

VIKSIT BHARAT 2047: SHAPING INDIA'S FUTURE THROUGH INNOVATION AND INCLUSIVE GROWTH

Guest Editors

Dr.S.Selvanathan

Dr.T.Suguna

2026

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VIKSIT BHARAT 2047: SHAPING INDIA'S FUTURE THROUGH INNOVATION AND INCLUSIVE GROWTH

Guest Editors

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Preface

The Department of Commerce (SF), Virudhunagar Hindu Nadars' Senthikumara Nadar College (Autonomous), Virudhunagar, organised the 2nd International Conference on 'Empowering India Through Advancing Sustainable Development Goals for Viksit Bharat@2047' on 24th & 25 August, 2026. This International Journal of Business and Economics Research (IJBER) journal Special Issue titled "VIKSIT BHARAT 2047: Shaping India's Future Through Innovation and Inclusive Growth"is an outcome of this conference.

This special issue explores India's vision of becoming a developed nation by 2047. This vision aims to transform India into a country characterised by social progress, economic prosperity, environmental sustainability and efficient governance. It seeks to establish India as a leading global power while ensuring a high quality of life and equal opportunities for all its citizens. Building a self-sufficient country with a strong and flourishing economy is a major focus of the project.

I would like to express my heartfelt gratitude to the Managing Board of Virudhunagar Hindu Nadars' Senthikumara Nadar College (Autonomous), Virudhunagar, for its constant support and encouragement throughout the publication of this special issue.

My sincere thanks go to the President Thiru A.S.M.R. Mariappan, Vice-Presidents Thiru S.P.G.R.S. Venkatesh and Tmty B. Shanthi, Secretary and Correspondent Thiru U.S.M.Sampathkumar, Treasurer Thiru R. Kannan for their constant support throughout the publication of this special issue. I also extend my heartfelt thanks to the Principal Dr.A.Sarathi for his blessings, valuable support and guidance in bringing out this publication.

My sincere gratitude goes to all the paper contributors for sharing their knowledge and expertise in the publication of this special issue. This edited volume is a collection of articles submitted by academicians, research scholars, undergraduate and postgraduate students from various institutions.

Finally, I acknowledge the support of Dr.BGR Publications, Tuticorin, Tamil Nadu which was instrumental in publishing this special issue. We gratefully acknowledge the efforts taken by everyone who has helped us in getting this special issue published.

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List of Contributors

S. No.	*Paper ID*	Title	Page No.
1)	*INC 048*	Challenges in implementing Digital Banking Services in Rural Areas-A Study with reference to Virudhunagar District Dr. N. Vijayalakshmi	1
2)	*INC 088*	Workplace Gender Equality and Women's Empowerment: HR Strategies for an Inclusive Viksit Bharat *A. Josephine Reena, Dr. K. Famitha Begum*	15
3)	*INC 093*	Smart Cities and Sustainable Urban Development: Building Better Cities for the Future P. Vijaya	25
4)	*INC 106*