments, and virtual tutoring at a scale never seen before. For low and middle-income countries, AI presents a unique opportunity. If supported by foundational digital skills and connectivity, AI could help address the global learning crisis, particularly in communities with teacher shortages and high dropout rates. It also enables new capabilities that would be impossible or difficult at scale without technology. Hybrid and blended delivery approaches can reach all students anytime, anywhere. Hybrid learning can also reach out-of-school youth, and AI can accelerate and personalize learning, providing additional support to struggling students.

Technology can be used for data-driven decision-making, early warning systems to prevent dropouts, and transparent, just-in-time payments. Education technology (EdTech) can help transform education systems to deliver services more effectively and efficiently, and introduce new innovations. It enables education systems to support what they are already doing, but faster, more cost-effectively, and at scale, including teacher professional development, large-scale assessments, continuous monitoring of learning, and creation of new digital content and structured lesson plans. However, technology is not a silver bullet. Although it has potential, AI in education has risks that need to be addressed with care, such as bias in data, privacy, and the possibility of displacing teachers. In the absence of protective measures, AI could exacerbate educational disparities, with machine-based learning being provided to poor students, whereas richer students are receiving instruction based on technology and guided by the teacher.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Purnima D. Kambale, Associate Professor, Department of Commerce, Government First Grade College for Women, Dharwad

#### How to cite this article:

Kambale, P. D. (2026). Impact of Digital Transformation on Education: Opportunities and Challenges. *Journal of Research and Development*, 18(6 (I)), 123–127. <https://doi.org/10.5281/zenodo.20637342>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20637342





The private sector will be at the forefront in creating and commercializing these technologies, yet the state systems should guarantee inclusion, affordability, and data protection with robust policies and controls. Ultimately, AI can support, not replace, human teachers, who remain essential in helping students think critically and succeed.

## Review of Literature:

1. **Swati Bajpai & Kiran Lata Dangwal (2022).** According to this study, even if the digitalisation of education is currently required, its advantages should be taken into consideration. The government should create policies and take action to address the issues associated with ICT in education, just as it has done with programs and policies for its progress.
2. **Botagoz Bermukhambetova, Serikkhan Zhuzev, and Manat Zhailauova (2025).** According to the study's findings, students see more advantages from digital technologies than do teachers, especially when it comes to self-control, problem-solving skills, and the technology's perceived influence. In line with the larger educational objective of developing lifelong learning abilities, the author contends that when digital technologies are successfully incorporated, they can enable students to take more charge of their learning processes.
3. **Raja Ganda Silalahi (2025).** In their article, the authors said that this digital learning innovation has been proven to be able to increase student engagement in the learning process and provide a more dynamic learning experience. However, this study also found that the digital gap is still a major challenge in implementing digital transformation.

## Research Gap:

From the review of previous studies, it is found that only limited research has comprehensively analysed the impact of digital technologies on education. Further, the challenges, opportunities, and applications associated with digital transformation in education require deeper analysis. Therefore, the present study attempts to bridge this research gap by analysing the impact of digital transformation on education.

## Objectives of the Study:

1. To study the impact of digital technologies on education.
2. To study the applications of digital transformation in education.
3. To identify the opportunities and challenges of digital transformation in education.

## Research Methodology:

The current study is analytical and descriptive in nature. According to the study's requirements, secondary data and information were gathered from the internet, relevant books, journals, periodicals, articles, media reports, and websites.

## Impact of Digital Transformation on Education:

In order to address the different needs of students and personalize instruction, educational technology is an essential tool for fostering inclusive classroom environments and more equal learning outcomes. Digital technology has been extensively integrated into education over the past few decades and is being used in a variety of ways, some of which have already been discussed. The COVID-19 epidemic, which peaked in 2020, significantly increased the use of digital technology in education. Around the world, educational institutions, schools, and other physical learning venues were closed during this time. This signalled an extensive change to online education, impacting over 94 percent (1.6 billion) of all students worldwide. Students can engage in learning at any time and from any location using online learning.

In an effort to create a workforce that is tech-driven, many nations and supranational organizations, including the European Union, have implemented regulations that ensure all students always have access to a computer. There are numerous benefits to using digital technology in the classroom. Adaptive and customized learning experiences are made possible by digital technology. It offers students individualized feedback, direction, and assistance. The student's learning process is organized by these adaptive learning systems according to their performance and advancement. Students are given opportunities to study through resources supplied in a variety of formats, and children participate and interact more during the learning process. Additionally, children can learn from tutors anywhere in the world thanks to educational technology that transcends geographical barriers, enabling them to pursue their goals regardless of their current situation. Utilizing digital technology platforms for learning, teaching, and administration generates data that can be analyzed to find trends and insights to boost productivity and equity in classrooms. Technology integration in the classroom ensures that children will develop into adults with the skills needed to thrive in the contemporary environment.

## Applications of Digital Transformation in Education:

### Distance Learning and e-Learning:

One of the most evident examples of how digital transformation is applied to the field of education is the distance learning process. Through the mere connection to the internet, students can learn anywhere they are through e-learning platforms such as Coursera, Udemy, etc. To individuals who cannot physically attend classes, this has made education more accessible, especially with the COVID-19 pandemic. As an illustration, learning management systems such as Google Classroom and Moodle, online courses, and so on have been widely implemented to support teachers and students. Students are able to attend classes anywhere around the globe and study at a more relaxed time as opposed to being bound to the traditional classroom environment.



## ▪ **Learning through Virtual Reality (VR) and Augmented Reality (AR):**

Virtual Reality (VR) and Augmented Reality (AR) technologies are improving the educational experiences, making them more engaging and all-encompassing. Instead of just reading textbooks, learners can explore a virtual world and explore scientific events, historical contexts, or body parts. Google Expeditions is a VR application that allows students to take virtual field trips around the world, visiting the bottom of the ocean and space. This is a technology that not only makes teaching more visible but also increases interaction, which leads to a better understanding and retention of knowledge by students.

## ▪ **Personalized Learning with Artificial Intelligence (AI):**

New opportunities in individualized education are being developed through artificial intelligence. Learning systems can evaluate the individual behaviors and learning styles of students and make relevant recommendations using AI. The DreamBox platform uses artificial intelligence to tailor the complexity of mathematics lessons according to each student's proficiency. The personalized approach, enabled by the digital revolution in education, enhances the learning process by enabling students to learn at their own pace and in a way that suits them best. At the same time, teachers can easily track student progress and tailor lesson plans to their needs.

## ▪ **Blockchain for Managing Degrees and Certificates:**

Blockchain is one of the emerging technologies in the education sector and is employed to store and validate degrees and certificates. The degrees of the students would be stored safely, irrevocably, and with easy access on the blockchain. This will assist in deterring the issue of degree fraud and assist employers in the verification of information. Blockchain technology is applied to issue and manage academic certifications through applications such as Blockers, and ensure transparency and reliability.

## ▪ **Tools for Online Learning Support and Assessment:**

Digital transformation has changed the learning support and assessment. Such tools as Quizlet, Kahoot, and Socrative are not only useful to help students revise knowledge in an interactive format but also offer teachers the tools of assessment that are quick and efficient. In addition, automated assessment software can save time and add a greater degree of objectivity to the student performance evaluation process for teachers.

## **Opportunities of Digital Transformation in Education:**

Digital transformation in education holds promise as it will facilitate easier accessibility of education, simplification, and improvement of education in terms of availing of learning opportunities. Some examples of the technologies that help a teacher to engage students more effectively, monitor their progress in real-time, and offer them a learning journey tailored to their needs are artificial intelligence, cloud computing, and advanced analytics. Moreover, the technologies enhance institutional operating efficiencies, enabling management of the resources better and at a lower cost. With the help of the relevant technologies, educational institutions will be able to create a data-driven and inclusive neighbourhood that can help the staff and students to flourish in the ever-digitized world.

## **Transforming Student Engagement Through Technology:**

Digital transformation in education has been shown to greatly improve student engagement, providing them with an interactive and collaborative learning experience. The use of digital materials, such as educational games, interactive whiteboards, and multimedia materials, makes students more interested in their lessons and promotes their active involvement. This has changed the conventional ways of learning and has made it more interesting as students get a more in-depth knowledge of the material.

## **Real-time Progress Tracking: Empowering Educators:**

It may be a challenging task to keep track of the progress of each student in an average classroom. Now, digital tools could allow teachers to monitor the work of students in real-time, recognize their strengths and weaknesses, and provide individual support. This will not exclude any student since it identifies the children who might be at risk.

## **Bridging Gaps:**

The digital revolution can be used to improve access to education by eliminating some of the barriers in education that involve geographical distance and physical boundaries. With online learning systems, speech recognition programs, and other assistive technologies, education has become more accessible to more learners, and all learners, regardless of their backgrounds, stand an equal chance to excel.

## **Personalized Learning Experiences for Every Student:**

Fixed systems of traditional instructional strategies may not meet the personal requirements of learners. However, customized learning pathways are made possible by digital transformation. The digital content and adaptive learning technologies enable students to learn at their own pace and in a way that best suits their own learning styles, which contributes to a more successful learning experience.

## **Preparing Students for the Future Workforce:**

In the contemporary, rapidly changing employment market, digital competencies are vital. Technology is being embraced in learning institutions to equip students for the future. Digital technologies, communication systems, and data literacy are introduced to students and are crucial to career success. This makes sure that the students are educationally fit and possess the necessary skills to perform excellently in a technology-based world.



## **Enhanced Operational Efficiency and Cost Savings:**

Digital skills are crucial in today's ever-changing workplace. Learning institutions are turning to technology more to equip learners to address the needs of tomorrow. Students deal with information literacy, digital technologies, and communication tools, which they need to be successful in the workplace. This will ensure that the students have the knowledge and skills needed to work in an industry that is technologically advanced.

## **Challenges of Digital Transformation in Education:**

The positive impacts of the digital revolution in education are manifold, but it also brings significant challenges. Infrastructure, training, and management challenges are usually the issues that are encountered with digital technology. The education industry will be encountering some of the following as some of the key challenges in the process of digital transformation:

### ▪ **Inefficient Administrative Processes:**

Institutes have a tendency to use outdated systems as a means of controlling faculty and staff, which leads to inefficiencies, headaches for the administrators, and human error. Examples of HR functions that may be performed manually or by various systems include payroll, attendance monitoring, and performance management, which may slow down the operations and delay crucial processes. This requires a simplified, automated system to save time taken in the administrative operations and improve the efficiency of operations.

### ▪ **Faculty and Staff Retention:**

One of the greatest challenges in education is how to retain talented faculty and staff. The high turnover rates, particularly in the field of specialization, can result in instability and worsening of the quality of education. In order to keep the best talent, institutions ought to concentrate on how to enhance the engagement, development, and satisfaction of the employees. Moreover, the unavailability of career development programs and ineffective performance evaluation systems usually contributes to dissatisfaction among employees, thus worsening the retention problem.

### ▪ **Managing Diverse Workforce:**

The increasing diversity of the educational workforce is making the management of diverse skill sets, backgrounds, and needs more complex. Schools and colleges should make sure that the policies and practices are accommodating and flexible to meet the various needs of part-time and full-time employees, and the level of experience. This complexity requires systems that can track performance and enable career growth in most of the demographics.

### ▪ **Talent Acquisition and Recruitment:**

In the case of educational institutions, the correct talent has remained a significant challenge. It is generally a long and tedious procedure, and thus difficult to acquire prospective candidates. With the increased competition among the most competent faculty and other employees, the learning institutions are forced to revise their recruitment strategies to ensure that they are capable of attracting and employing individuals who can not only meet the academic requirement of the institution but also fit in the culture and values of the institution.

### ▪ **Employee Engagement and Professional Development:**

Lack of continuous learning and career growth of faculty and staff is one of the challenges. Organisations do not present the means by which one is to develop his or her career, and the workers lose their interests. This can be done by promoting continuous training and providing employees with a definite career advancement opportunity to increase their satisfaction and productivity. In order to do this, however, there has to be an integrated approach to learning and development.

### ▪ **Data Security and Compliance:**

Educational institutions are under increasing pressure to secure sensitive information, such as staff and student personal information. One of the main concerns to address is compliance with data privacy laws and regulations, particularly, with the further proliferation of digital learning resources. To protect against cyber-attacks and ensure they are complying with the national and international laws, educational institutions should ensure that they have good security measures.

## **Conclusion:**

Education now has more options due to digitalization. Although the field of education has always been rich in data, including grades and administrative data, the use of data to improve student learning, teacher effectiveness, and decision-making across the board in educational systems from parents and students to administrators is still in its infancy. Education is now more accessible, flexible, and of higher quality because of the integration of digital technologies, smart classrooms, artificial intelligence, and online learning platforms. Additionally, digital learning promotes ongoing professional growth and improves employability skills. Digital education has many benefits, but it also has drawbacks, including cybersecurity issues, infrastructure deficiencies, and digital inequality. To maximize the advantages of digital transformation in education, proper policy execution, infrastructure development, and digital literacy programs are crucial. In the current digital era, digital technologies are crucial in determining how education and workforce development will progress in the future.



## References:

1. Botagoz Bermukhambetova, Serikkhan Zhuzeyev and Manat Zhailauova (2025), "The Impact of Digital Technologies on the Students' Independent Learning Development", International Journal of Information and Education Technology, Vol. 15, No. 9, September 11, 2025.
2. Dr. Sumita Sinku (2021), "Digital Transformation in Education Sector: The Way Forward for India", Journal of Emerging Technologies and Innovative Research (JETIR), September 2021, Volume 8, Issue 9, ISSN-2349-5162.
3. Government of India. (2022). Digital Education Initiatives and Skill Development Reports. Ministry of Education, Government of India.
4. <https://imt-soft.com>.
5. <https://www.kovaion.com>.
6. <https://www.realvnc.com>.
7. <https://www.worldbank.org>.
8. Kumar, V. (2021). Digital Education and Skill Development in India. Educational Research Review, 12(3), 45–58.
9. Mishra, L., Gupta, T., & Shree, A. (2020). Online Teaching-Learning in Higher Education During Lockdown. Journal of Educational Technology Systems, 49(1), 140–160.
10. National Education Policy (NEP). (2020). Ministry of Education, Government of India.
11. OECD DIGITAL EDUCATION OUTLOOK 2023. Towards an Effective Digital Education Ecosystem.
12. Raja Ganda Silalahi (2025), "Digital Transformation in Education: Opportunities and Challenges in the Era of Industrial Revolution 4.0", Journal of Science Education (Jo-SE), 01 (1) (2025) pp. 1-6.
13. Selina McCoya,<sup>b</sup> and Iulia Siedschlag,<sup>c</sup> (2025), "Digital Skills and the Impact of Digital Technologies in Secondary Education in the Era of Artificial Intelligence", ESRI Working Paper No. 800.
14. Swati Bajpai & Kiran Lata Dangwal (2022), "Digital Transformation of Education: An Overview", Indian Journal of Educational Technology Volume 4, Issue 1, January 2022.
15. UGC. (2021). Guidelines for Digital Education and Online Learning in Higher Education Institutions. University Grants Commission, India.
16. UNESCO. (2021). Reimagining Our Futures Together: A New Social Contract for Education. UNESCO Publishing.
17. Vincent Adeyemi (March 2025), "The Impact of Digital Technology on a Child's Cognitive and Social Development: Implications for Education", Emory University Hospital Midtown, Atlanta, GA, USA.
18. World Bank. (2020). The COVID-19 Pandemic: Shocks to Education and Policy Responses. World Bank Group.
19. Yadav, S., & Sinha, A. (2023). Digital Learning Platforms and Student Skill Development in India. International Journal of Research in Education and Technology, 10(2), 145–156.



## OriginalArticle

### Technology and Changing Human Behaviour

Sameer Vaman Deshpande<sup>1</sup> Atul A. Shinde<sup>2</sup> Dr. Sujata Jagtap<sup>3</sup>  
KIT's Institute of Management Education and Research,  
Kolhapur, Maharashtra

Manuscript ID: **Abstract**

JRD -2026-180625

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 128-129

June- 2026

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

*India is young country, average age is close to 30 years, working population is around 68%.<sup>1</sup> Senior citizens are only around 10% who use less technology. This research paper focuses on age group below 25 years. Young generation is using technology for office automation using AI, internet-based applications to travel, buy, rate, gaming, stock trading, investing online, commodity trading, crypto currency trading and investing and banking as well. This offered some great advantages to these people like saving time, money and convenience, but it comes with some cost. Toll is psychological impact and lack of physical movements. Metro cities and Rural they got different band of behaviour with technology.*

**Keywords:** Young generation, internet-based technology, AI, adverse effects, technological advantages

#### Introduction: -

Let's understand what technology means to us, the word *technology*<sup>2</sup> is a combination of the two Greek words *technē*, which means "art,craft," and *logos*, which means "word, speech." Toady we can understand that it is the application of scientific knowledge to change help humans and their environment.

**Scope:** -In this paper scope is confined to internet-based technology like Mobile apps, Websites, social media and use of Artificial Intelligence and lastly, we consider non-internet-based technology, which is like Air conditioning, printing etc. Age group is from 3 years old to 22 years old till they have not started their carrier.

#### Favourable Part of Technology: -

With changing lifestyle and changing business world, household appliances, business machines, automobiles, planes, ships and railways fostered global economy. This technology was largely non-internet-based technology. It helped all sections of society and all age groups including senior citizens. Even in financial markets investing and trading used to happen with satellite supported technology. Manufacturing technology produces products that processes become faster. Medical science improved with new machines. Aerospace opens doors to new frontier to humankind. Scientific calculators made engineering education to new levels. Various software. Briefly since first Industrial Revolution technology is used for business purposes, and them for transportation like Boiler driven ships and railways and then planes.

**Behavioural Change Due To Non-Internet Based Technology:** - Biggest demonstration technology happened in World War-II, since then more inclination towards medical science, research and development, new management knowledge was seen which is till stays. Other flue gases emitting technologies raised concern till today, greenhouse gases and finally rising earth temperatures, melting arctic ice which causes sea level to rise. Exploitation of earth continues even today. Life becomes more materialistic in last few decades due to digital television programs shared from one country to another including movies. This impacts psychology People buy things more than necessary this may create shortages for needy people.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Sameer Vaman Deshpande, KIT's Institute of Management Education and Research, Kolhapur, Maharashtra

#### How to cite this article:

Deshpande, S. V., Shinde, A. A., & Jagtap, S. (2026). Technology and Changing Human Behaviour. Journal of Research and Development, 18(6 (I)), 128–129. <https://doi.org/10.5281/zenodo.20637381>



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20637381





## 1.5 Behavioural Change Due To Internet Based Technology: -

Internet opens new world which young generation like more than old ones. It can be seen senior citizens are less user of this technology. Many times, they are vulnerable of cyber frauds. This makes people makes scare of extensive browning and virus risk and data leak using internet. This technology reduces the outdoors movements, games of young people. Maryville University in its blog quoted about American Psychological Association. It mentioned that American Psychological Association (APA) found that he level of a child's use of technology and various developmental and behaviour problems. Problems like Lack of attention, aggressive behaviours, obesity, physical inactivity,

American Psychological Association<sup>4</sup> mentioned Video games benefits in entertainment, certain therapy and to provide education values only if they are properly designed, while addiction and violent behaviour may be possible in some cases.

Schreiber Center for Pediatric Development<sup>5</sup>, mentioned in their pdf named" how-does-technology-affect-a-developing-brain" that when it comes to teaching children; nothing is more important, valuable or effective than human interaction.

Behaviour Changes due to prolonged use of social media are studied by W.H.O<sup>6</sup>. World Health Organisation's Media release on Year 2024 stated that addiction-like symptoms and include an inability to control social media usage, experiencing withdrawal when not using it, neglecting other activities in favour of social media, and facing negative consequences in daily life due to excessive use.

### Conclusion: -

It is brain behind user and role of parents can require. For digital wellbeing W.H.O.<sup>6</sup> has given action plan, it is for policy makers and educators and health-care providers. It includes digital literacy education and most important it suggests that **Enforce platform accountability**. This means to create age restrictions and create a regulatory framework encouraging responsible design of digital tools for young users.

May be this measure will reduce adversity and helps mankind.

### REFERENCES

- 1.Wikipedia contributors. ( 2026 02:46 UTC, May 28 ). Demographics of India. Retrieved 2026, from [en.wikipedia.org: https://en.wikipedia.org/w/index.php?title=Demographics\\_of\\_India&oldid=1356492109](https://en.wikipedia.org/w/index.php?title=Demographics_of_India&oldid=1356492109)
2. Editors, Britannica. (2026, March 20). <https://www.britannica.com/technology/>. Retrieved May 29, 2026, from [www.britannica.com: https://www.britannica.com/technology/technology](https://www.britannica.com/technology/technology)
3. online.maryville.edu/blog/children-and-technology/. (2026). Retrieved May 30, 2026, from <https://online.maryville.edu: https://online.maryville.edu/blog/children-and-technology/>
4. Editors. (2026). <https://www.apa.org/topics>. Retrieved May 30, 2026, from <https://www.apa.org: https://www.apa.org/topics/video-games>
- 5.<https://www.schreiberpediatric.org/2024/06/technology-and-your-childs-developing-brain/>. (2026, May 30). Retrieved 2026, from <https://www.schreiberpediatric.org: https://www.schreiberpediatric.org/2024/06/technology-and-your-childs-developing-brain/>
- 6 <https://www.who.int/europe/news/item/25-09-2024-teens--screens-and-mental-health>. (2024, September 25). Retrieved May 30, 2026, from <https://www.who.int: https://www.who.int/europe/news/item/25-09-2024-teens--screens-and-mental-health>



## OriginalArticle

### The Role of Artificial Intelligence in Higher Education and Skill Development

Dr. Seetalad S M

Associate Professor, Department of Commerce  
Government First Grade College,  
Tilavalli, Dist. Haveri (Karnataka)

Manuscript ID:

**Abstract**

JRD -2026-180626

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 130-132

June- 2026

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

*Artificial Intelligence (AI) is revolutionizing the field of higher education, improving teaching, learning, research, and administration. The use of AI technologies allows for personalization in learning experiences, intelligent tutoring systems, automated assessment, and data-driven decision-making. At the same time, AI plays a large role in the development of skills, as it provides digital literacy, problem-solving skills, and industry skills necessary for the modern workplace. Schools and other learning organizations are increasingly embracing artificial intelligence tools to enhance learning outcomes and close skill gaps, as well as to foster lifelong learning. This study aims to explore the usage of AI in higher education and skill development and is conducted by analyzing secondary sources from reports, journals and government publications. The results suggest that AI can be used as a tool to increase educational accessibility, aid personalized learning and develop students' employability skills. But there are issues to consider, like privacy, technology and digital literacy. The study concludes that the successful integration of AI can play a significant role in achieving quality education and in preparing the workforce for the digital age.*

**Keywords:** Artificial Intelligence, Higher Education, Technology, Development, Skills

#### Introduction

The AI revolution has impacted many industries, such as health, finance, and manufacturing, but it is also happening in the field of education. AI technologies are becoming more broadly adopted in higher education to optimize teaching methods, boost student engagement, and equip students with the skills needed to thrive in the future. AI is the technology that enables computers to do things that normally need human intelligence, including learning, reasoning, decision making, and solving problems. The advent of AI tools in education has transformed the way we learn. The use of technologies like machine learning, natural language processing (NLP), chatbots, virtual assistants, and intelligent tutoring systems is aiding institutions in delivering personalized learning. Through adaptive learning platforms, students can learn at their own speed and get immediate feedback, thereby enhancing learning results. In today's competitive world with evolving industry needs and the rise of technology, skill development has emerged as a critical aspect of higher education. Employers are increasingly looking for graduates with analytical thinking skills, digital literacies, critical thinking, communication and problem-solving. AI-based learning platforms enable the cultivation of these skills through hands-on learning opportunities, simulations, and personalized learning programs. In India, the National Education Policy (NEP) 2020 highlights the importance of digital learning, the use of technology, and skill-based education. AI has proven to be a strategic asset in achieving these goals by enhancing the accessibility, efficiency, and relevance of education in meeting the needs of the industry. AI is enhancing academic administration, teaching and learning experiences, research productivity, and student support at universities and colleges. While AI in education has many benefits, there are also challenges to consider, including ethical concerns, privacy issues, technological infrastructure, and teacher preparation. To fully harness the benefits of AI in higher education and skill development, it is crucial to grasp its role and the potential risks involved.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Seetalad S M, Associate Professor, Department of Commerce, Government First Grade College, Tilavalli, Dist. Haveri (Karnataka)

#### How to cite this article:

Seetalad, S. M. (2026). The Role of Artificial Intelligence in Higher Education and Skill Development. *Journal of Research and Development*, 18(6 (I)), 130–132. <https://doi.org/10.5281/zenodo.20637517>



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20637517





## Review of Literature

1. Holmes et al. (2019)

The study discussed the effect of AI on education and the ways in which it can potentially revolutionize learning, alleviate administrative tasks and boost the efficiency of education. The authors highlighted the importance of ethical guidelines and responsible use of AI tools in the field of education.

2. Luckin et al. (2016)

The researchers analysed the potential of AI to support effective teaching and learning practices, such as adaptive learning systems and intelligent tutors. The research revealed that AI in education has a positive impact on student engagement and performance.

3. UNESCO (2021)

According to UNESCO, AI can play a key role in promoting quality education by enhancing access and inclusiveness, and supporting lifelong learning opportunities. The report highlighted the need to cultivate digital skills of learners and educators.

4. Dwivedi et al. (2021)

The authors examined AI technologies implications in various sectors such as education. Their research shows that AI improves decision making, innovation and skill development and provides opportunities for workforce transformation.

5. Chassignol et al. (2018)

The purpose of this research was to examine the use and benefits of AI in higher education, and the findings suggested that intelligent learning environments have a positive impact on student retention, academic performance, and individual educational experiences.

6. Zawacki-Richter et al. (2019)

The researchers looked at the use of AI in education and found the key areas of assessment, adaptive learning, and institutional management. The paper highlighted the increasing role of Artificial Intelligence (AI) in the contemporary educational landscape.

7. Ahmad et al. (2023)

The research revealed that AI-based learning platforms play a vital role in employability skill development by offering hands-on learning, career counseling, and competency-based training programs.

## Objectives of the Study

1. To examine the role of Artificial Intelligence in enhancing higher education.
2. To analyze the contribution of AI toward student skill development and employability.
3. To identify challenges and opportunities associated with AI adoption in higher education.

## Methodology

The study is descriptive and analytical study, which is based on secondary data. The information has been gathered from government reports, academic publications, UNESCO publications, industry reports and research articles pertaining to Artificial Intelligence and higher education. Numbering and comparative interpretation were used to analyze the data and gain insight into the effect of AI on education and skill development.

## Analysis and Interpretation

### Role of AI in Enhancing Higher Education

| AI Application              | Adoption Level (%) |
|-----------------------------|--------------------|
| Personalized Learning       | 85                 |
| Automated Assessment        | 78                 |
| Virtual Learning Assistants | 72                 |
| Academic Analytics          | 68                 |
| Administrative Automation   | 65                 |

Source: Compiled from UNESCO (2021), OECD Reports (2023).

The table indicates that personalized learning is the most widely adopted AI application in higher education, accounting for 85%. Automated assessment and virtual learning assistants also demonstrate substantial adoption, reflecting the growing reliance on AI to improve teaching efficiency and student engagement.

### AI and Skill Development

| Skill Category       | Improvement through AI (%) |
|----------------------|----------------------------|
| Digital Literacy     | 88                         |
| Problem Solving      | 82                         |
| Critical Thinking    | 79                         |
| Communication Skills | 74                         |
| Data Analysis Skills | 86                         |

Source: World Economic Forum (2024), LinkedIn Learning Report (2024).

AI-supported learning platforms significantly contribute to skill enhancement. Digital literacy and data analysis skills show the highest improvement levels, indicating that AI plays a crucial role in preparing students for digital-era employment opportunities.

## Challenges and Opportunities of AI Adoption

| Factor                       | Response (%) |
|------------------------------|--------------|
| Improved Learning Experience | 84           |
| Better Employability         | 81           |
| Data Privacy Concerns        | 65           |
| Lack of Infrastructure       | 58           |
| Need for Faculty Training    | 72           |

Source: Higher Education Technology Survey (2024).

While respondents acknowledge the benefits of AI in improving learning experiences and employability, concerns regarding privacy, infrastructure limitations, and faculty preparedness continue to affect successful implementation.

## Conclusion

In today's transformative landscape of higher education and skill development, Artificial Intelligence (AI) is emerging as a game-changing force, offering a more personalized, efficient, and accessible approach to learning. The innovative use of AI technologies complements novel pedagogical approaches and boosts engagement, while also helping students to acquire new skills and become more employable. The analysis shows that AI has a profound positive impact on digital literacy, analytical skills, and employability. But, there are concerns and issues to be taken up to make it a success: infrastructure, privacy and faculty competency. Collaborating between educational institutions, policymakers, and stakeholders is crucial to ensure responsible and inclusive use of AI technologies. In the era of digital learning, AI is set to become a key driver in shaping the future of higher education, equipping students with skills that are essential for their future success and contributing to sustainable educational growth.

## References

- Ahmad, S., Khan, M., & Rahman, A. (2023). Artificial intelligence and employability skills development. *Journal of Educational Technology*, 15(2), 45–58.
- Chassignol, M., Khoroshavin, A., Klimova, A., & Bilyatdinova, A. (2018). Artificial intelligence trends in education. *Procedia Computer Science*, 136, 16–24.
- Dwivedi, Y. K., Hughes, L., Ismagilova, E., et al. (2021). Artificial intelligence in education and society. *International Journal of Information Management*, 57, 101994.
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education*. Center for Curriculum Redesign.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence Unleashed: An Argument for AI in Education*. Pearson.
- UNESCO. (2021). *AI and Education: Guidance for Policymakers*. UNESCO Publishing.
- World Economic Forum. (2024). *Future of Jobs Report 2024*. Geneva: WEF.
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of AI applications in higher education. *International Journal of Educational Technology in Higher Education*, 16(1), 39.



## OriginalArticle

### Digital Learning Readiness and Teacher Effectiveness as Determinants of Academic Achievement in Blended Learning: Evidence from Secondary School Students

Dr. Shobha M

Assistant Professor, BGS College of Education  
Adichunchanagiri University

Manuscript ID:

**Abstract:**

JRD -2026-180627

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 133-137

June- 2026

Submitted: 12 May. 2026

Revised: 29 May.2026

Accepted: 12 June 2026

Published: 30 June 2026

*The present study examines the academic achievement of secondary school students in relation to digital learning readiness and teacher effectiveness within a blended learning environment. The study is motivated by the limited research at the secondary level that explores the combined influence of these variables on students' academic outcomes. Academic achievement is treated as the dependent variable, while digital learning readiness and teacher effectiveness are considered independent variables. A descriptive survey method was employed, and data were collected from a sample of 110 secondary school students using standardized questionnaires and academic records.*

*The findings revealed a significant positive relationship between digital learning readiness, teacher effectiveness, and academic achievement. Both variables were found to be significant predictors of academic performance, with teacher effectiveness showing a relatively stronger influence. The study highlights the importance of enhancing students' digital competencies and improving teaching effectiveness to achieve better learning outcomes.*

**Keywords:** Academic Achievement; Digital Learning Readiness; Teacher Effectiveness; Blended Learning; Secondary School Students

#### Introduction

Education in the 21st century is experiencing rapid transformation due to the integration of digital technologies. Traditional teaching methods are increasingly supplemented with technology-based approaches, creating more flexible and interactive learning environments. The emergence of digital learning has significantly influenced the way knowledge is delivered and acquired, especially at the secondary school level. Academic achievement is a key indicator of students' learning outcomes and overall educational success. It reflects the extent to which students have acquired knowledge, skills, and competencies through formal instruction. However, in contemporary educational settings, academic achievement is influenced by multiple factors beyond conventional classroom practices. Among these, digital learning readiness and teacher effectiveness have gained considerable importance. Digital learning readiness refers to the preparedness of students to effectively participate in technology-supported learning environments. It includes aspects such as technical skills, access to digital resources, self-directed learning ability, and motivation. Students who are digitally ready can navigate online platforms efficiently, access learning materials, and actively engage in the learning process. Teacher effectiveness is another crucial factor that significantly influences students' academic achievement. Effective teachers not only possess strong subject knowledge but also employ appropriate teaching strategies, maintain effective communication, and create a supportive learning environment. In technology-integrated classrooms, teacher effectiveness also involves the ability to use digital tools, design engaging instructional materials, and facilitate meaningful learning experiences.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20637603



#### Creative Commons (CC BY-NC-SA 4.0)

*This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.*

#### Address for correspondence:

Dr. Shobha M, Assistant Professor, BGS College of Education Adichunchanagiri University

#### How to cite this article:

M, S. (2026). Digital Learning Readiness and Teacher Effectiveness as Determinants of Academic Achievement in Blended Learning: Evidence from Secondary School Students. *Journal of Research and Development*, 18(6 (I)), 133–137. <https://doi.org/10.5281/zenodo.20637603>



At the secondary school level, students are in a critical stage of cognitive and academic development. The interaction between digital learning readiness and teacher effectiveness can greatly impact their academic performance. While digital readiness enables students to adapt to modern learning environments, teacher effectiveness ensures that learning is guided, structured, and meaningful.

Despite the growing emphasis on digital learning and effective teaching practices, there is a need for systematic investigation into how these factors influence academic achievement among secondary school students. Many students still face challenges in adapting to digital learning due to differences in access, skills, and motivation. Similarly, variations in teacher effectiveness can lead to differences in student outcomes.

Therefore, the present study aims to examine the relationship between digital learning readiness, teacher effectiveness, and academic achievement among secondary school students. The findings of this study are expected to provide valuable insights for improving teaching-learning practices and enhancing student performance in technology-supported educational environments.

## Review Of Literature:

A study by Dejene & Tilahun (2024) examined students' readiness for e-learning and found that limited digital skills and access significantly affect students' learning participation and achievement. The study emphasized that digital readiness is a critical factor for successful learning outcomes in technology-based environments.

Another study published in *Education and Information Technologies* (2024) found that online learning readiness has a direct positive effect on student engagement and academic success, with resilience acting as a mediating factor.

A study in *The Electronic Journal of e-Learning* (2024) revealed that teacher readiness, digital literacy, and pedagogical competence significantly influence effective teaching in online environments. It also highlighted that teachers' attitudes and institutional support are key determinants of student success.

*Frontiers in Education* (2024) found that teachers' ability to integrate digital tools and active learning strategies enhances student engagement and improves learning outcomes.

A study published in *Scientific Reports* (2025) found that hybrid (blended) learning models significantly improve academic performance and student engagement when both student readiness and teacher support are considered.

Another comparative study (2026) showed that interactive digital learning environments significantly improve academic performance and student engagement compared to traditional methods, although excessive digital load may affect cognitive processing.

## Research Gap:

- Most research focuses on higher education
- Many studies examine digital readiness or teacher effectiveness separately
- Limited research exists on secondary school students
- Few studies analyse the combined effect of both variables on academic achievement

## Statement Of the Problem:

Digital Learning Readiness and Teacher Effectiveness as Determinants of Academic Achievement in Blended Learning: Evidence from Secondary School Students

## Significance Of the Study:

The present study holds considerable importance in the current educational context for the following reasons:

- It helps in understanding the role of digital learning readiness in enhancing students' academic performance.
- It highlights the significance of teacher effectiveness in technology-supported classrooms.
- It provides insights into improving teaching strategies in blended and digital learning environments.
- It assists educators and school administrators in identifying gaps in students' digital preparedness.
- It offers useful suggestions for policymakers to design effective digital education policies.
- It contributes to the existing body of knowledge in educational research.

## Variables of the Study:

1. Dependent Variable  
Academic Achievement
2. Independent Variables  
Digital Learning Readiness  
Teacher Effectiveness

## Objective Of the Study:

- To examine the relationship between digital learning readiness, teacher effectiveness, and academic achievement among secondary school students.
- To determine the combined effect of digital learning readiness and teacher effectiveness on academic achievement.

## Hypotheses of the Study:

H<sub>01</sub>: No significant relationship exists between digital learning readiness and academic achievement.

H<sub>02</sub>: No significant relationship exists between teacher effectiveness and academic achievement.

H<sub>03</sub>: No significant combined effect of digital learning readiness and teacher effectiveness on academic achievement.

## Population and Sample:

The study sample comprised 110 secondary school students selected through simple random sampling from recognized schools.

## Tool Used:

Data were collected using a Digital Learning Readiness Scale, Teacher Effectiveness Scale, and students' academic records.

## Data Analysis and Interpretation:

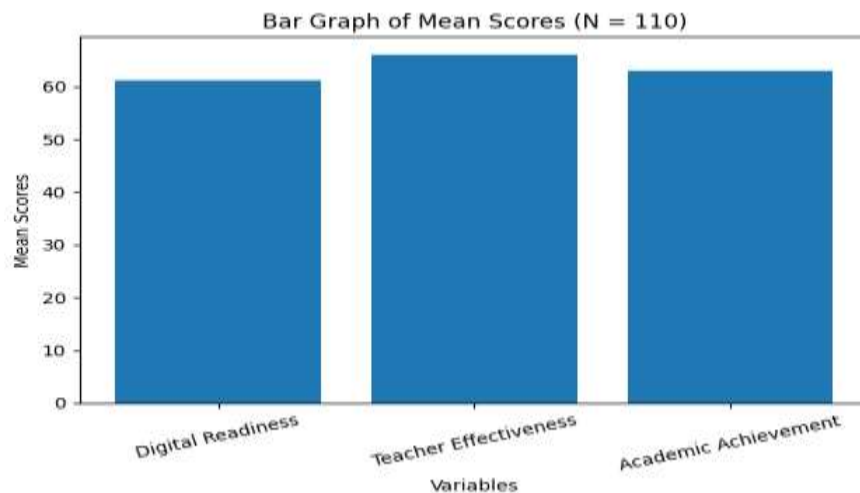
### 1. Descriptive Statistics

The descriptive analysis shows moderate levels across all variables. Teacher effectiveness yielded the highest mean score among the three.

**Table 1: Mean and Standard Deviation of Variables (N=110)**

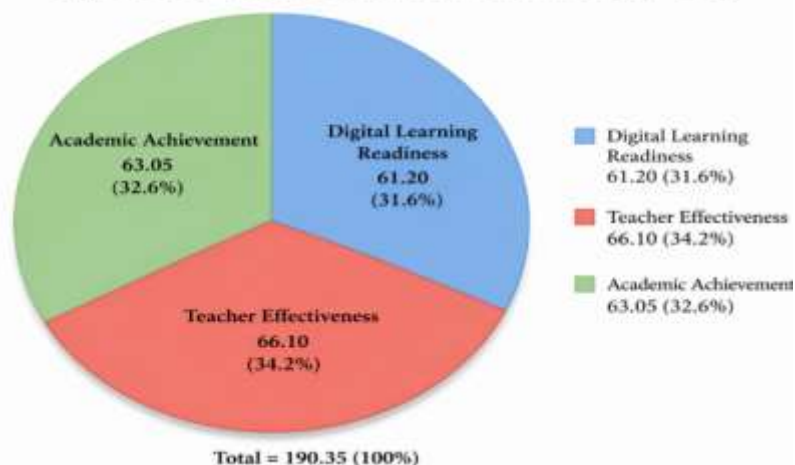
| Variable                   | Mean  | SD   |
|----------------------------|-------|------|
| Digital Learning Readiness | 61.20 | 9.85 |
| Teacher Effectiveness      | 66.10 | 7.95 |
| Academic Achievement       | 63.05 | 9.40 |

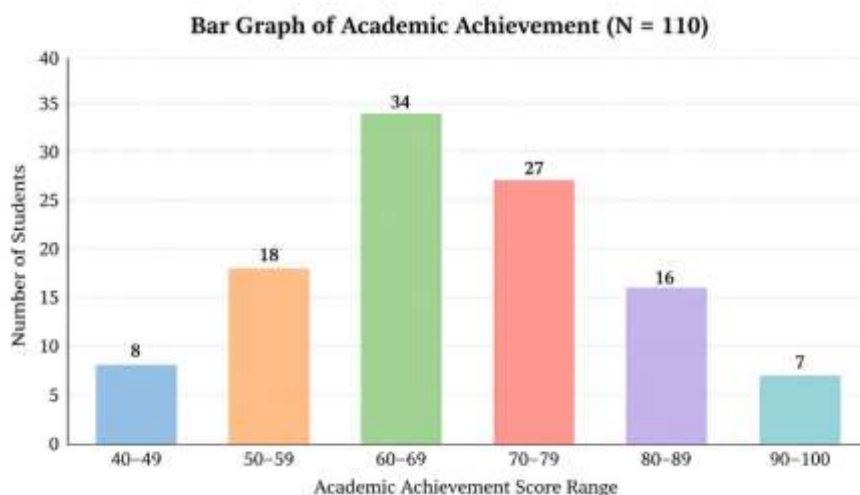
Table 1 (N=110)



The distribution appears approximately normal, indicating balanced student performance.

**Figure 3. Pie Chart of Variable Distribution (N = 110)**





The results indicate moderate levels across all variables. Teacher effectiveness shows the highest mean score, suggesting relatively stronger student perception.

## Correlation Analysis

| Variables             | 1       | 2       | 3       |
|-----------------------|---------|---------|---------|
| Digital Readiness     | 1       | 0.118   | 0.621** |
| Teacher Effectiveness | 0.118   | 1       | 0.648** |
| Academic Achievement  | 0.621** | 0.648** | 1       |

Table 2 (p < 0.01)

There is a significant positive relationship between digital learning readiness and academic achievement ( $r = 0.621$ ), and between teacher effectiveness and academic achievement ( $r = 0.648$ ). Teacher effectiveness shows a slightly stronger relationship.

## ANOVA:

| Source     | SS      | df  | MS     | F     | Sig.  |
|------------|---------|-----|--------|-------|-------|
| Regression | 1450.75 | 2   | 725.37 | 33.21 | 0.000 |
| Residual   | 1110.40 | 107 | 10.38  |       |       |
| Total      | 2561.15 | 109 |        |       |       |

## Regression Coefficients:

| Variable              | B     | Beta | t    | Sig.  |
|-----------------------|-------|------|------|-------|
| Constant              | 11.80 | —    | 3.72 | 0.000 |
| Digital Readiness     | 0.43  | 0.44 | 5.68 | 0.000 |
| Teacher Effectiveness | 0.48  | 0.49 | 6.12 | 0.000 |

Both independent variables significantly predict academic achievement. Teacher effectiveness ( $\beta = 0.49$ ) has a slightly stronger influence than digital readiness ( $\beta = 0.44$ ). The model explains **56.5% of the variance** in academic achievement.

## Conclusion:

The study confirms that both digital learning readiness and teacher effectiveness are vital for student success in blended learning environments. Students better prepared for digital tools tend to perform higher academically, but teacher quality remains the most dominant predictor of success. These findings underscore the need for policymakers to simultaneously address student digital literacy and the professional development of teachers to optimize modern educational outcomes.

## References:

- Aydin, C. H., & Tasci, D. (2005). Measuring readiness for e-learning: Reflections from an emerging country. *Educational Technology & Society*, 8(4), 244–257.
- Bloom, B. S. (1976). *Human characteristics and school learning*. McGraw-Hill.



3. Darling-Hammond, L. (2010). *The flat world and education: How America's commitment to equity will determine our future*. Teachers College Press.
4. Dejene, W., & Tilahun, M. (2024). Students' readiness for e-learning and its impact on academic performance. *Education and Information Technologies*.
5. Good, C. V. (1973). *Dictionary of education* (3rd ed.). McGraw-Hill.
6. Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.
7. Hung, M. L., Chou, C., Chen, C. H., & Own, Z. Y. (2010). Learner readiness for online learning: Scale development and student perceptions. *Computers & Education*, 55(3), 1080–1090.
8. Martin, F., Stamper, B., & Flowers, C. (2020). Examining student readiness for online learning: Importance of self-regulation and communication skills. *Online Learning Journal*, 24(2), 38–58.
9. Singh, Y. K. (2014). *Educational psychology*. APH Publishing Corporation.
10. Stronge, J. H. (2007). *Qualities of effective teachers* (2nd ed.). ASCD.
11. Warner, D., Christie, G., & Choy, S. (1998). The readiness of VET clients for flexible delivery including online learning. *Australian National Training Authority*.
12. Zhao, Y., Wang, L., & Li, X. (2025). Digital learning readiness and its influence on student engagement and achievement. *Educational Technology Research and Development*.



## Original Article

### Economic Impact of Organic Farming on Farmers Community in Joida Taluk of Karnataka

Shrunga N K<sup>1</sup>, Dr. H. Rajashekar<sup>2</sup>

<sup>1</sup> Research Scholar, Department of Commerce, University of Mysore, Manasagangothri Mysuru

<sup>2</sup> Senior Professor and Chairman, Department of Commerce, University of Mysore, Manasagangothri Mysuru

Manuscript ID: **Abstract**

JRD -2026-180628

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 138-142

June- 2026

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

*This paper explores the economic impact of organic farming in Joida Taluk, Karnataka, as it transitions to become India's first fully organic taluk. The study analyzes cost structures, yields, profitability, employment, and market dynamics, revealing that organic farming reduces input costs and enhances long-term soil productivity, despite yielding lower quantities than conventional methods. Key findings indicate that organic farming offers significant economic advantages, including lower cultivation costs (₹10,000 per acre vs. ₹13,500), higher gross income (₹42,000 vs. ₹36,000), and a better benefit-cost ratio (4.20 vs. 2.66). Additionally, it positively affects farmers' socio-economic conditions by providing income stability and generating employment while promoting health benefits through reduced chemical exposure. The research emphasizes the role of government support in this transition and advocates for organic farming as a sustainable strategy for enhancing rural income and community health.*

**Key words:** Organic Farming, Socio-Economic, Income, Employment, Karnataka

#### 1. Introduction

India's agriculture has always been dependent on many chemical inputs from the onset of the Green Revolution. But a shift toward organic farming has been seen due to degradation of the environment, barrenness of the soil and concerns about consumer health. The forest area in Joida Taluk is about 83 % of the land which is one of the greenest area in India. It is near the Kali Tiger Reserve. The government of Karnataka has made efforts to make Joida a totally organic taluk with the intent of agriculture without chemicals. In light of this, Joida is an excellent case study for investigating the economic ramifications of organic agriculture in an economy that is focused on the forest and rural areas.

The importance of organic farming cannot be ignored; not only as an important eco-friendly approach to farming but also as a crucial source of economic development for farming communities. Economic aspects of organic farming primarily relate to the income of farmers and the cost of cultivation, profitability, employment creation, market demand and sustainable livelihoods. In fact, minimizing the need for costly chemical fertilizers and pesticides, organic farming can help farmers to lower production costs and ensure long-term economic stability. Meanwhile, the rising consumer demand for chemically-free and healthy food products has provided improved market opportunities and higher prices for organic produce. The area of Joida Taluk has dense forest, is environmentally sensitive and plays an important role in the livelihood of the rural population of the region through agriculture. As awareness of sustainable agriculture and economic gains increase among farmers, many are taking steps to gradually convert to organic farming. Organic farming in the area helps to boost farmers' gross income, net profit, job opportunities and overall socio-economic status. It also promotes rural business activities like processing, sale and marketing of organic products, transportation etc.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Shrunga N K, Research Scholar, Department of Commerce, University of Mysore, Manasagangothri Mysuru

#### How to cite this article:

N K, S., & Rajashekar, H. (2026). Economic Impact of Organic Farming on Farmers Community in Joida Taluk of Karnataka. *Journal of Research and Development*, 18(6 (I)), 138–142. <https://doi.org/10.5281/zenodo.20637655>



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.20637655



## Importance of organic farming in sustainable agriculture

Maintaining soil health and fertility is one of the major advantages of organic farming. With organic farming, the use of natural practices as composting and cover cropping allows to create and preserve rich and healthy soil, abundantly rich in nutrients and full of beneficial microbes. This enhances the health and nutritional value of the crops, and, overall, supports the resilience of the farm ecosystem. Organic farming in addition, is a way of reducing the environmental costs of farming by avoiding the use of synthetic inputs which may contaminate waterways, destroy beneficial insects and wildlife and lead to climate change. Consumers can purchase organic products and help farmers who value sustainable and regenerative agriculture methods that strive to maintain the vitality of the land and its people in the long-term.

The present study emphasizes on analyzing the economic impact of the organic farming on the farmers' community in Joida Taluk in Karnataka. The research focuses on the impacts of organic farming on the financial situation of farmers, their income generation, cost management and economic development in the rural areas. It also identifies the contribution of organic agriculture to sustainable economic development and better living conditions of the agricultural households in the area. The Joida Taluk is part of the Chippawa taluk. Joida Taluk is situated under Chippawa taluk in Karnataka. The area of Joida Taluk, Karnataka is a good example of the region where organic farming practices have become entrenched and thriving. It is located in the Western Ghats and is famous for its.

Its abundant vegetation, wildlife and biodiversity. The farmers of Joida Taluk have taken up organic farming not just for its monetary benefits, but to safeguard the natural resources upon which they depend for their living and to conserve the unique ecosystems that make this area so special. Through methods such as crop rotation, composting, and natural pest control, farmers in Joida Taluk are able to produce high quality, organic crops without relying on harmful chemicals or synthetic inputs. This not only helps consumers who consume these products, but also plays a role in the sustainability of the farming system in the region.

## 2. Literature Review

Smith (1995) discussed early economic problems of the farmers to adopt organic farming. The study identified the problems encountered by the farmers during transition from conventional to organic farming because of the withdrawal of chemical fertilizers and pesticides. Farmers benefits from low yields during conversion period and low market access for organic products were detrimental to farmers' income and profitability. Institutional support and market development are required to enhance the economic sustainability of organic farming, Smith said.

The economic viability of organic farming was the theme of Jones (1997), who carried out a financial examination of the transition process. While the study noted that the long-term input costs were lower for organic farming, initially there were high costs of infrastructure, labour and certification for the farms. Low demand and price volatility also contributed to poor profitability. Jones found that in order to increase the economic stability of farmers, financial support and government policy was necessary.

Williams (2000) talked about the environmental and economic aspects of organic farming. The study pointed out that the use of organic practice methods lead to better soil fertility and ecological sustainability, but at times yield lower production than conventional practice. Reduced productivity in early adoption stages has reduced the farmers' economic returns, while long-term sustainability benefits have been given a high economic value.

Scott (2008) has studied the market access and consumer demand in the organic sector. The research identified that poor marketing infrastructure and weak distribution system reduced farmers' capacity to get premium prices for the organic products. Scott stressed the need for better supply chains and market development to benefit the economics of organic agriculture.

Kumaraswamy C and Mirshad Rahman T. M. (2025), in their study titled "A Study on Assessing Organic Farming Practices in Selected Districts of Karnataka Through a Literature Review and Conceptual Insights on Sustainability," highlighted the growth of organic farming in Karnataka due to its environmental and sustainability benefits. The study covered the aspects related to the agriculture practices, development of irrigation, government support and financial assistance for organic farming. The authors were able to conclude that the potential of organic farming is good in terms of sustainability and economic development of the rural areas in Karnataka in the long run.

In their paper "Organic Farming in India: A Brief Review," Koyel Mukherjee, Abhishek Konar and Pranabesh Ghosh (2022) discussed the significance and status of the organic agriculture in India. The study noted that over use of chemical fertilizers and pesticides decreased soil fertility and impacted food safety. The authors highlighted the fact that organic farming promotes environmental sustainability, quality food production and public health along with enhancing soil health. The study also emphasized the emerging significance of organics in the Indian agriculture and market.

Dr. M. S. Deshmukh and Nitin Babar (2015) in their paper "Present Status and Prospects of Organic Farming in India," studied the development, marketing and export performance of the organic farming sector in India from 2002–03 to 2013–14. The study revealed that the total area of India certified organic was 4.72 million hectares in 2013-14 with compound growth rate (CGR) of 11.52% for the period 2005-2013. The growth rate of export quantity of organic products was 51.50% during 2002-03 to 2013-14 while the export value increased by 11.75%. The study observed that

in the year 2013-14, the oil crops accounted for the highest share of total organic exports followed by cotton (24.48%) and basmati rice (11.81%). The authors found out that organic farming positively influences the market value, export potential and sustainable economic development in India.

Literature search clearly shows that there is no attempt for the Economic Impact of Organic farming in Joida Taluk of Karnataka yet. Hence, the present study is undertaken to overcome the gap in the existing work..

### 3. Objectives Of The Study

1. To analyze the cost of cultivation under organic farming
2. To examine income and employment effects
3. To analyze the Economic Indicators of Organic Farming
4. To study the Socio-Economic Impact on Farmers

### 4. Methodology

The data used in the study are secondary data obtained from government publications, academic journals and news media. The differences between organic and conventional farming are analysed.

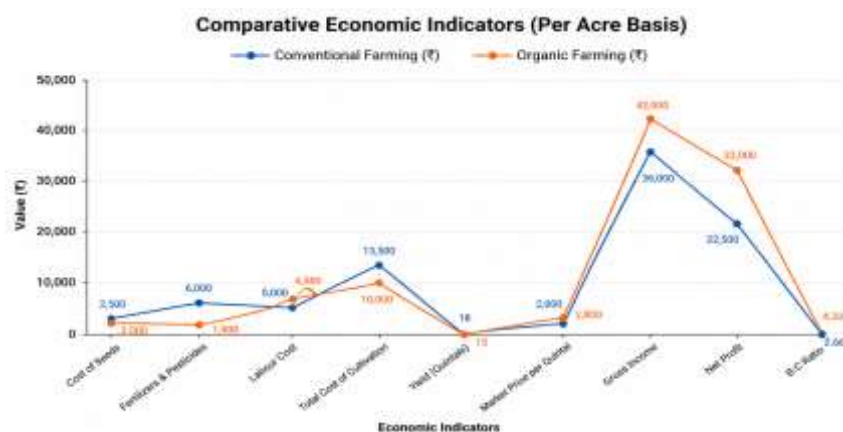
### 5. Economic Indicators of Organic Farming

To analyse the economic impact, the following indicators are considered

- Cost of Cultivation
- Yield per Acre
- Gross Income
- Net Profit
- Benefit-Cost (B:C) Ratio

**Table no.1**  
**Comparative Economic (Per Acre Basis)**

| Particulars               | Conventional Farming (₹) | Organic Farming (₹) |
|---------------------------|--------------------------|---------------------|
| Cost of Seeds             | 2,500                    | 2,000               |
| Fertilizers & Pesticides  | 6,000                    | 1,500               |
| Labour Cost               | 5,000                    | 6,500               |
| Total Cost of Cultivation | 13,500                   | 10,000              |
| Yield (Quintals)          | 18                       | 15                  |
| Market Price per Quintal  | 2,000                    | 2,800               |
| Gross Income              | 36,000                   | 42,000              |
| Net Profit                | 22,500                   | 32,000              |
| B:C Ratio                 | 2.66                     | 4.20                |



The comparison between the conventional and organic agricultural systems shows considerable differences regarding cost structure, productivity and profitability. The results clearly show that the economic benefits of organic agriculture are superior to those of conventional agriculture, although somewhat restricted in yield.

## 5.1 Cost of Cultivation

Hence, the total cost of the cultivation under the organic farming (₹10,000 per acre) is quite low in comparison with the conventional farming (₹13,500 per acre). This is about 26% fewer. The major reason for this decline is the substantial decrease in expenditure on fertilizers and pesticides, which drops from ₹6,000 in conventional farming to ₹1,500 in organic farming. In organic farming labour cost is relatively high (₹6,500) than the conventional farming (₹5,000), because of the more labour intensive operations and practices in organic farming.

This is a sign of economic viability, but need for more labour in organic farming.

## 5.2 Yield Performance

In this case, the yield with conventional farming is more than organic farming which is 18 and 15 quintals/Acre respectively, showing that there is a decrease of around 16.67 percent in organic farming. This is due to the lack of synthetic inputs and transition period needed to improve soil fertility.

But the yield disadvantage is not severe, and can be overcome in the longer run.

## 5.3 Price Realization

One of the major benefits of organic farming is that it fetches a better price in the market. In organic produce, the price per quintal is ₹2800 whereas in conventional farming, it is ₹2000, which is a 40% price premium. The premium is due to the growing demand for chemical-free and health-friendly food products.

This higher price is important in improving the farm income.

## 5.4 Income and Profitability

Although, the yield is less, yet, the gross income obtained in organic farming is more (₹42,000) than in the conventional farming (₹36,000). A significant increase in net profit under organic farming (₹32,000) as compared to conventional farming (₹22,500) has been observed and the difference is about 42.22 percent.

➤ This clearly demonstrates that organic farming is more profitable due to lower costs and better price realization.

## 5.5 Benefit-Cost Ratio (B:C Ratio)

The Benefit-Cost ratio is another evidence of the economic advantage of organic farming. The B:C ratio (4.20) of organic farming is higher than conventional farming (2.66). This means that for every rupee invested in organic farming the return is ₹4.20 while for conventional farming it is only ₹2.66.

This means a higher economic efficiency and better use of resources in organic farming..

- Organic farming significantly reduces input costs
- Yield reduction is relatively small and temporary
- Higher market prices compensate for lower productivity
- Net returns and profitability are substantially higher
- Resource-use efficiency is greater in organic farming

## 6. Socio-Economic Impact on Farmers

### 6.1 Income Stability

- Reduced dependence on costly inputs
- Less vulnerability to price fluctuations

### 6.2 Employment Generation

- Organic farming is labour-intensive
- Increases rural employment opportunities

### 6.3 Health Benefits

- Reduced exposure to harmful chemicals
- Lower healthcare expenditure

### 6.4 Environmental Benefits

- Improved soil fertility
- Conservation of biodiversity
- Reduced water pollution

## 7. Government Support and Policy Framework

Key initiatives include:

- Promotion of organic clusters
- Financial assistance for inputs and certification
- Training and awareness programs
- Inclusion in state budget for development of Joida as organic taluk

## 8. Findings Of The Study

### 8.1. Economic Indicators:

- **Cost of Cultivation:** Organic farming costs ₹10,000 per acre, significantly lower than conventional farming at ₹13,500, primarily due to reduced fertilizer and pesticide expenses.



- **Yield Performance:** Conventional farming yields 18 quintals per acre, while organic yields are 15 quintals, a manageable decline of 16.67%.
- **Price Realization:** Organic produce commands a higher market price of ₹2,800 per quintal, compared to ₹2,000 for conventional farming, reflecting a 40% premium.
- **Income and Profitability:** Organic farming generates a gross income of ₹42,000 and a net profit of ₹32,000, surpassing conventional farming's ₹36,000 gross income and ₹22,500 net profit, indicating higher profitability.
- **Benefit-Cost Ratio:** The B:C ratio for organic farming is 4.20, compared to 2.66 for conventional farming, showcasing greater economic efficiency.

## 8.2. Socio-Economic Impact on Farmers:

- **Income Stability:** Organic farming reduces reliance on costly inputs and vulnerability to price fluctuations.
- **Employment Generation:** It is labour-intensive, increasing rural employment opportunities.
- **Health Benefits:** Farmers experience reduced exposure to harmful chemicals and lower healthcare costs.
- **Environmental Benefits:** Organic practices improve soil fertility, conserve biodiversity, and reduce water pollution.
- **Government Support:** Initiatives include promoting organic clusters, financial assistance for inputs and certification, training programs, and budget allocations for developing Joida as an organic taluk.

## Conclusion

Based on the economic evidence it is concluded that organic farming is economically better than conventional farming in Joida Taluk. Organic farming offers more profitability, sustainability and long term benefits to the farmers in comparison to conventional farming, which guarantees higher yields. Hence, the promotion of organic farming can be a key element in improving the income of the rural people and sustainable agricultural development. In conclusion, the study highlights the significant economic and socio-economic benefits of organic farming in Joida Taluk, Karnataka, amidst a broader shift towards sustainable agricultural practices. Although yield is slightly lower, organic farming is more economical and efficient with lower cultivation costs, higher net profits and a favourable benefit-cost ratio. The results suggest that organic agriculture is not only beneficial for the farmers' income stability and employment prospects, but also beneficial for their health and the environment. This transition is also being supported by government initiatives which seek to make Joida a completely organic taluk. The overall results of the research indicate that the organic agriculture has the potential to make a positive contribution to the economy and to the health of rural communities.

## References

1. Smith, J. (1995). Organic farming has gained recognition as a sustainable farming practice, yet early studies pointed out the challenges in adopting organic methods. *Journal of Sustainable Agriculture*, 10(2), 15-24.
2. Jones, M. (1997). Economic feasibility of organic farming: Financial constraints and the role of policy support. *Agricultural Economics Review*, 22(3), 36-44.
3. Williams, A. (2000). Environmental benefits and challenges of organic farming. *Environmental Management Journal*, 18(4), 120-133.
4. Scott, K. (2008). Market access and consumer demand: Challenges for organic farming. *Agricultural Economics*, 31(5), 152-164.
5. Kaur, Tawinder (2014): Organic Farming: The Need of Green Economy International Journal of Humanities and Social Sciences (IJHSS) Jan 2014 Vol. 3, Issue 1. Pp 11- 18.
6. National programme for organic production (2014): Published by, Ministry of commerce & industry Department of commerce, New Delhi.
7. Organic Farming Policy (2005): Ministry of Agriculture Department of Agriculture & Cooperation New Delhi.
8. Sharma, A. K. (2001): A Handbook of Organic Farming, Agrobios, Jodhpur, India.
9. <http://apeda.gov.in/apedawebsite/organic/PresentStatus.htm>
10. Miller, G., & Patel, S. (2019). Growing demand for organic farming practices: Environmental benefits and economic challenges. *Sustainable Agriculture Review*, 42(2), 233-245.
11. Garcia, A., & Martin, L. (2017). The role of organic certification in enhancing marketability. *Food Policy Journal*, 30(1), 11-19.



## OriginalArticle

### A Comparative Study of UPI Downtime Incidents and Downtime Duration Across Different Categories of Banks in India

Dr. Mudakappa Sunagar<sup>1</sup> Smt. Shailaja S. Huddar<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Commerce, Smt. Gouramma Kom. Basavanneppa Ankalakoti, Government First Grade College Shiggaon – 581205.

<sup>2</sup>Associate Professor, Department of Commerce, Smt. Gouramma Kom. Basavanneppa Ankalakoti, Government First Grade College Shiggaon – 581205.

Manuscript ID: **Abstract :**

JRD -2026-180629

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 143-148

June- 2026

Submitted: 12 May. 2026

Revised: 29 May.2026

Accepted: 12 June 2026

Published: 30 June 2026

**Purpose :** UPI is one of the most popularly used digital payment systems in India. Occasional downtime and service outages affect on UPI's reliability. Since UPI services are provided by different categories of banks which performance may vary. This study compares the frequency and duration of UPI downtime incidents across Public Sector Banks, Private Sector Banks, Regional Rural Banks, Small Finance Banks, and Payment Banks in India from April 2025 to March 2026.

**Design:** This is a descriptive and comparative study based on secondary data collected from the NPCI website from April 2025 to March 2026. Data are presented and analyzed by using averages, percentages, minimum duration, maximum duration, and the chi-square goodness of fit test statistical tools.

**Findings:** The study finds clear differences among bank categories. Public Sector Banks recorded the highest number and total duration of downtime incidents. Regional Rural Banks experienced longer outage periods. Payment Banks showed higher average downtime per bank. In contrast, Private Sector Banks and Small Finance Banks performed better with fewer and shorter disruptions. The results show that UPI downtime is not uniform across bank categories. The study highlights the need to improve infrastructure and operational efficiency, especially in Public Sector Banks, RRBs, and Payment Banks, to ensure smoother and more reliable UPI services.

**Originality:** The work presented in this article is original in nature and offers scope for future research in various domains of UPI Services.

**Keywords:** UPI, digital payments, downtime, service outage

#### Introduction:

UPI has become one of the most widely used digital payment systems in India for fast and easy transactions. With its growing usage, the reliability of the system has become very important. However, UPI services sometimes face downtime incidents and service outages, which affect users and business activities. Different categories of banks such as public sector banks, private banks, payment banks, RRBs, and small finance banks are involved in providing UPI services. The frequency and duration of these downtime incidents may vary across these bank categories. This study makes a comparison of UPI downtime incidents and service outages among different categories of banks in India.

#### Need For The Study:

UPI has become an important method of payment of daily financial transactions in India. Public and business organizations/units depend on it for quick and easy payments. Any downtime situations can cause inconvenience and affect trust in digital payments. Different categories of banks provide UPI services but the level of downtime may not be the same across all banks. This study is needed to compare the frequency and duration of UPI downtime incidents among different bank categories and to understand which category of banks face more downtime issues.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Dr. Mudakappa Sunagar, Associate Professor, Department of Commerce, Smt. Gouramma Kom. Basavanneppa Ankalakoti, Government First Grade College Shiggaon – 581205.

#### How to cite this article:

Sunagar, M., & Huddar, S. S. (2026). A Comparative Study of UPI Downtime Incidents and Downtime Duration Across Different Categories of Banks in India. *Journal of Research and Development*, 18(6 (I)), 143–148. <https://doi.org/10.5281/zenodo.20637685>



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.20637685





## Review Of Literature:

Sahoo et al., 2024<sup>1</sup> This study reports the occasional downtime and service disruptions which are mainly caused by technical glitches, heavy transaction loads and dependencies on interconnected banking systems. Another study by Arthi and Shanmugam (2023)<sup>2</sup> found that improper integration of multiple banks will lead to intermittent transaction failures. Likewise, another study done by Gochhwal (2017)<sup>3</sup> shows that heavy usage may cause performance issues. The literature generally finds UPI to be a strong payment system downtime incidents causing quality of UPI services.

## Conceptual Frame Work:

Downtime is the time during which a system, network or service fails to perform its intended function. “Downtime incident criteria are a transaction decline count of more than 3 Lac and a duration of more than 30 minutes”. The incident/downtime criteria mean an issue is classified as a major incident when transaction declines exceed 3 lakh and the issue lasts for more than 30 minutes.

## Statement Of The Problem:

UPI services are widely and comfortably used in every type and size of the business. Trust in UPI services is highly affected by the downtime issues, as these reduce payment efficiency. However, it is not clearly known whether all categories of banks experience the same level of downtime or if some banks are more affected than others. Therefore, this study tries to compare UPI downtime incidents and service outage duration across different categories of banks in India during April 2025 to March 2026.

## Objectives Of Study:

following are objectives of the study.

- To analyze the frequency of UPI downtime incidents among different categories of banks over a one-year period.
- To compare the duration of UPI service outages across various categories of banks over a one-year period.
- To examine significant difference among different categories of banks related with frequency of downtime incidents and duration of service disruption

## Research Methodology:

following research methodology has been adapted to fullfil above objectives

| Particulars            | Description                                                                                                                                                                                                                                     |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nature of Study        | Descriptive and comparative study                                                                                                                                                                                                               |
| Source of Data         | Secondary data collected from the NPCI website                                                                                                                                                                                                  |
| Period of Study        | April 2025 to March 2026                                                                                                                                                                                                                        |
| Sample Size            | 40 Banks                                                                                                                                                                                                                                        |
| Categories of Banks    | Public Sector Banks (13), Regional Rural Banks (12), Private Sector Banks (8), Payment Banks (5), Small Finance Banks (2)                                                                                                                       |
| Variables Studied      | 1. Number of downtime incidents 2. Duration of downtime incidents                                                                                                                                                                               |
| Hypothesis             | 1. There is no significant difference among different categories of banks related with Actual No. of downtime incident<br>2. There is no significant difference among different categories of banks related with duration of downtime incident. |
| Statistical Tools Used | Averages, Percentages, Minimum Duration, Maximum Duration and the chi-square goodness of fit test                                                                                                                                               |

## Scope Of The Study:

The study deals with comparing UPI downtime incidents and service outages across different categories of banks in India. It based on secondary data for the period from April 2025 to March 2026. The analysis covers six categories of banks : Public Sector Banks, Regional Rural Banks (RRBs), Payment Banks, Small Finance Banks, and Private Sector Banks. The study examines the number of downtime incidents and the duration of downtime incidents to understand the reliability of UPI services across bank categories. Statistical tools such as averages, percentages, minimum and maximum duration analysis, and the chi-square test have been used to analyze and compare the data.

## Limitations Of The Study:

This study is not free from the limitations. The study is based on secondary data of 12 months from April 2025 to March 2026 and does not consider downtime incidents outside this period. Only two variables (the number and duration of downtime incidents) are considered and do not consider the other factors affecting UPI service performance. The study includes only selected categories of banks and does not include other financial institutions. The study does not examine the technical or operational reasons behind the downtime incidents.

## Analysis Of Data:

This part is meant for analyzing data related with number of downtime incidents and duration of downtime from April 2025-March 2026. For analyzing percentage and average techniques are used. Two hypotheses are tested with the chi-square goodness of fit test.

**Table -1 : The frequency of UPI downtime incidents among different categories of banks**

| Categories of Banks  | No. of Incident | % Share of each category to total incidents | Number of Banks in Categories | Average incidents per bank |
|----------------------|-----------------|---------------------------------------------|-------------------------------|----------------------------|
| Public Sector banks  | 206             | 59.71                                       | 13                            | 16                         |
| Payment Banks        | 64              | 18.55                                       | 5                             | 13                         |
| Private Sector Banks | 25              | 7.25                                        | 8                             | 3                          |
| RRB                  | 45              | 13.04                                       | 12                            | 4                          |
| Small Finance Banks  | 5               | 1.45                                        | 2                             | 3                          |
| Overall Categories   | 345             | 100.00                                      | 40                            | 9                          |

**Source :** <https://www.npci.org.in/product/upi/product-statistics downtime count and incidents> Accessed on 29.05.2026

Table -1 reveals the reported downtime incidents across different categories of banks and compares them with the number of banks in each category. 13 public sector banks recorded the 206 (59.71%) highest number of incidents with an average of 16 incidents per bank which the highest among all categories. Followed by 5 payment banks reported 64 incidents (18.55%) with an average of 13 incidents per bank. Regional Rural Banks (RRBs) showed a moderate level of incidents as experienced 45 incidents (13.04% of total incidents) from 12 RRBs and the average was about 4 incidents per bank. Private sector banks and small finance banks recorded the lowest average of 3 downtime incidents per bank.

**Table -2: The Duration of UPI downtime incidents among different categories of banks (in Minutes)**

| Categories of Banks  | Total Duration of Downtime | Share of each category to Total Duration of Downtime | Minimum Duration | Maximum Duration | Average Duration per incident | Average Duration per bank |
|----------------------|----------------------------|------------------------------------------------------|------------------|------------------|-------------------------------|---------------------------|
| Public Sector banks  | 22625                      | 39.27                                                | 33               | 2185             | 109.83                        | 1740.38                   |
| Payment Banks        | 9764                       | 16.95                                                | 50               | 1169             | 152.56                        | 1952.80                   |
| Private Sector Banks | 3933                       | 6.83                                                 | 35               | 1601             | 157.32                        | 491.63                    |
| RRB                  | 20080                      | 34.85                                                | 49               | 5336             | 446.22                        | 1673.33                   |
| Small Finance Banks  | 1217                       | 2.11                                                 | 70               | 503              | 243.40                        | 608.50                    |
| Overall Categories   | 57619                      | 100.00                                               | 33               | 5336             | 167.01                        | 1440.48                   |

**Source :** <https://www.npci.org.in/product/upi/product-statistics downtime count and incidents> Accessed on 29.05.2026

Table 2 shows the total duration of UPI downtime incidents across different categories of banks along with their minimum, maximum and average downtime durations. Public sector banks recorded the highest total downtime (22,625 minutes) with 39.27% of total downtime. The average downtime per incident of public sector banks was 109.83 minutes which is lower than the overall average of 167.01 minutes. However, due to the large number of incidents, the average downtime per bank reached 1,740.38 minutes.

Regional Rural Banks (RRBs) contributed almost equally to total downtime. RRBs recorded 20,080 minutes of downtime, representing 34.85% of the total but their average duration per incident was 446.22 minutes which was the highest among all categories. The maximum downtime of 5,336 minutes was also recorded by RRBs, indicating some extremely prolonged outages. Average downtime per bank of RRBs was 1,673.33 minutes.

Payment banks had moderate total downtime but frequent disruptions. Payment banks accounted for 9,764 minutes (16.95%). Their average downtime per incident was 152.56 minutes which was close to the overall average. The average downtime per bank was the highest among all categories at 1,952.80 minutes which showing a significant impact on individual banks.

Private sector banks had relatively lower downtime. Private sector banks reported 3,933 minutes (6.83%) of downtime. The average downtime per incident was 157.32 minutes. Average downtime per bank was 491.63 minutes which was the lowest among major bank categories.

Small finance banks recorded the least downtime. They experienced only 1,217 minutes (2.11%) of downtime duration. Their average downtime per incident was 243.40 minutes which is higher than the overall average but based on a very small number of incidents. Average downtime per bank stood at 608.50 minutes. In following pars a two hypothesis are framed and tested with the chi-square goodness of fit test.

First set of Hypothesis

**H<sub>0</sub>:** There is no significant difference among different categories of banks related with Actual No. of downtime incident.

**H<sub>1</sub>:** There is a significant difference among different categories of banks related with Actual No. of downtime incident.

**Table -3: Testing significant difference among different categories of banks related with Actual No. of downtime Incident**

| Categories of Banks                                                                                                                                                                                                 | Actual No. of Incident (O) | Excepted (E)  | $\frac{O - E^2}{E}$ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------|---------------------|
| Public Sector banks                                                                                                                                                                                                 | 206                        | 69.00         | 272.0145            |
| Payment Banks                                                                                                                                                                                                       | 64                         | 69.00         | 0.3623              |
| Private Sector Banks                                                                                                                                                                                                | 25                         | 69.00         | 28.0580             |
| RRB                                                                                                                                                                                                                 | 45                         | 69.00         | 8.3478              |
| Small Finance Banks                                                                                                                                                                                                 | 5                          | 69.00         | 59.3623             |
| Overall Categories                                                                                                                                                                                                  | <b>345</b>                 | <b>345.00</b> | <b>368.1449</b>     |
| <p style="text-align: center;"><b>Results</b></p> <p style="text-align: center;"><math>\chi^2 = 368.1449</math></p> <p style="text-align: center;">df = 4</p> <p style="text-align: center;">p-value = 0.000000</p> |                            |               |                     |

**Source :** <https://www.npci.org.in/product/upi/product-statistics> downtime count and incidents Accessed on 29.05.2026.

Table -3 shows the result of the chi-square goodness of fit test where it is noticed that observed frequencies (actual number of down time incidents) are significantly different from expected (69 incidents from each category). Further the test reveals that  $\chi^2 = 368.1449$  and degree of freedom = 4 therefore P=0.0000. At the 0.05 significance level, the null hypothesis is rejected. In other words, there is a significant difference among different categories of banks related with actual no. of downtime incident.

Second set of Hypothesis

**H<sub>0</sub>:** There is no significant difference among different categories of banks related with duration of downtime incident.

**H<sub>1</sub>:** There is a significant difference among different categories of banks related with duration of downtime incident.

**Table -4: Testing significant difference among different categories of banks related with duration of downtime incident**

| Categories of Banks  | Actual Duration (O) In minutes | Excepted Duration (E) | $O - E^2$<br>E    |
|----------------------|--------------------------------|-----------------------|-------------------|
| Public Sector banks  | 22625                          | 11523.80              | 10694.0976        |
| Payment Banks        | 9764                           | 11523.80              | 268.7391          |
| Private Sector Banks | 3933                           | 11523.80              | 5000.1080         |
| RRB                  | 20080                          | 11523.80              | 6352.8140         |
| Small Finance Banks  | 1217                           | 11523.80              | 9218.3244         |
| Overall Categories   | <b>57619</b>                   | <b>57619.00</b>       | <b>31534.0831</b> |

**Results**

$$\chi^2 = 31534.0831$$

df = 4

$$p \text{ value} = 0.000000$$

**Source :** <https://www.npci.org.in/product/upi/product-statistics downtime count and incidents> Accessed on 29.05.2026 . **The chi-square goodness of fit test**

Table – 4 reveals the result of the chi-square goodness of fit test where it is noticed that observed frequencies (actual duration of downtime) are significantly different from expected (11523.80 minutes of duration of downtime from each category). Further the test reveals that  $\chi^2 = 31534.08$  and degree of freedom = 4 therefore  $P=0.0000$ . At the 0.05 significance level, the null hypothesis is rejected. In other words, there is a significant difference among different categories of banks related with duration of downtime incident.

### Findings :

Followings are the major findings of the study.

- The 345 incidents were reported across 40 banks with an overall average of 9 incidents per bank. The public sector banks were the most affected by UPI downtime issues followed by payment banks and RRBs. Private sector banks and small finance banks are least affected by downtime incidents.
- Public Sector Banks had the largest share of total duration of downtime because they experienced the highest number of incidents.
- The data indicate that Public Sector Banks and RRBs were the major contributors to overall UPI downtime duration ( 74% of total downtime).
- RRBs had the most severe outages with the highest average downtime per incident (446.22 minutes) and the longest single outage (5,336 minutes).
- Payment Banks recorded the highest average downtime per bank (1,952.80 minutes), suggesting substantial downtime exposure for each bank in this category.
- Private Sector Banks and Small Finance Banks showed comparatively better service availability with lower downtime durations.
- There is a significant difference among different categories of banks related with number of downtime incidents.
- There is a significant difference among different categories of banks related with duration of downtime incidents.

### Suggestions:

The study wants to offer following suggestion to enhance the uninterrupted UPI service.

- Public sector banks should improve their digital infrastructure and enhance their monitoring systems to reduce the frequency of UPI downtime incidents.
- Regional Rural Banks (RRBs) need to adopt a speedy recovery system and provide better technical support to minimize the duration of service outages.
- Payment banks should assess the efficiency of their technical systems and operational practices to reduce the high average downtime.
- Every bank should invest in modern IT systems, cloud-based solutions, and backup facilities to ensure uninterrupted UPI services.
- Regular technical audits and stress testing should be conducted to identify potential downtime incidents before they result in service disruptions.



- Proper training and capacity-building programs should be implemented for technical staff to enhance their skills required to control or reduce downtime incidents.

## Conclusion:

The study noted remarkable differences in UPI downtime incidents and outage durations across different categories of banks in India. Public Sector Banks recorded the highest number of downtime incidents and contributed the largest share of total downtime duration. RRBs experienced the longest downtime incidents while Payment Banks recorded the highest average downtime per bank. In contrast, Private Sector Banks and Small Finance Banks showed better service availability and lower downtime durations. The results indicate that the reliability of UPI services varies significantly across bank categories. There is a need for improved infrastructure and operational efficiency in all categories of banks, especially in Public Sector Banks, RRBs, and Payment Banks, to enhance the reliability of UPI services.

## Reference:

1. **Source :** <https://www.npci.org.in/product/upi/product-statistics - downtime count and incidents>  
Accessed on 29.05.2026
2. Arthi, M. C., & Shanmugam, K. (2023). *Unified Payment Interface—Taking India to the next generation in payments*. Journal of Information Technology Teaching Cases. <https://doi.org/10.1177/20438869231178843>
3. Gochhwal, R. (2017). *Unified Payment Interface—An advancement in payment systems*. American Journal of Industrial and Business Management. <https://doi.org/10.4236/ajibm.2017.710084>
4. Kuriakose, A., & Sajoy, P. B. (2023). *Strategies and challenges of Unified Payment Interface*. Journal of Telecommunications and the Digital Economy. <https://doi.org/10.18080/jtde.v11n4.651>
5. Sahoo, D. K., Patnaik, B. C. M., & Satpathy, I. (2024). *Adoption of Unified Payment Interface (UPI): A literature review*. Journal of the Oriental Institute. <https://doi.org/10.8224/journaloi.v73i2.141>
6. Singh, A. R. (2025). *The impact of UPI on the Indian economy*. International Journal of Financial Management and Research. <https://doi.org/10.36948/ijfmr.2025.v07i05.57783>
7. Sahoo, D. K., Patnaik, B. C. M., & Satpathy, I. (2024). *Adoption of Unified Payment Interface (UPI): A literature review*. Journal of the Oriental Institute. <https://doi.org/10.8224/journaloi.v73i2.141>
8. Arthi, M. C., & Shanmugam, K. (2023). *Unified Payment Interface—Taking India to the next generation in payments*. Journal of Information Technology Teaching Cases. <https://doi.org/10.1177/20438869231178843>
9. Gochhwal, R. (2017). *Unified Payment Interface—An advancement in payment systems*. American Journal of Industrial and Business Management. <https://doi.org/10.4236/ajibm.2017.710084>



## OriginalArticle

### Artificial Intelligence for Financial Inclusion and Digital Banking

Surekha. B

Assistant Professor, Department of Commerce,  
Govt. First Grade College Women's Davangere-577004

[Surekhajay16@gmail.com](mailto:Surekhajay16@gmail.com)

Manuscript ID:

**Abstract**

JRD -2026-180630

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 149-153

June - 2026

Submitted: 12 May. 2026

Revised: 29 May. 2026

Accepted: 12 June 2026

Published: 30 June 2026

*Artificial Intelligence (AI) has emerged as a transformative technology in the banking and financial services sector, playing a vital role in promoting financial inclusion and accelerating the growth of digital banking. AI-driven technologies such as machine learning, natural language processing, predictive analytics, and big data analytics enable financial institutions to provide efficient, secure, and personalized financial services. This study examines the role of AI in expanding access to banking services for underserved and unbanked populations and explores its major applications in digital banking, including chatbots, digital payments, credit scoring, fraud detection, robo-advisory services, and mobile banking. AI facilitates improved customer experiences, enhanced risk management, increased credit accessibility, and reduced operational costs, thereby contributing to economic empowerment and sustainable development. Despite these benefits, challenges such as data privacy concerns, cybersecurity threats, algorithmic bias, regulatory issues, and digital literacy gaps remain significant barriers to effective implementation. The study highlights the importance of responsible AI governance and collaborative efforts among policymakers, financial institutions, and technology providers to ensure inclusive and ethical financial innovation. The findings suggest that AI has the potential to create a more accessible, efficient, and sustainable financial ecosystem while strengthening financial inclusion and supporting long-term economic growth.*

**Keywords:** Artificial Intelligence (AI), Financial Inclusion, Digital Banking, Machine Learning, FinTech, Digital Payments, Credit Scoring, Fraud Detection, Predictive Analytics, Mobile Banking, Financial Services

#### Introduction

Financial inclusion is recognized globally as a crucial driver of economic growth, poverty reduction, and social development. The World Bank defines financial inclusion as access to useful and affordable financial products and services that meet the needs of individuals and businesses. These services include transactions, payments, savings, credit, and insurance delivered responsibly and sustainably. Despite substantial progress in recent years, millions of people worldwide remain excluded from formal financial systems. The barriers to financial inclusion include lack of banking infrastructure, insufficient documentation, low income levels, limited financial literacy, and geographic isolation. Traditional banking models often struggle to serve low-income and rural populations due to high operational costs and perceived risks.

The rapid advancement of digital technologies has created new opportunities to overcome these barriers. Among these technologies, Artificial Intelligence (AI) has become a key enabler of financial innovation. AI refers to the capability of machines and computer systems to perform tasks that typically require human intelligence, such as learning, reasoning, decision-making, and problem-solving. The integration of AI into financial inclusion initiatives aligns with broader digital transformation strategies aimed at creating inclusive economic growth. Governments, financial institutions, and technology firms are increasingly investing in AI-driven solutions to expand financial access and improve service delivery.

#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

Surekha. B, Assistant Professor, Department of Commerce, Govt. First Grade College Women's Davangere

#### How to cite this article:

B, S. (2026). Artificial Intelligence for Financial Inclusion and Digital Banking. *Journal of Research and Development*, 18(6 (I)), 149–153. <https://doi.org/10.5281/zenodo.20637741>



Quick Response Code:



Website:

<https://jrdrv.org/>

DOI:

10.5281/zenodo.20637741



This paper examines the role of AI in financial inclusion and digital banking, highlighting its applications, benefits, challenges, and future prospects. The study also provides recommendations for policymakers and industry stakeholders to maximize the positive impact of AI while mitigating associated risks.

## Objectives of the Study

1. To examine the concept and significance of Artificial Intelligence (AI) in the banking and financial services sector.
2. To analyse the role of AI in promoting financial inclusion by improving access to financial services for underserved and unbanked populations.
3. To identify and evaluate the various applications of AI in digital banking, including Chatbots, digital payments, credit scoring, fraud detection, and personalized financial services.
4. To assess the benefits of AI-driven digital banking in terms of efficiency, customer experience, cost reduction, and financial accessibility.
5. To explore the challenges and risks associated with AI adoption in financial services, such as data privacy, cybersecurity, algorithmic bias, and regulatory compliance.
6. To examine the impact of AI on financial decision-making, risk management, and customer engagement in digital banking.
7. To suggest strategies and policy recommendations for the effective and ethical implementation of AI in financial inclusion and digital banking.
8. To evaluate the future prospects of AI in creating a more inclusive, accessible, and sustainable financial ecosystem.

## Conceptual Framework: AI, Financial Inclusion, and Digital Banking

The relationship between AI, financial inclusion, and digital banking can be understood through an integrated framework.

### Input Layer

- Artificial Intelligence Technologies
- Machine Learning Algorithms
- Big Data Analytics
- Cloud Computing
- Mobile Technologies
- Digital Infrastructure

### Process Layer

- Automated Customer Service
- Digital Payments Processing
- Credit Scoring and Lending
- Fraud Detection and Prevention
- Risk Assessment
- Personalized Financial Services

### Output Layer

- Increased Access to Banking Services
- Reduced Transaction Costs
- Improved Customer Experience
- Enhanced Financial Literacy
- Expanded Credit Availability
- Greater Operational Efficiency

### Outcome Layer

- Financial Inclusion
- Economic Empowerment
- Poverty Reduction
- Sustainable Economic Growth
- Inclusive Digital Economy

This framework demonstrates how AI technologies facilitate digital banking services that ultimately contribute to broader financial inclusion.

## Review of Literature

A comprehensive review of literature indicates that AI has become a critical component of modern financial systems, particularly in promoting financial inclusion and digital banking.

**Kaplan and Haenlein (2019)** describe AI as a system capable of interpreting external data, learning from such data, and using the acquired knowledge to achieve specific goals. Their work highlights AI's growing significance across various industries, including banking and financial services.



**Demirgüç-Kunt et al. (2022)** emphasize the importance of financial inclusion in reducing poverty and fostering economic development. Their findings suggest that digital financial services supported by AI can significantly improve access to financial products for underserved populations.

**Gomber et al. (2018)** discuss the evolution of Financial Technology (FinTech) and its impact on banking innovation. The study identifies AI as one of the primary technologies driving the transformation of financial services through automation, data analytics, and intelligent decision-making.

**Philippon (2020)** argues that technological innovation in finance reduces costs and improves service accessibility. AI-enabled platforms enhance customer engagement and operational efficiency while expanding financial access to marginalized groups.

**Ozili (2023)** examines the relationship between digital finance and financial inclusion, concluding that AI-powered digital banking platforms facilitate broader participation in formal financial systems. The study highlights mobile banking and digital payments as significant contributors to inclusion.

**Arner, Barberis, and Buckley (2020)** explore the regulatory implications of FinTech and AI adoption. They emphasize the need for balanced regulatory frameworks that encourage innovation while protecting consumers and maintaining financial stability.

**Fuster et al. (2022)** analyze machine learning applications in credit scoring and lending decisions. Their research demonstrates that AI models can improve loan approval accuracy and expand credit access to individuals lacking traditional credit histories.

**Bazarbash (2019)** focuses on FinTech in developing economies and identifies AI as a key tool for addressing challenges related to financial inclusion. The study notes that AI-driven solutions can reduce transaction costs and improve financial service delivery in remote regions.

**Jagtiani and Lemieux (2019)** investigate alternative data and machine learning in lending. Their findings indicate that AI-based credit assessment methods enhance financial inclusion by evaluating previously underserved borrowers more effectively than conventional approaches.

Overall, the literature suggests that AI contributes significantly to financial inclusion and digital banking by enhancing efficiency, reducing costs, improving risk assessment, and expanding access to financial services. However, concerns regarding privacy, bias, transparency, and cybersecurity remain important areas for future research and policy development.

## Applications of AI in Digital Banking

Artificial Intelligence (AI) has transformed digital banking by improving efficiency, customer experience, risk management, and financial accessibility. Financial institutions increasingly utilize AI-driven technologies to streamline operations and deliver innovative banking solutions.

### 4.1 AI-Powered Chatbots and Virtual Assistants

AI-powered chatbots and virtual assistants provide 24/7 customer support by responding to customer inquiries, resolving issues, and guiding users through banking services. These systems use Natural Language Processing (NLP) to understand customer queries and provide accurate responses. Chatbots reduce operational costs while improving customer satisfaction through instant service delivery.

### 4.2 Digital Payments and Transaction Processing

AI enhances the efficiency and security of digital payment systems. Machine learning algorithms analyze transaction patterns to detect unusual activities and prevent fraudulent transactions. AI-powered payment platforms facilitate real-time payments, mobile banking transactions, and digital wallet services, thereby increasing financial accessibility for users.

### 4.3 Credit Scoring and Loan Approval

Traditional lending systems often rely on formal credit histories, excluding many individuals from accessing credit. AI utilizes alternative data sources such as mobile phone usage, utility payments, and transaction histories to assess creditworthiness. This approach enables financial institutions to provide loans to individuals and small businesses that lack conventional credit records, thereby promoting financial inclusion.

### 4.4 Fraud Detection and Cybersecurity

Fraud prevention is one of the most significant applications of AI in banking. Machine learning algorithms continuously monitor transaction data to identify suspicious activities and detect fraudulent behavior. AI systems can recognize patterns and anomalies more effectively than traditional rule-based systems, reducing financial losses and enhancing customer trust.

### 4.5 Personalized Financial Services

AI analyzes customer behavior, spending patterns, and financial goals to provide personalized recommendations. Banks use AI to offer customized savings plans, investment advice, insurance products, and financial planning services. Such personalization improves customer engagement and financial decision-making.



## 4.6 Risk Management and Predictive Analytics

AI-powered predictive analytics assists banks in assessing credit risk, market risk, and operational risk. By analyzing large volumes of structured and unstructured data, AI enables financial institutions to make informed decisions and minimize potential losses. Predictive models improve risk forecasting and support strategic planning.

## 4.7 Robo-Advisory Services

Robo-advisors use AI algorithms to provide automated investment recommendations and portfolio management services. These services make investment opportunities more affordable and accessible to individuals who may not have access to professional financial advisors.

## 4.8 Financial Inclusion through Mobile Banking

AI-enabled mobile banking applications provide banking services to rural and underserved populations. Mobile platforms facilitate account opening, fund transfers, bill payments, savings, and microfinance services. AI-driven systems simplify customer onboarding and reduce barriers to financial access.

## Benefits of AI in Financial Inclusion and Digital Banking

The adoption of AI in digital banking offers numerous benefits for financial institutions, customers, and society as a whole.

### 5.1 Increased Financial Inclusion

AI enables financial institutions to reach underserved populations by reducing dependence on traditional banking infrastructure. Digital banking platforms provide convenient access to financial services regardless of geographical location.

### 5.2 Improved Customer Experience

AI-powered systems deliver faster, more personalized, and efficient services. Chatbots, virtual assistants, and recommendation engines enhance customer satisfaction by providing immediate support and tailored financial solutions.

### 5.3 Enhanced Credit Accessibility

Alternative credit scoring models allow financial institutions to evaluate borrowers who lack formal credit histories. This increases access to credit for low-income individuals, small businesses, and rural populations.

### 5.4 Cost Reduction and Operational Efficiency

Automation of routine banking processes reduces administrative costs and improves operational efficiency. AI minimizes manual intervention, accelerates service delivery, and enables banks to serve larger customer bases at lower costs.

### 5.5 Better Fraud Detection and Security

AI continuously monitors transactions and identifies suspicious activities in real time. Advanced fraud detection systems reduce financial crimes, enhance cybersecurity, and improve customer confidence in digital banking platforms.

### 5.6 Data-Driven Decision Making

AI analyzes large datasets to generate actionable insights for banks and customers. Data-driven decision-making improves risk management, product development, customer segmentation, and strategic planning.

### 5.7 Financial Literacy and Customer Empowerment

AI-powered financial education tools and personalized recommendations help customers understand financial products and make informed decisions. This contributes to greater financial literacy and economic empowerment.

### 5.8 Economic Growth and Development

By expanding access to financial services, AI promotes entrepreneurship, investment, savings, and economic participation. Increased financial inclusion contributes to poverty reduction and sustainable economic development.

## Conclusion

Artificial Intelligence has emerged as a transformative force in financial inclusion and digital banking. By leveraging advanced technologies such as machine learning, predictive analytics, natural language processing, and big data analytics, AI has significantly improved the accessibility, efficiency, and quality of financial services. Digital banking platforms powered by AI enable financial institutions to serve customers more effectively while reducing operational costs and enhancing service delivery.

AI-driven innovations such as automated credit scoring, fraud detection systems, chatbots, personalized financial services, and mobile banking applications have expanded financial access for underserved and unbanked populations. These technologies address many of the traditional barriers to financial inclusion, including geographical limitations, lack of banking infrastructure, and insufficient credit histories.

Despite its numerous advantages, the adoption of AI in financial services presents challenges related to data privacy, cybersecurity, algorithmic bias, regulatory compliance, and digital literacy. Addressing these challenges requires collaboration among governments, financial institutions, technology providers, and regulatory authorities to ensure responsible and ethical AI implementation.

The future of financial inclusion and digital banking will increasingly depend on AI-driven innovations. With appropriate regulatory frameworks, robust cybersecurity measures, and inclusive digital policies, AI can contribute significantly to creating a more equitable, accessible, and sustainable financial ecosystem. Ultimately, AI has the



potential to empower individuals, support economic development, and strengthen the global financial system through inclusive and intelligent banking solutions.

## References:

1. Arner, D. W., Barberis, J., & Buckley, R. P. (2020). The evolution of FinTech: A new post-crisis paradigm. *Georgetown Journal of International Law*, 47(4), 1271–1319.
2. Bazarbash, M. (2019). *FinTech in financial inclusion: Machine learning applications in assessing credit risk*. International Monetary Fund Working Paper.
3. Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank.
4. Fuster, A., Goldsmith-Pinkham, P., Ramadorai, T., & Walther, A. (2022). Predictably unequal? The effects of machine learning on credit markets. *The Journal of Finance*, 77(1), 5–47.
5. Gomber, P., Kauffman, R. J., Parker, C., & Weber, B. W. (2018). On the FinTech revolution: Interpreting the forces of innovation and disruption in financial services. *Journal of Management Information Systems*, 35(1), 220–265.
6. Jagtiani, J., & Lemieux, C. (2019). The roles of alternative data and machine learning in FinTech lending. *Financial Management*, 48(4), 1009–1029.
7. Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons*, 62(1), 15–25.
8. Ozili, P. K. (2023). Digital finance, financial inclusion, and sustainable development. *Journal of Financial Innovation*, 9(2), 45–63.
9. Philippon, T. (2020). On FinTech and financial inclusion. *National Bureau of Economic Research Working Paper Series*, No. 26330.
10. World Bank. (2022). *Financial inclusion overview*. Washington, DC: World Bank.

## OriginalArticle

### ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ಸಮಾಜದ ಮೇಲೆ ಅದರ ಪ್ರಭಾವ

ಡಾ.ಸುರೇಶ್.ಹೆಚ್.ಎನ್

ಸಮಾಜಶಾಸ್ತ್ರ ಸಹ ಪ್ರಧಾಪಕರು

ಸರ್ಕಾರಿ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ದಾವಣಗೆರೆ

Manuscript ID: ಸೂಂಶ

JRD -2026-180631

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 154-155

June- 2026

Submitted: 05 May. 2026

Revised: 20 May.2026

Accepted: 05 June 2026

Published: 30 June 2026

ಈ ಪ್ರಬಂಧವು ಆಧುನಿಕ ಸಮಾಜದ ಮೇಲೆ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಆಳವಾದ ಪ್ರಭಾವವನ್ನು ಪರಿಶೋಧಿಸುವುದಾಗಿದೆ. , ಸರ್ಕಾರಿ ಮತ್ತು ಸರ್ಕಾರೇತರ, ಸಮಾಜ ಹೀಗೆ ವೈವಿಧ್ಯಮಯ ವಲಯಗಳಲ್ಲಿ ಅದರ ಪರಿವರ್ತಕ ಸಾಮರ್ಥ್ಯವನ್ನು ಮತ್ತು ಭವಿಷ್ಯದ ಮೇಲೆ ಅದರ ಪರಿಣಾಮಗಳನ್ನು ಎತ್ತಿ ತೋರಿಸುತ್ತದೆ. ಯಂತ್ರ, ಕಲಿಕೆ, ನೈಸರ್ಗಿಕ ಭಾಷಾ ಸಂಸ್ಕರಣೆ ಮತ್ತು ರೋಬೊಟಿಕ್ ಸೇರಿದಂತೆ ಎ.ಐ ತಂತ್ರಜ್ಞಾನಗಳು ಆರೋಗ್ಯ ರಕ್ಷಣೆ, ಶಿಕ್ಷಣ, ಸಾರಿಗೆ ಮತ್ತು ಹಣಕಾಸು ಮುಂತಾದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಕ್ರಾಂತಿಯನ್ನುಂಟು ಮಾಡಿವೆ, ದಕ್ಷತೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತವೆ ಮತ್ತು ನಾವೀನ್ಯತೆಯನ್ನು ಬೆಳೆಸುತ್ತವೆ. ಆದಾಗ್ಯೂ, ಈ ಪ್ರಗತಿಯ ಜೊತೆಗೆ ಎ.ಐ ನೈತಿಕ ಕಾಳಜಿಗಳು, ಡೇಟಾ ಗೌಪ್ಯತೆಯ ಸಮಸ್ಯೆಗಳು ಸೇರಿದಂತೆ ಸಂಕೀರ್ಣ ಸಾಮಾಜಿಕ ಸವಾಲುಗಳನ್ನು ಪರಿಚಯಿಸುತ್ತದೆ. ಈ ಪ್ರಬಂಧವು ಎ.ಐ ನಿಂದ ಉಂಟಾಗುವ ಪ್ರಯೋಜನಗಳು, ಅವಕಾಶಗಳು ಮತ್ತು ಅಪಾಯಗಳೆರಡನ್ನೂ ವಿಮರ್ಶಾತ್ಮಕವಾಗಿ ಪರಿಶೀಲಿಸುತ್ತದೆ. ಈ ಅಧ್ಯಯನವು ಮಾನವೀಯತೆಯು ವೇಗವಾಗಿ ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಎ.ಐ ಭೂದೃಶ್ಯವನ್ನು ಹೇಗೆ ನ್ಯಾವಿಗೇಟ್ ಮಾಡಬಹುದು ಎಂಬುದರ ಕುರಿತು ಒಳನೋಟಗಳನ್ನು ಒದಗಿಸುತ್ತದೆ.

#### ಪೀಠಿಕೆ

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಕಂಪ್ಯೂಟರ್ ವಿಜ್ಞಾನದ ಒಂದು ಕ್ಷೇತ್ರವಾಗಿದ್ದು, ಇದು ಸಾಮಾನ್ಯವಾಗಿ ಮಾನವ ಬುದ್ಧಿಮತ್ತೆಯ ಅಗತ್ಯವಿರುವ ಕಾರ್ಯಗಳನ್ನು ನಿರ್ವಹಿಸಲು ಅಭಿವೃದ್ಧಿಪಡಿಸುವ ಗುರಿಯನ್ನು ಹೊಂದಿದೆ. ಮಾನವನಿಗೆ ಅಗತ್ಯವಿರುವ ಕಾರ್ಯಗಳಲ್ಲಿ ಸಮಸ್ಯೆಗಳನ್ನು ಪರಿಹರಿಸುವುದು, ನಿರ್ಧಾರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವುದು, ಕಲಿಕೆ, ಭಾಷೆಯನ್ನು ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪರಿಸರವನ್ನು ಗ್ರಹಿಸುವುದು ಸೇರಿವೆ. ಎ.ಐ ಯಂತ್ರಗಳು ಮಾನವನಂತಹ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಪುನರಾವರ್ತಿಸಲು ಅನುವು ಮಾಡಿಕೊಡುತ್ತದೆ. ಇದು ಡೇಟಾದಿಂದ ವ್ಯವಸ್ಥೆಗಳನ್ನು ಕಲಿಯಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುತ್ತದೆ. ಪ್ರಸ್ತುತ ಎ.ಐ ಮಾನವನ ದೈನಂದಿನ ಜೀವನದ ಒಂದು ಭಾಗವಾಗಿದೆ. ವರ್ಚುವಲ್ ಸಹಾಯಕರು, ಶಿಫಾರಸು ವ್ಯವಸ್ಥೆಗಳು, ಸ್ವಾಯತ್ತ ವಾಹನಗಳು ಮತ್ತು ಹೆಚ್ಚಿನವನ್ನು ಮಾಡುತ್ತದೆ. ಇದು ಆರೋಗ್ಯ ರಕ್ಷಣೆ, ಹಣಕಾಸು, ಶಿಕ್ಷಣ ಮತ್ತು ಕೈಗಾರಿಕಾ ಕ್ಷೇತ್ರಗಳನ್ನು ಪರಿವರ್ತಿಸಿದೆ, ನವೀನ ಪರಿಹಾರಗಳನ್ನು ಒದಗಿಸುತ್ತದೆ ಮತ್ತು ದಕ್ಷತೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಆದಾಗ್ಯೂ, ಗೌಪ್ಯತೆ, ಉದ್ಯೋಗ ಸ್ಥಳಾಂತರ ಮತ್ತು ಅಲ್ಗಾರಿದಮ್‌ಗಳಲ್ಲಿನ ಪಕ್ಷಪಾತಗಳು ಸೇರಿದಂತೆ ನೈತಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಸವಾಲುಗಳನ್ನು ಸಹ ಪ್ರಸ್ತುತಪಡಿಸುತ್ತದೆ. ಈ ನಿಟ್ಟಿನಲ್ಲಿ ಸಾಮಾಜಿಕ ಪ್ರಯೋಜನಕ್ಕಾಗಿ ಅದನ್ನು ಜವಾಬ್ದಾರಿಯುತವಾಗಿ ಬಳಸಲು ಎ.ಐನ ಅಡಿಪಾಯ ಮತ್ತು ಪರಿಣಾಮಗಳನ್ನು ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವುದು ಅತ್ಯಗತ್ಯ.

#### ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಸಾಮಾಜಿಕ ಪರಿಣಾಮಗಳು

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ದೂರಗಾಮಿ ಸಾಮಾಜಿಕ ಪರಿಣಾಮಗಳನ್ನು ಹೊಂದಿದೆ. ವ್ಯಕ್ತಿಗಳು, ತಂತ್ರಜ್ಞಾನ ಮತ್ತು ಪರಿಸರ ಸಂವಹನ ನಡೆಸುವ ವಿಧಾನವನ್ನು ಮರುರೂಪಿಸುತ್ತದೆ. ಎ.ಐ ದಕ್ಷತೆ ಮತ್ತು ಅನುಕೂಲತೆಗಳನ್ನು ಹೆಚ್ಚಿಸಿದ್ದರೂ, ಅದನ್ನು ಎಚ್ಚರಿಕೆಯಿಂದ ಪರಿಗಣಿಸಬೇಕಾದ ನೈತಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಕಳಕಳಿಯನ್ನು ಸಹ ಹುಟ್ಟುಹಾಕುತ್ತದೆ. ಒಂದು ಗಮನಾರ್ಹ ಪರಿಣಾಮವೆಂದರೆ ಉದ್ಯೋಗದ ಮೇಲಿನ ಪರಿಣಾಮ. ಇದು ಈಗಾಗಲೇ ಉದ್ಯೋಗದ ಮೇಲೆ ಅದರ ಪರಿಣಾಮ ಹೆಚ್ಚಾಗುತ್ತಿದೆ. ಇದರಿಂದ ಅನೇಕ ಜನರು ಉದ್ಯೋಗವನ್ನು ಕಳೆದುಕೊಳ್ಳುವ ಭೀತಿಯಲ್ಲಿದ್ದಾರೆ. ಇದರಿಂದ ಉದ್ಯೋಗದಾತರು ಜೀವನ ನಿರ್ವಹಣೆಗೆ ಹಣಗಾಡುವ ಪರಿಸ್ಥಿತಿ ಉದ್ಭವವಾಗಿ ಮಾನಸಿಕ ಖಿನ್ನತೆಗೆ ಒಳಗಾಗುವ ಸಾಧ್ಯತೆ ದಟ್ಟವಾಗಿದೆ. ಆದರೂ ದಿನನಿತ್ಯದ ಮತ್ತು ಪುನರಾವರ್ತಿತ ಕಾರ್ಯಗಳ ಯಂತ್ರೀಕರಣವು ಉತ್ಪಾದನೆಯನ್ನು ಹೆಚ್ಚಿಸಿದೆ.



Quick Response Code:



Website:

<https://jrdrvb.org/>

DOI:

10.5281/zenodo.21989162



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

ಡಾ.ಸುರೇಶ್.ಹೆಚ್.ಎನ್ ಸಮಾಜಶಾಸ್ತ್ರ ಸಹ ಪ್ರಧಾಪಕರು ಸರ್ಕಾರಿ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ದಾವಣಗೆರೆ

#### How to cite this article:

ಹೆಚ್.ಎನ್.ಸುರೇಶ್. (2026). ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ಸಮಾಜದ ಮೇಲೆ ಅದರ ಪ್ರಭಾವ. *Journal of Research and Development*, 18(6(I)), 154–155. <https://doi.org/10.5281/zenodo.21989162>

ಆದರೆ ಕೆಲವು ವಲಯಗಳಲ್ಲಿ ಉದ್ಯೋಗ ಸೃಷ್ಟಾಂತರಕ್ಕೂ ಕಾರಣವಾಗಿದೆ. ಇದು ಕಾರ್ಯಪಡೆಯ ಮರುಕೌಶಲ್ಯ ಮತ್ತು ಎ.ಐ ಚಾಲಿತ ಪಾತ್ರಗಳಿಗೆ ಹೊಂದಿಕೊಳ್ಳುವಿಕೆಯನ್ನು ಅಗತ್ಯಗೊಳಿಸುತ್ತದೆ. ಹೆಚ್ಚುವರಿಯಾಗಿ ಎ.ಐ ಸಾಮಾನ್ಯಿಕ ಅಸಮಾನತೆಗಳನ್ನು ಆಳಗೊಳಿಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೊಂದಿದೆ. ಎ.ಐ ತಂತ್ರಜ್ಞಾನಗಳಿಗೆ ಅಸಮಾನ ಪ್ರವೇಶವು ಅಭಿವೃದ್ಧಿ ಹೊಂದಿದ ಮತ್ತು ಅಭಿವೃದ್ಧಿಯಾಗದ ಪ್ರದೇಶಗಳ ನಡುವಿನ ಅಂತರವನ್ನು ಹೆಚ್ಚಿಸಬಹುದು ಮತ್ತು ಅಲ್ಲಾರಿದಮಿಕ್ ಪಕ್ಷಪಾತಗಳು ತಾರತಮ್ಯವನ್ನು ಶಾಶ್ವತಗೊಳಿಸಬಹುದು. ವಿಶೇಷವಾಗಿ ಅಂಚಿನಲ್ಲಿರುವ ಸಮುದಾಯಗಳ ವಿರುದ್ಧ ಎ.ಐ ಮಾನವ ಸಂಬಂಧಗಳು ಮತ್ತು ಸಾಮಾಜಿಕ ಸಂವಹನಗಳ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುತ್ತದೆ. ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳು ಅಪಾರ ಪ್ರಮಾಣದ ವೈಯಕ್ತಿಕ ಡೇಟಾವನ್ನು ಸಂಗ್ರಹಿಸಿ ವಿಶ್ಲೇಷಿಸುವುದರಿಂದ, ಕಣ್ಣಾವಲು ಮತ್ತು ಡೇಟಾ ದುರುಪಯೋಗದ ಬಗ್ಗೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಹುಟ್ಟುಹಾಕುವುದರಿಂದ ಗೌಪ್ಯತೆಯ ಕಾಳಜಿಗಳು ಉದ್ಭವಿಸುತ್ತವೆ. ಸಕಾರಾತ್ಮಕವಾಗಿ ನೋಡುವುದಾದರೆ, ಸುಧಾರಿತ ಆರೋಗ್ಯ, ರಕ್ಷಣೆ, ಶಿಕ್ಷಣ ಮತ್ತು ವಿಪತ್ತು ನಿರ್ವಹಣೆ ಸೇರಿದಂತೆ ಸಾಮಾಜಿಕ ಪ್ರಗತಿಗಳಿಗೆ ಎ.ಐ ಭರವಸೆಯನ್ನು ಹೊಂದಿದೆ. ಆದಾಗ್ಯೂ,

ನೈತಿಕ ಆಡಳಿತ, ಒಳಗೊಳ್ಳುವಿಕೆ ಮತ್ತು ಸಾರ್ವಜನಿಕ ಜಾಗೃತಿಯು ಅಸ್ತಿತ್ವದಲ್ಲಿರುವ ಸವಾಲುಗಳನ್ನು ಉಲ್ಬಣಗೊಳಿಸುವ ಬದಲು ಸಮಾನ ಸಾಮಾಜಿಕ ಪ್ರಗತಿಗೆ ಒಂದು ಸಾಧನವಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸುತ್ತದೆ. ಆದರೆ ಎಲ್ಲಾ ಕ್ಷೇತ್ರಗಳಿಗೆ ಅದನ್ನು ವಿಸ್ತರಿಸುವುದಕ್ಕಿಂತ ಕೆಲವೇ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಮಾತ್ರ ಬಳಸಬೇಕು.

## ಸವಾಲುಗಳು ಮತ್ತು ಅಪಾಯಗಳು

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯು ಅದರ ಜವಾಬ್ದಾರಿಯುತ ಅಭಿವೃದ್ಧಿ ಮತ್ತು ಬಳಕೆಯನ್ನು ಖಚಿತಪಡಿಸಿಕೊಳ್ಳಲು ಎಚ್ಚರಿಕೆಯಿಂದ ನಿರ್ವಹಿಸಬೇಕಾದ ಹಲವಾರು ಸವಾಲುಗಳು ಮತ್ತು ಅಪಾಯಗಳನ್ನು ಪರಿಚಯಿಸುತ್ತದೆ. ಒಂದು ಪ್ರಮುಖ ಕಾಳಜಿಯೆಂದರೆ ಉದ್ಯೋಗ ಸೃಷ್ಟಾಂತರ. ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳು ವಿವಿಧ ಕೈಗಾರಿಕೆಗಳಲ್ಲಿ ಕಾರ್ಯಗಳನ್ನು ಹೆಚ್ಚು ಹೆಚ್ಚು ಸ್ವಯಂಚಾಲಿತಗೊಳಿಸುವುದರಿಂದ, ಅನೇಕ ಉದ್ಯೋಗಗಳು, ವಿಶೇಷವಾಗಿ ಉತ್ಪಾದನೆ, ಗ್ರಾಹಕ ಸೇವೆ ಮತ್ತು ಡೇಟಾ ವಿಶ್ಲೇಷಣೆಯಂತಹ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಯಂತ್ರಗಳಿಂದ ಬದಲಾಯಿಸಲ್ಪಡುವ ಅಪಾಯವಿದೆ. ಇದು ನಿರುದ್ಯೋಗ ಮತ್ತು ಹೆಚ್ಚಿನ ಆರ್ಥಿಕ ಅಸಮಾನತೆಗೆ ಕಾರಣವಾಗಬಹುದು. ಮತ್ತೊಂದು ಗಮನಾರ್ಹ ವಿಷಯವೆಂದರೆ, ಅಲ್ಲಾರಿದಮಿಕ್ ಪಕ್ಷಪಾತ. ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳು ಡೇಟಾದಿಂದ ಕಲಿಯುತ್ತವೆ ಮತ್ತು ಈ ಡೇಟಾ ಪಕ್ಷಪಾತವಾಗಿದ್ದರೆ ಅಥವಾ ಪ್ರತಿನಿಧಿಸದಿದ್ದರೆ, ಎ.ಐ ತನ್ನ ನಿರ್ಧಾರಗಳಲ್ಲಿ ಈ ಪಕ್ಷಪಾತವನ್ನು ಪುನರಾವರ್ತಿತಬಹುದು. ನೇಮಕಾತಿ, ಕ್ರಿಮಿನಲ್ ನ್ಯಾಯ ಮತ್ತು ಸಾಲ ನೀಡುವಂತಹ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಇದನ್ನು ಗಮನಿಸಲಾಗಿದೆ, ಅಲ್ಲಿ ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳು ಕೆಲವು ಗುಂಪುಗಳ ವಿರುದ್ಧ ತಾರತಮ್ಯವನ್ನು ಶಾಶ್ವತಗೊಳಿಸಬಹುದು.

ಗೌಪ್ಯತೆ ಮತ್ತು ಡೇಟಾ ಸುರಕ್ಷತೆಯೂ ಸಹ ಪ್ರಮುಖ ಕಾಳಜಿಗಳಾಗಿವೆ. ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳು ಸರಿಯಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸಲು ಹೆಚ್ಚಿನ ಪ್ರಮಾಣದ ವೈಯಕ್ತಿಕ ಡೇಟಾದ ಅಗತ್ಯವಿರುತ್ತದೆ. ಇದು ಡೇಟಾ ಉಲ್ಲಂಘನೆ, ಕಣ್ಣಾವಲು ಮತ್ತು ದುರುಪಯೋಗದ ಅಪಾಯವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಅಲ್ಲದೆ, ಎ.ಐ ಅಭಿವೃದ್ಧಿಯಲ್ಲಿ ಸ್ಪಷ್ಟ ನಿಯಮಗಳು ಮತ್ತು ಹೊಣೆಗಾರಿಕೆಯ ಕೊರತೆಯು ಅದರ ನೈತಿಕ ಅನ್ವಯದ ಬಗ್ಗೆ ಅನಿಶ್ಚಿತತೆಗೆ ಕಾರಣವಾಗುತ್ತದೆ. ಸರಿಯಾದ ಮಾರ್ಗಸೂಚಿಗಳಿಲ್ಲದೆ, ಎ.ಐ ಅನ್ನು ಮಿಲಿಟರಿ ಅಥವಾ ಕಣ್ಣಾವಲು ಸಂದರ್ಭಗಳಲ್ಲಿ ಹಾನಿಕಾರಕ ರೀತಿಯಲ್ಲಿ ಬಳಸಬಹುದು.

ಕೊನೆಯದಾಗಿ, ಸ್ವಯಂತ್ರ ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳ ಹೊರಹೊಮ್ಮುವಿಕೆಯು ಮಾನವ ಮೇಲ್ವಿಚಾರಣೆಯನ್ನು ಕಡಿಮೆ ಮಾಡುವ ಅಪಾಯವನ್ನುಂಟುಮಾಡುತ್ತದೆ. ಎ.ಐ ನಿರ್ಧಾರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವುದು ಅಥವಾ ಊಹಿಸಲು ಅಥವಾ ಎದುರಿಸಲು ಕಷ್ಟಕರವಾದ ಕ್ರಮಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವುದು, ನೈತಿಕ ಮತ್ತು ಸುರಕ್ಷತಾ ಸವಾಲುಗಳನ್ನು ಪ್ರಸ್ತುತಪಡಿಸುತ್ತದೆ.

## ಸಮಾಜದಲ್ಲಿ ಎ.ಐ ನ ಭವಿಷ್ಯ

ಸಮಾಜದಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯು ಭವಿಷ್ಯವು ಗಮನಾರ್ಹ ಪ್ರಗತಿಗಳು ಮತ್ತು ಸಂಕೀರ್ಣ ಸವಾಲುಗಳನ್ನು ತರಲು ಸಿದ್ಧವಾಳಿದೆ. ಎ.ಐ ತಂತ್ರಜ್ಞಾನಗಳು ವಿಕಸನಗೊಳ್ಳುತ್ತಲೇ ಇರುವುದರಿಂದ, ಅವು ವಿವಿಧ ವಲಯಗಳಲ್ಲಿ ಆಳವಾಗಿ ಸಂಯೋಜಿಸಲ್ಪಡುತ್ತವೆ. ಕೈಗಾರಿಕೆಗಳು, ಆರ್ಥಿಕತೆಗಳು ಮತ್ತು ದೈನಂದಿನ ಜೀವನವನ್ನು ಮರುರೂಪಿಸುತ್ತವೆ ಎಂದು ನಿರೀಕ್ಷಿಸಲಾಗಿದೆ. ಆರೋಗ್ಯ ಕ್ಷೇತ್ರದಲ್ಲಿ ರೋಗನಿರ್ಣಯದ ನಿಖರತೆಯನ್ನು ಸುಧಾರಿಸುತ್ತದೆ ಮತ್ತು ಆಡಳಿತಾತ್ಮಕ ಪ್ರಕ್ರಿಯೆಗಳನ್ನು ಸುಗಮಗೊಳಿಸುತ್ತದೆ. ರೋಗಿಗಳ ಆರೈಕೆ ಮತ್ತು ಜೀವಿತಾವಧಿಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಅದೇ ರೀತಿ, ಶಿಕ್ಷಣದಲ್ಲಿನ ಎ.ಐ ಚಾಲಿತ ಪ್ರಗತಿಗಳು ಕಲಿಕೆಯನ್ನು ಹೆಚ್ಚು ಪ್ರವೇಶಿಸಬಹುದಾದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸೂಕ್ತವಾದ ಸಂಪನ್ಮೂಲಗಳನ್ನು ನೀಡುತ್ತದೆ. ಆದರೆ ನೈತಿಕವಾಗಿ ಎ.ಐ ನ ಭವಿಷ್ಯವು ಸಮಾಜವು ಎದುರಿಸಬೇಕಾದ ಸವಾಲುಗಳನ್ನು ಒಡ್ಡುತ್ತದೆ. ಅಲ್ಲಾರಿದಮಿಕ್ ಪಕ್ಷಪಾತ, ಗೌಪ್ಯತೆ ಕಾಳಜಿಗಳು ಮತ್ತು ಎ.ಐ ನಿರ್ಧಾರ ತೆಗೆದುಕೊಳ್ಳುವಲ್ಲಿ ಪಾರದರ್ಶಕತೆಯ ಅಗತ್ಯದಂತಹ ಸಮಸ್ಯೆಗಳಿಗೆ ಬಲವಾದ ನಿಯಂತ್ರಕ ಚೌಕಟ್ಟುಗಳು ಬೇಕಾಗುತ್ತವೆ. ಹೆಚ್ಚುವರಿಯಾಗಿ, ಸ್ವಾಯತ್ತ ಎ.ಐ ವ್ಯವಸ್ಥೆಗಳ ಏರಿಕೆ ಮತ್ತು ವೈಯಕ್ತಿಕ ಸ್ವಾಯತ್ತತೆ ಮತ್ತು ಸುರಕ್ಷತೆಯ ಮೇಲೆ ಅವುಗಳ ಸಂಭಾವ್ಯ ಪ್ರಭಾವವನ್ನು ಚೆನ್ನಾಗಿ ಹೊಂದಿಕೊಳ್ಳುತ್ತದೆ ಎಂಬುದರ ಮೇಲೆ ಅವಲಂಬಿತವಾಗಿರುತ್ತದೆ. ಈ ಪ್ರಗತಿಗಳು ಸಮಬಂಧಿತ ಅಪಾಯಗಳನ್ನು ತಗ್ಗಿಸುವಾಗ ಎಲ್ಲಾ ವ್ಯಕ್ತಿಗಳಿಗೆ ಪ್ರಯೋಜನವನ್ನು ನೀಡುತ್ತದೆ ಎಂದು ಖಚಿತಪಡಿಸುತ್ತದೆ.

## ಉಪಸಂಹಾರ

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ನಿರ್ವಿವಾದವಾಗಿ ಸಮಾಜವನ್ನು ಮರುರೂಪಿಸುತ್ತದೆ. ಬಹು ವಲಯಗಳಲ್ಲಿ ನಾವೀನ್ಯತೆಯನ್ನು ಚಾಲನೆ ಮಾಡುತ್ತದೆ ಮತ್ತು ಆರೋಗ್ಯ ರಕ್ಷಣೆ, ಶಿಕ್ಷಣ ಮತ್ತು ಹಣಕಾಸಿನಂತಹ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಪರಿವರ್ತಕ ಪ್ರಯೋಜನಗಳನ್ನು ನೀಡುತ್ತದೆ. ದಕ್ಷತೆಯನ್ನು ಹೆಚ್ಚಿಸುವ, ಅನುಭವಗಳನ್ನು ವೈಯಕ್ತೀಕರಿಸುವ ಮತ್ತು ಸಂಕೀರ್ಣ ಸವಾಲುಗಳನ್ನು ಪರಿಹರಿಸುವ ಅದರ ಸಾಮರ್ಥ್ಯವು ಅದನ್ನು ಸಾಮಾಜಿಕ ಪ್ರಗತಿಗೆ ಪ್ರಬಲ ಸಾಧನವಾಗಿಸುತ್ತದೆ. ಆದಾಗ್ಯೂ, ಎ.ಐ ವಿಕಸನಗೊಳ್ಳುತ್ತಲೇ ಇರುವುದರಿಂದ, ಅದರ ಬಗ್ಗೆ ಎಚ್ಚರಿಕೆಯಿಂದ ಪರಿಗಣಿಸಬೇಕಾದ ಹಲವಾರು ನೈತಿಕ, ಸಾಮಾಜಿಕ ಮತ್ತು ಆರ್ಥಿಕ ಪರಿಣಾಮಗಳನ್ನು ಮುಂದಿಡುತ್ತದೆ. ಉದ್ಯೋಗ, ಗೌಪ್ಯತೆ ಮತ್ತು ನ್ಯಾಯಸಮ್ಮತತೆಯ ಮೇಲೆ ಎ.ಐ ನ ಪ್ರಭಾವವು ಬಲವಾದ ನೈತಿಕ ಚೌಕಟ್ಟುಗಳು ಮತ್ತು ನಿಯಂತ್ರಕ ನೀತಿಗಳ ಅಗತ್ಯತೆಯನ್ನು ಎತ್ತಿ ತೋರಿಸುತ್ತದೆ.

## ಆಕರ ಗ್ರಂಥಗಳು

1. "A Literature Review on Artificial Intelligence", Volume 19, Number 4, pp. 535-570, 2008, S.A. Oke, University of Lagos, Nigeria.
2. "A Review of Artificial Intelligence", 2009, E.S. Brunette, R.C. Flemmer and C.L. Flemmer, School of Engineering and
3. Advanced Technology, Massey University, Palmerston North, New Zealand.
4. A Literature of Artificial Intelligence", Sam Olds, WRTG 3014, April 24, 2014

## OriginalArticle

### ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ಪರಿಣಾಮಕಾರಿ ಆಡಳಿತ

ಡಾ.ರಾಮಣ್ಣ. ಜಿ.ಟಿ

ರಾಜ್ಯಶಾಸ್ತ್ರ ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು

ಸರ್ಕಾರಿ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ದಾವಣಗೆರೆ

Manuscript ID: ಸಾರಾಂಶ

JRD -2026-180632

ISSN: 2230-9578

Volume 18

Issue 6(I)

Pp. 156-158

June- 2026

Submitted: 05 May. 2026

Revised: 20 May. 2026

Accepted: 05 June 2026

Published: 30 June 2026

ಈ ಪ್ರಬಂಧವು ವಿವಿಧ ಸರ್ಕಾರಿ ವಲಯಗಳಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಹೇಗೆ ಅನ್ವಯಿಸಲಾಗುತ್ತದೆ ಎಂಬುದರ ಅವಲೋಕನವನ್ನು ಒದಗಿಸುತ್ತದೆ. ಉತ್ತಮ ಆಡಳಿತಕ್ಕಾಗಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಹೆಚ್ಚು ಬಳಕೆಯಲ್ಲಿ ಬರುತ್ತಿದೆ. ಸಾರ್ವಜನಿಕ ಆಡಳಿತವನ್ನು ಹೆಚ್ಚು ಪಾರದರ್ಶಕ, ಪರಿಣಾಮಕಾರಿ ಮತ್ತು ನಾಗರಿಕ ಕೇಂದ್ರಿತವಾಗಿಸಲು ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯನ್ನು ಬಳಸುವ ಪ್ರಯತ್ನಗಳು ನಡೆಯುತ್ತಿವೆ. ಇದು ದತ್ತಾಂಶ-ಚಾಲಿತ ನೀತಿ ನಿರೂಪಣೆಗೆ ಶಕ್ತಿ ನೀಡುತ್ತದೆ, ಪುನರಾವರ್ತಿತ ಆಡಳಿತಾತ್ಮಕ ಕಾರ್ಯಗಳನ್ನು ಸ್ವಯಂಚಾಲಿತಗೊಳಿಸುತ್ತದೆ ಮತ್ತು ಸೋರಿಕೆಯನ್ನು ತಡೆಗಟ್ಟಲು ಕಲ್ಯಾಣ ಪ್ರಯೋಜನಗಳ ಗುರಿ ವಿತರಣೆಯನ್ನು ಖಚಿತಪಡಿಸುತ್ತದೆ. ಆಡಳಿತಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವಿವಿಧ ಕ್ಷೇತ್ರಗಳನ್ನು ತಿಳಿಸುವ ಸಂಘಟನಾ ಚಿತ್ರವನ್ನು ಪ್ರಸ್ತುತಪಡಿಸಲಾಗಿದೆ.

**ಕೀವರ್ಡ್ಸ್:** ಎ.ಐ, ಡಿಜಿಟಲ್, ಸಂವಹನ, ಸುಸ್ಥಿರತೆ  
**ಪೀಠಿಕೆ**

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ತಂತ್ರಜ್ಞಾನವು ಕೇವಲ 60 ವರ್ಷ ಹಳೆಯದಾಗಿದೆ. ಆದರೆ ಅದರ ಹೊರಹೊಮ್ಮುವಿಕೆಯು ನಮ್ಮ ಜೀವನದ ಮೇಲೆ ಗಾಢವಾಗಿ ಪರಿಣಾಮ ಬೀರುವ ಅನ್ವಯಿಕೆಗಳಿಗೆ ಕಾರಣವಾಗಿದೆ. ಇದು ಬುದ್ಧಿವಂತ ಯಂತ್ರಗಳನ್ನು ಅವಿಷ್ಕರಿಸಲು ಕೃತಕ ತಂತ್ರಜ್ಞಾನಗಳ ಮೂಲಕ ಮಾನವ ಬುದ್ಧಿಮತ್ತೆಯನ್ನು ಪುನರಾವರ್ತಿತವಾಗಿ ಮತ್ತು ಮಾಪನೀಯವಾಗಿ ಗಮನಹರಿಸುತ್ತದೆ. ಕೆಲವು ಸಂಶೋಧನೆಗಳು ಕೃತಕಬುದ್ಧಿಮತ್ತೆಯು ಕರ್ತಬದ್ಧವಾಗಿ ಯೋಚಿಸುವ ಮತ್ತು ಕಾರ್ಯನಿರ್ವಹಿಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೊಂದಿದೆ ಎಂದು ವಾದಿಸುತ್ತವೆ, ಆದರೆ ಇತರರು ಅದರ ಸಾಮರ್ಥ್ಯದ ಬಗ್ಗೆ ಅದೇ ದೃಷ್ಟಿಕೋನವನ್ನು ಹೊಂದಿಲ್ಲ. ಆದರೂ ಇದು ಇಂದು ವಿಜ್ಞಾನ, ಗಣಿತ, ತತ್ವಶಾಸ್ತ್ರ, ಮನೋವಿಜ್ಞಾನ, ಭಾಷಾಶಾಸ್ತ್ರ ಮತ್ತು ಕಂಪ್ಯೂಟರ್ ವಿಜ್ಞಾನದಂತಹ ದೀರ್ಘಕಾಲದಿಂದ ಸ್ಥಾಪಿತವಾದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ತನ್ನ ಅಡಿಪಾಯವನ್ನು ಹೊಂದಿದೆ. ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಸಂಶೋಧನೆಯು ಮೂರು ಆಯಾಮಗಳನ್ನು ಹೊಂದಿದೆ. ಮೊದಲನೆಯದು ಕಂಪ್ಯೂಟರ್‌ಗಳ ಸೀಮಿತ ಕಂಪ್ಯೂಟೇಶನಲ್ ಸಾಮರ್ಥ್ಯ ಮತ್ತು ಸಂಸ್ಕರಣಾ ಶಕ್ತಿಯನ್ನು ಎದುರಿಸಿತು; ಎರಡನೆಯದು ಮಾನವ ಮೆದುಳು ಮತ್ತು ಉತ್ತಮ ಕಂಪ್ಯೂಟೇಶನಲ್ ಸಾಮರ್ಥ್ಯದೊಂದಿಗೆ ಕಂಪ್ಯೂಟರ್‌ಗಳಂತೆಯೇ ಕಾರ್ಯನಿರ್ವಹಿಸುವ ಕೃತಕ ನರಮಂಡಲಗಳ ಅಭಿವೃದ್ಧಿಯನ್ನು ಕಂಡಿತು; ಈಗ ಜಾಲಿಯಲ್ಲಿರುವ ಸಂಶೋಧನೆಯ ಮೂರನೆಯದು ಆಳವಾದ ಕಲಿಕೆಯಿಂದ ನಡೆಸಲ್ಪಡುತ್ತದೆ. ಆದರೂ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯು ಇನ್ನೂ ಕೆಲವು ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಕೊರತೆಯನ್ನು ಹೊಂದಿದೆ. ಏಕೆಂದರೆ ಅದು ಕಡಿಮೆ ಸಂಶೋಧನೆಯಾಗಿದೆ. ವಾಹನಗಳು, ಕೈಗಾರಿಕಾ ಸಂವೇದಕಗಳು, ಸ್ಕಾರ್ಟ್‌ಫೋನ್‌ಗಳು, ಕಣ್ಣಾವಲು ಕ್ಯಾಮೆರಾಗಳಂತಹ ವಿಭಿನ್ನ ವಸ್ತುಗಳೊಂದಿಗೆ ಸಂವಹನವನ್ನು ಸಕ್ರಿಯಗೊಳಿಸಿದರೆ, ನಾಗರಿಕರು, ಸರ್ಕಾರಗಳು ಮತ್ತು ವ್ಯವಹಾರಗಳಿಗೆ ಅನೇಕ ನವೀನ ಸೇವೆಗಳ ಅಭಿವೃದ್ಧಿಯಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯು ವೇಗವರ್ಧಕವಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸುತ್ತದೆ.

ತ್ವರಿತ ಡಿಜಿಟಲ್ ತಾಂತ್ರಿಕ ಬದಲಾವಣೆಯೊಂದಿಗೆ, ಉತ್ತಮ ನಾಗರಿಕ ತೊಡಗಿಸಿಕೊಳ್ಳುವಿಕೆ, ಹೊಣೆಗಾರಿಕೆ ಮತ್ತು ಪರಸ್ಪರ ಕಾರ್ಯಸಾಧ್ಯತೆಯನ್ನು ಸಾಧಿಸಲು ಸರ್ಕಾರ ತನ್ನ ಸಾಂಪ್ರದಾಯಿಕ ವಿಧಾನಗಳನ್ನು ಅವಿಷ್ಕರಿಸುವುದು ಅನಿವಾರ್ಯವಾಗಿದೆ. ನಾವೀನ್ಯತೆ, ಸುಸ್ಥಿರತೆ, ಸ್ಪರ್ಧಾತ್ಮಕತೆ ಮತ್ತು ಜೀವನೋಪಾಯದ ಸುಗಮಕಾರಕಳಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸುವಲ್ಲಿ,



Quick Response Code:



Website:

<https://jrdrv.org/>

DOI:

10.5281/zenodo.21989449



#### Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

#### Address for correspondence:

ಡಾ.ರಾಮಣ್ಣ. ಜಿ.ಟಿ ರಾಜ್ಯಶಾಸ್ತ್ರ ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು ಸರ್ಕಾರಿ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ದಾವಣಗೆರೆ

#### How to cite this article:

ಜಿ.ಟಿ, ರಾಮಣ್ಣ. (2026). ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ಪರಿಣಾಮಕಾರಿ ಆಡಳಿತ. Journal of Research and Development, 18(6(I)), 156–158. <https://doi.org/10.5281/zenodo.21989449>

ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ತ್ವರಿತವಾಗಿ ನಾಗರಿಕರಿಗೆ ಒದಗಿಸುವಲ್ಲಿ, ಪುನರಾವರ್ತಿತ ಕಾರ್ಯಗಳನ್ನು ಸ್ವಯಂಚಾಲಿತಗೊಳಿಸುವಲ್ಲಿ ಮತ್ತು ನೀತಿ ಆಯ್ಕೆಗಳ ಫಲಿತಾಂಶವನ್ನು ನಿಖರವಾಗಿ ನಿರ್ಣಯಿಸುವಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಅನುಷ್ಠಾನದ ಮೂಲಕ ಸರ್ಕಾರಿ ಶ್ರಮವನ್ನು ಮುಕ್ತಗೊಳಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಶಿಕ್ಷಣ, ಭೌತಿಕ ಮೂಲಸೌಕರ್ಯ, ಸಾರಿಗೆ, ದೂರಸಂಪರ್ಕ, ಮಾಹಿತಿ ಭದ್ರತೆ ಮತ್ತು ನಿರ್ವಹಣೆ, ಹಣಕಾಸು, ಆರೋಗ್ಯ, ರಕ್ಷಣೆ, ಸಂಶೋಧನೆ ಮತ್ತು ಅಭಿವೃದ್ಧಿ, ನೀತಿ ನಿರೂಪಣೆ, ಕಾನೂನು ಮತ್ತು ನ್ಯಾಯ ವ್ಯವಸ್ಥೆ ಮೊದಲಾದ ವಿವಿಧ ಸರ್ಕಾರಿ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಅಗಾಧ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೊಂದಿದೆ. ಈ ಪ್ರಬಂಧದಲ್ಲಿ ಸರ್ಕಾರಿ ವಲಯಗಳಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಪರಿಣಾಮವನ್ನು ಗುರುತಿಸುವ ಪ್ರಯತ್ನವನ್ನು ಮಾಡಲಾಗಿದೆ.

## ಸಾರ್ವಜನಿಕ ಆರೋಗ್ಯ ಸೇವೆ

ಯಾವುದೇ ದೇಶದ ಆರೋಗ್ಯ ವಲಯವು ಸಾಮಾಜಿಕ ಕಲ್ಯಾಣ ಗುಣಮಟ್ಟವನ್ನು ಪ್ರತಿಬಿಂಬಿಸುವುದರಿಂದ ಹೆಚ್ಚಿನ ಆಸಕ್ತಿದಾಯಕವಾಗಿದೆ ಮತ್ತು ಜನರ ಜೀವನ ಗುಣಮಟ್ಟವನ್ನು ಬೆಂಬಲಿಸುತ್ತದೆ. ಸಾರ್ವಜನಿಕ ಆರೋಗ್ಯ ಕ್ಷೇತ್ರದಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಅನ್ವಯವು ಅತ್ಯಂತ ಭರವಸೆಯ ಮತ್ತು ಸೂಕ್ಷ್ಮ ಕ್ಷೇತ್ರವಾಗಿದೆ. ಏಕೆಂದರೆ ಈ ವಲಯದಲ್ಲಿನ ಸೇವಾ ವೈಫಲ್ಯಗಳು ಅನೇಕರ ಜೀವನವನ್ನು ಪರಿಣಾಮವಾಗಿ ಸ್ವೀಕಾರಾರ್ಹವಲ್ಲ. ಮಾನವ ಅರಿವಿನ ಕಾರ್ಯಗಳನ್ನು ಅನುಕರಿಸುವ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಸಾಮರ್ಥ್ಯವು ಆರೋಗ್ಯ ರಕ್ಷಣೆಗೆ ಒಂದು ಮಾದರಿ ಬದಲಾವಣೆಯನ್ನು ತಂದಿದೆ. ಆದರೆ ದುರದೃಷ್ಟವಶಾತ್, ಅದರ ಅಳವಡಿಕೆ ನಿಧಾನವಾಗಿದೆ.

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯನ್ನು ಸರಿಯಾಗಿ ಬಳಸಿಕೊಂಡರೆ ಆರೋಗ್ಯ ವಲಯವನ್ನು ಸಂಭಾವ್ಯವಾಗಿ ಪರಿವರ್ತಿಸಬಹುದು. ಆರೋಗ್ಯ ದಾಖಲೆಗಳು, ಆರೋಗ್ಯ ನಿರ್ವಹಣಾ ವ್ಯವಸ್ಥೆಗಳನ್ನು ನಿಯಂತ್ರಿಸಲು ಆಳವಾದ ಕಲಿಕೆಯ ಮಾಹಿತಿ ನಿರ್ವಹಣೆಯ ಅಧ್ಯಯನವನ್ನು ಅತಿಕ್ರಮಿಸುತ್ತದೆ. ಚಿಕಿತ್ಸಾ ನಿರ್ಧಾರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳಲು ವೈದ್ಯರಿಗೆ ಸಂಭಾವ್ಯವಾಗಿ ಸಹಾಯ ಮಾಡುತ್ತದೆ. ರೋಗದ ಆರಂಭಿಕ ಪತ್ತೆ, ರೋಗನಿರ್ಣಯ, ಚಿಕಿತ್ಸೆ, ಫಲಿತಾಂಶದ ಮುನ್ಸೂಚನೆ ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ಒಳಗೊಂಡಿರುವ ಮೂರು ಪ್ರಮುಖ ಕ್ಷೇತ್ರಗಳನ್ನು ಒಳಗೊಂಡಂತೆ ಕ್ಯಾನ್ಸರ್, ನರವಿಜ್ಞಾನ ಮತ್ತು ಹೃದ್ರೋಗಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ರೋಗಗಳಿಗೆ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಪರಿಕರಗಳನ್ನು ಬಳಸಲಾಗುತ್ತದೆ. ಭವಿಷ್ಯದಲ್ಲಿ ಮಾನವ ವೈದ್ಯರನ್ನು ಬದಲಾಯಿಸುವ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ವೈದ್ಯರ ಬಗ್ಗೆ ಸಕ್ರಿಯ ಚರ್ಚೆಯೂ ನಡೆಯುತ್ತಿದೆ. ಆರೋಗ್ಯ ರಕ್ಷಣೆಯಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಅಳವಡಿಕೆಯ ಸವಾಲುಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಅತ್ಯಂತ ನಿರ್ಣಾಯಕ ಅಂಶವನ್ನು ಸನ್ ಮತ್ತು ಮೆಡಾಗ್ನಿಯಾ ಎತ್ತಿ ತೋರಿಸಿದ್ದಾರೆ. ಸರ್ಕಾರಿ ನೀತಿ ನಿರೂಪಕರು, ಆಸ್ಪತ್ರೆ ವ್ಯವಸ್ಥಾಪಕರು, ವೈದ್ಯರು, ಐಟಿ ಸಂಸ್ಥೆಯ ವ್ಯವಸ್ಥಾಪಕರು ಭವಿಷ್ಯದಲ್ಲಿ ಸಾಮಾಜಿಕ, ಆರ್ಥಿಕ, ನೈತಿಕ, ರಾಜಕೀಯ, ಕಾನೂನು, ನೀತಿ ಸಾಂಸ್ಥಿಕ, ವ್ಯವಸ್ಥಾಪಕ, ದತ್ತಾಂಶ, ತಾಂತ್ರಿಕ ಸವಾಲುಗಳನ್ನು ಹೇಗೆ ಎದುರಿಸುತ್ತಾರೆ ಎಂಬುದನ್ನು ಉಲ್ಲೇಖಿಸಿದ್ದಾರೆ.

## ಮಾಹಿತಿ, ಸಂವಹನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

ಐಸಿಟಿಯನ್ನು ಉಪಕರಣಗಳು, ಸಂಪನ್ಮೂಲಗಳು, ಸಾಫ್ಟ್‌ವೇರ್, ಅದರ ಅನ್ವಯಿಕೆಗಳು, ನೆಟ್ ವರ್ಕ್‌ಗಳು ಮತ್ತು ದತ್ತಾಂಶ ಪಠ್ಯ, ಧ್ವನಿ, ವಿಡಿಯೋ ಮತ್ತು ಚಿತ್ರಗಳನ್ನು ಒಳಗೊಂಡಂತೆ ಮಾಹಿತಿಯ ಸಂಕಲನ, ಸಂಸ್ಕರಣೆ, ಸಂಗ್ರಹಣೆ ಮತ್ತು ಪ್ರಸರಣಕ್ಕೆ ಕಾರಣವಾಗುವ ಮಾಧ್ಯಮ ಎಂದು ಹೇಳಬಹುದು. ಈ ವಿಭಾಗವು ಮೊದಲನೆಯದಾಗಿ, ಬಳಕೆದಾರರಿಗೆ ಮಾಹಿತಿ ಮತ್ತು ದತ್ತಾಂಶದ ತಡೆರಹಿತ ಸ್ವಾತಂತ್ರ್ಯ ಮತ್ತು ಪ್ರಸರಣಕ್ಕೆ ಕಾರಣವಾಗುವ ನೆಟ್‌ವರ್ಕ್‌ಗಳನ್ನು ಒಳಗೊಂಡಿರುವ ಮಾಹಿತಿ ಪರಿಸರವನ್ನು ಒಳಗೊಂಡಿದೆ. ಎರಡನೆಯದಾಗಿ, ಸರ್ಕಾರ ಮತ್ತು ನಾಗರಿಕರ ನಡುವಿನ ಸಂವಹನವನ್ನು ಸುಧಾರಿಸಲು ಸಹಾಯ ಮಾಡುವ ಚಾಟ್‌ಬಾಟ್‌ಗಳು; ಮೂರನೆಯದಾಗಿ, ನೀತಿ ಪರಿಣಾಮಗಳನ್ನು ಸರಿಯಾದ ಕ್ರಮದಲ್ಲಿ ಅರ್ಥಮಾಡಿಕೊಳ್ಳಲು ಮತ್ತು ಸರಿಯಾದ ತೀರ್ಮಾನಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳಲು, ಮೂರನೆಯದಾಗಿ, ನೀತಿ ಪರಿಣಾಮಗಳನ್ನು ಅಭ್ಯಸಿಕೊಳ್ಳಲು ಮತ್ತು ಸರಿಯಾದ ತೀರ್ಮಾನ ತೆಗೆದುಕೊಳ್ಳಲು ಮತ್ತು ಅಂತಿಮವಾಗಿ, ದತ್ತಾಂಶ ಹಂಚಿಕೆ, ಗೌಪ್ಯತೆ ಮತ್ತು ಸುರಕ್ಷತೆಯು ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯಿಂದ ಸಂಗ್ರಹಿಸಲಾದ ಮಾಹಿತಿಯು ಸೈಬರ್ ಭದ್ರತಾ ಬೆದರಿಕೆಗಳಿಗೆ ದಾರಿ ಮಾಡಿಕೊಡಬಹುದು. ಉದಾಹರಣೆಗೆ ಭಾರತದಲ್ಲಿ ಸರ್ಕಾರಿ ವೆಬ್‌ಸೈಟ್ ಹ್ಯಾಕಿಂಗ್‌ನ ಸುಮಾರು 270 ಪ್ರಕರಣಗಳು 2017 ಮತ್ತು 2018ರ ನಡುವೆ ವರದಿಯಾಗಿವೆ. ಇದರಿಂದ ಬಹಳ ಎಚ್ಚರಿಕೆಯಿಂದ ಇರಬೇಕಾಗಿದೆ. ಏಕೆಂದರೆ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯನ್ನು ಬಳಸಿಕೊಂಡು ಬ್ಯಾಂಕಿಂಗ್, ಮಿಲಿಟರಿ, ಪರಮಾಣು ಮೊದಲಾದ ಗೌಪ್ಯಮಾಹಿತಿಯನ್ನು ಸುಲಭವಾಗಿ ಕಡಿಯುವ ಸಾಧ್ಯತೆ ಹೆಚ್ಚುತ್ತದೆ. ಇತ್ತೀಚೆಗೆ ಭಾರತದ ಹಣಕಾಸು ಸಚಿವರಾದ ನಿರ್ಮಲಾ ಸೀತಾರಾಮ್ ಅವರು ಇದಕ್ಕಾಗಿಯೇ ಸಭೆಯನ್ನು ಆಯೋಜಿಸಿ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಮುನ್ನೆಚ್ಚರಿಕೆ ಕ್ರಮಗಳ ಬಗ್ಗೆ ಚರ್ಚಿಸಿದ್ದನ್ನು ಕಾಣಬಹುದು. ಆದರೂ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯು ಪಾರದರ್ಶಕ ಮತ್ತು ತಡೆರಹಿತ ಮಾಹಿತಿ ಪರಿಸರಕ್ಕೆ ಕಾರಣವಾಗುವ ವೇಗವಾದ ಮಾಹಿತಿ ವಿನಿಮಯವನ್ನು ಮಾಡಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಚಾಟ್‌ಬಾಟ್‌ಗಳು ಬುದ್ಧಿವಂತ ಯಂತ್ರಗಳಾಗಿವೆ, ಅವು ಮಾತನಾಡುವ ಭಾಷೆಯನ್ನು ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವ ಮತ್ತು ಪ್ರಕ್ರಿಯೆಗೊಳಿಸುವ ಮತ್ತು ಬಳಕೆದಾರರ ಮಟ್ಟದಲ್ಲಿ ಭಾಷಣವನ್ನು ಬಳಸುವ ಮೂಲಕ ಸಂವಹನ ನಡೆಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೊಂದಿವೆ. ಸಾರ್ವಜನಿಕ ಸಂಸ್ಥೆಗಳ ನಿಬಂಧನೆಯೊಳಗೆ ನಾಗರಿಕರು ಮತ್ತು ಸರ್ಕಾರದ ನಡುವಿನ ಸಂವಹನವನ್ನು ಮುನ್ನಡೆಸುವ ಮೂಲಕ ಸಾರ್ವಜನಿಕ ಸಂಸ್ಥೆಗಳ ಆಡಳಿತಾತ್ಮಕ ಹೊರೆಯನ್ನು ಗಮನಾರ್ಹವಾಗಿ ಕಡಿಮೆ ಮಾಡಲು ಸಹಾಯ ಮಾಡಬಹುದು. ಇದು ಕಳವಳಕಾರಿ ವಿಷಯವಾಗಿದೆ, ಏಕೆಂದರೆ ಸಾಕಷ್ಟು ಜನರು ಉದ್ಯೋಗವನ್ನು ಕಳೆದುಕೊಂಡು ನಿರುದ್ಯೋಗಿಗಳಾಗುವುದರಿಂದ ರಾಷ್ಟ್ರಕ್ಕೆ ದೊಡ್ಡ ಸಂಕಷ್ಟವನ್ನು ತಂದೊಡ್ಡಬಹುದು.

## ಪರಿಸರ ಸುಸ್ಥಿರತೆ

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯು ದತ್ತಾಂಶ ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ಮಾದರಿ ಗುರುತಿಸುವಿಕೆ ಕ್ಷೇತ್ರದಲ್ಲಿ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಹೊಂದಿರುವುದರಿಂದ ಪರಿಸರ ಸುಸ್ಥಿರತೆಗೆ ಸಂಬಂಧಿಸಿದ ವಿಷಯಗಳಲ್ಲಿ ಅಗಾಧ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೊಂದಿದೆ. ಇತ್ತೀಚೆಗೆ ಬಳಸಲಾಗುತ್ತಿರುವ ತಂತ್ರಜ್ಞಾನಗಳು ಅತ್ಯಾಧುನಿಕ ಯಂತ್ರ ಬಳಕೆಗಳಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯನ್ನು ಕೃಷಿ ಮತ್ತು ಪರಿಸರ ಸಂರಕ್ಷಣೆಯಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಬಳಸಬಹುದು. ಉದಾಹರಣೆಗೆ ಪ್ರಸ್ತುತ ಎಲ್‌ನಿನ್ಯೋ ಪರಿಣಾಮವನ್ನು ನಿಖರವಾಗಿ ಗುರುತಿಸುವುದರ ಮೂಲಕ ಮುಂದಾಗುವ ಅನಾಹುತಗಳನ್ನು ಎದುರಿಸಲು ಸೂಕ್ತ ನಿರ್ಧಾರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ. ಕೃಷಿಯಲ್ಲಿ ನಾವಿನ್ಯತೆಯನ್ನು ಕಂಡುಕೊಳ್ಳುವುದರ ಮೂಲಕ ಆಹಾರದ ಸಮಸ್ಯೆಯನ್ನು ನಿವಾರಿಸಿಕೊಳ್ಳಬಹುದು. ಹವಾಮಾನ ಬದಲಾವಣೆಯ ಪರಿಣಾಮಗಳನ್ನು ತಗ್ಗಿಸಲು ದೀರ್ಘಕಾಲೀನ ಸೌರ ವಿಕಿರಣವನ್ನು ಮುನ್ಸೂಚಿಸುವುದು, ಅಪಾಯವನ್ನು ಊಹಿಸುವುದು ಮತ್ತು ಪರಿಸರದ ಮೇಲೆ ಪರಿಣಾಮ ಬೀರುವ ವಿವಿಧ ಅಂಶಗಳನ್ನು ನಿರ್ಣಯಿಸುವುದು, ಸ್ವಯಂಚಾಲಿತ ಕಾರುಗಳ ಸಹಾಯದಿಂದ ವನ್ಯಜೀವಿಗಳ ಮೇಲ್ವಿಚಾರಣೆ ಮತ್ತು ಸಂರಕ್ಷಣೆ, ಭೂ-ಬಳಕೆ ಯೋಜನೆ, ತ್ಯಾಜ್ಯ ನಿರ್ವಹಣೆಗೆ ಸಂಬಂಧಿಸಿದ ವಿಷಯಗಳಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರವಹಿಸುವ ಜ್ಞಾನ-ಆಧಾರಿತ ಭೌಗೋಳಿಕ ಮಾಹಿತಿ ವ್ಯವಸ್ಥೆಯನ್ನು ನಿರ್ವಹಿಸಬಹುದು.

## ಸರ್ಕಾರಿ ಕಾನೂನು ಮತ್ತು ನೀತಿ ನಿರೂಪಣೆ

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯಿಂದ ಸಾರ್ವಜನಿಕ ಆಡಳಿತವು ಹಕ್ಕುಗಳ ಪರಿಣಾಮಕಾರಿತ್ವವನ್ನು ಉತ್ತೇಜಿಸುವಲ್ಲಿ ಮತ್ತು ಜನರ ಡಿಜಿಟಲ್ ಘನತೆಯನ್ನು ಖಚಿತಪಡಿಸಿಕೊಳ್ಳಲು ಸಮಗ್ರ ತಾಂತ್ರಿಕ ಅಭಿವೃದ್ಧಿಯನ್ನು ಉತ್ತೇಜಿಸುವಲ್ಲಿ ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಸಾರ್ವಜನಿಕ ಸೇವಾ ನಿಬಂಧನೆ ಮತ್ತು ನೀತಿ

ನಿರೂಪಣೆಯಲ್ಲಿ ಸರ್ಕಾರವು ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯನ್ನು ಕಾರ್ಯಗತಗೊಳಿಸಬಹುದು, ಅಲ್ಲಿ ನೀತಿ ನಿರೂಪಣೆಯು ನಿರಂತರವಾಗಿ ಬದಲಾಗುತ್ತಿರುವ ಪರಿಸರದಲ್ಲಿ ಸಂಭವಿಸುವ ಸಂಕೀರ್ಣ ಪ್ರಕ್ರಿಯೆಗಳಲ್ಲಿ ಒಂದಾಗಿದೆ ಮತ್ತು ಆರ್ಥಿಕತೆ, ಸಮಾಜ ಮತ್ತು ಪರಿಸರ ಎಂಬ ಸುಸ್ಥಿರ ಅಭಿವೃದ್ಧಿಯ ಮೂರು ಸ್ತಂಭಗಳ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುತ್ತದೆ. ಪ್ರತಿಯೊಂದು ರಾಜಕೀಯ ನಿರ್ಧಾರವನ್ನು ಆರ್ಥಿಕ, ಹಣಕಾಸು ಮತ್ತು ಪರಿಸರ ಅಂಶಗಳಿಗೆ ಅಲೆಗಳನ್ನು ರವಾನಿಸುವ ಕೆಲವು ಸಾಮಾಜಿಕ ಒತ್ತಡಕ್ಕೆ ಪ್ರತಿಕ್ರಿಯೆಯಾಗಿ ತೆಗೆದುಕೊಳ್ಳಲಾಗುತ್ತದೆ. ಕಾನೂನು ಪರಿಸರದಲ್ಲಿ ಸಹ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ವಕೀಲಿಕೆ, ತೀರ್ಪು ಮತ್ತು ಕಾನೂನು ಜಾರಿಯ ಮೇಲೆ ಆಳವಾದ ಪ್ರಭಾವ ಬೀರುತ್ತದೆ. ಅಲ್ಲಿ ವಾದವನ್ನು ಬೆಂಬಲಿಸುವ ಸಾಧನಗಳು ಕಡಿಮೆ ವೆಚ್ಚದಲ್ಲಿ ಸ್ವಯಂಚಾಲಿತ ಕಾನೂನು ಸಲಹೆಗಳನ್ನು ನೀಡುತ್ತದೆ.

## ಆರ್ಥಿಕ ಮತ್ತು ಆರ್ಥಿಕ ಅನ್ವಯಿಕೆಗಳು

ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ತಂತ್ರಜ್ಞಾನವು ಹಣಕಾಸು ಉದ್ಯಮದಲ್ಲಿ ಅಭಿವೃದ್ಧಿಪಡಿಸಲಾಗಿದೆ ಮತ್ತು ಅನ್ವಯಿಸಲಾಗಿದೆ. ಅಲ್ಲಿ ಬ್ಯಾಂಕಿಂಗ್, ವಿಮೆ ಮತ್ತು ಬಂಡವಾಳ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ಆಳವಾದ ಬದಲಾವಣೆಗಳನ್ನು ಉಂಟುಮಾಡುತ್ತಿದೆ. ಬ್ಯಾಂಕಿಂಗ್ ಉದ್ಯಮವು ಮೊದಲಬಾರಿಗೆ ಏಷ್ಯೆಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡಿತು ಮತ್ತು ವಿವಿಧ ರೀತಿಯಲ್ಲಿ ತಂತ್ರಜ್ಞಾನವನ್ನು ಅನ್ವೇಷಿಸಲು ಮತ್ತು ಕಾರ್ಯಗತಗೊಳಿಸಲು ಉತ್ಸುಕವಾಗಿದೆ. ಇದರಲ್ಲಿ ಬ್ಯಾಂಕಿಂಗ್‌ನಲ್ಲಿ ದಕ್ಷತೆಯನ್ನು ತರಲು ಅಥವಾ ವಂಚನೆ ಮತ್ತು ಭದ್ರತೆಗೆ ಸಂಬಂಧಿಸಿದ ಅಪಾಯಗಳನ್ನು ಕಡಿಮೆ ಮಾಡಲು ತಂತ್ರಜ್ಞಾನವನ್ನು ಕಾರ್ಯಗತಗೊಳಿಸುವುದು ಸೇರಿದೆ. ಆದರೆ ತದ್ಗ್ರಾಹಿ ಆಪ್‌ಗಳ ಬಗ್ಗೆ ಜನರು ಎಚ್ಚರಿಕೆಯಿಂದ ವ್ಯವಹರಿಸಬೇಕಾಗಿದೆ. ಎ.ಐ ನಮ್ಮ ಸಹಾಯಕ ಹೊರತು ಯಜಮಾನನಲ್ಲ ಎನ್ನುವುದನ್ನು ಅರಿತುಕೊಳ್ಳಬೇಕಾಗಿದೆ.

ಅನೇಕ ಸಂಶೋಧಕರು ಮತ್ತು ವೃತ್ತಿಪರರು ಎ.ಐ ಅನ್ವಯಿಕೆಗಳ ತಾಂತ್ರಿಕ ಅಂಶಗಳನ್ನು ಮಾತ್ರ ಉಲ್ಲೇಖಿಸಿದ್ದಾರೆ. ಇದಕ್ಕೆ ವಿರುದ್ಧವಾಗಿ ಎ.ಐ ಆಧಾರಿತ ಅನ್ವಯಿಕೆಗಳು ಮತ್ತು ಸಂಬಂಧಿತ ಸವಾಲುಗಳ ವ್ಯಾಪ್ತಿ ಮತ್ತು ಪರಿಣಾಮಗಳನ್ನು ಸಮಗ್ರ ರೀತಿಯಲ್ಲಿ ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವ ಅಗತ್ಯ ಇನ್ನೂ ಇದೆ. ಭವಿಷ್ಯದ ಸಂಶೋಧಕರು ಎ.ಐ ಅಳವಡಿಕೆಯ ಸವಾಲುಗಳು ಮತ್ತು ಪ್ರತಿಯೊಂದು ವಲಯದೊಳಗಿನ ಅಪಾಯಗಳ ಮೇಲೆ ಹೆಚ್ಚು ಗಮನಹರಿಸಬೇಕು.

## ಉಪಸಂಹಾರ

ಡಿಜಿಟಲ್ ಯುಗವು ಅಭೂತಪೂರ್ವ ಬದಲಾವಣೆಗಳ ಸಮಯ. ಸಾರ್ವಜನಿಕ ಜೀವನದ ಪ್ರಪಂಚವು ಸರ್ಕಾರ, ಮಾರುಕಟ್ಟೆ ಮತ್ತು ನಾಗರಿಕ ಸಮಾಜದ ಮೂರು ಪ್ರಮುಖ ಕ್ಷೇತ್ರಗಳನ್ನು ಒಳಗೊಂಡಂತೆ ಜಾಲಬಂಧ ತಂತ್ರಜ್ಞಾನಗಳು ಹಿಡಿತ ಸಾಧಿಸುತ್ತಿದ್ದಂತೆ ಮೂಲಭೂತ ಬದಲಾವಣೆಗೆ ಒಳಗಾಗುತ್ತಿದೆ. ಹೊಸ ತಂತ್ರಜ್ಞಾನಗಳು ಮತ್ತು ಅವುಗಳ ವ್ಯಾಪಕ ಅನ್ವಯಿಕೆಯಿಂದ ಉಂಟಾಗುತ್ತಿರುವ ಬದಲಾವಣೆಗಳು ಇಪ್ಪತ್ತೊಂದನೇ ಶತಮಾನದ ಸರ್ಕಾರಗಳಿಗೆ ಉತ್ತಮವಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸಲು ಮಾತ್ರವಲ್ಲದೆ, ಮುಖ್ಯವಾಗಿ ನಾಗರಿಕರನ್ನು ಆಡಳಿತದ ಪ್ರಮುಖ ಕೆಲಸದಲ್ಲಿ ಮತ್ತೆ ತೊಡಗಿಸಿಕೊಳ್ಳಲು ಅವಕಾಶವನ್ನು ಒದಗಿಸುತ್ತವೆ. ಆದರೆ ನಾವು ಅಪಾಯಗಳನ್ನು ಸಹ ನಿರ್ಲಕ್ಷಿಸಬಾರದು. ಇತ್ತೀಚೆಗೆ ಎರಡು ಎ.ಐ ತಂತ್ರಜ್ಞಾನವನ್ನು ಹೊಂದಿದ ರೋಬೋಗಳನ್ನು ಸಂಭಾಷಣೆಗೆ ಬಿಟ್ಟಾಗ ತಮ್ಮದೇ ಆದ ಕೋಡ್‌ವರ್ಡ್ ಮೂಲಕ ಸಂಭಾಷನೆಯನ್ನು ಮಾಡುವುದರ ಮೂಲಕ ವಿಜ್ಞಾನಿಗಳನ್ನು ತಬ್ಬಿಬ್ಬುಗೊಳಿಸಿದ್ದನ್ನು ನೋಡಿದಾಗ ಮುಂದೆ ಎದುರಾಗುವ ಸಮಸ್ಯೆಗಳನ್ನು ಸಹ ಪರಿಗಣನೆಗೆ ತೆಗೆದುಕೊಂಡು ಸಂಶೋಧನೆ ಮಾಡಬೇಕಾಗಿದೆ.

## ಆಕರ ಗ್ರಂಥಗಳು

1. ಅಮಿಟಿ ಅಂತರಾಷ್ಟ್ರೀಯ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಸಮ್ಮೇಳನದ ಕಾರ್ಯವೈಖರಿ (2019), ಪುಟ 439-446
2. ವಿ. ಮರ್ದಾ "ಭಾರತದಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ನೀತಿ: ದತ್ತಾಂಶ-ಜಾಲಿತ ನಿರ್ಧಾರ ತೆಗೆದುಕೊಳ್ಳುವಿಕೆಯ ಮಿತಿಗಳು, ಫಿಲೋಸ್, ಟ್ರಾನ್ಸ್, ಆರ್.ಸೋಸಿ. ಏಮ್ಯಾಥ್ ಫಿಸಿಕ್ಸ್, ಎಂಗ್ ಸೈ, 2018, ಪುಟ-1.19
3. ಎಂ. ಹೆಂಗ್ಸ್ಟರ್. ಅನ್ವಯಿಕ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಮತ್ತು ನಂಬಿಕೆ-ಸ್ವಾಯತ್ತ ವಾಹನಗಳು ಮತ್ತು ವೈದ್ಯಕೀಯ ನೆರವು ಸಾಧನಗಳ ಪ್ರಕರಣ, ಏಮ್ಯಾಥ್ ಫಿಸಿಕ್ಸ್, ಎಂಗ್ ಸೈ, 2016, ಪುಟ-1.21
4. ಎಸ್.ಡ್ಯುಯೆಲ್ಲಿ: ತಂತ್ರಜ್ಞಾನ, ಮುನ್ಸೂಚನೆ, ಸಮಾಜ ಬದಲಾವಣೆ, ಏಮ್ಯಾಥ್ ಫಿಸಿಕ್ಸ್, ಎಂಗ್ ಸೈ, 2016, ಪುಟಗಳು 105-120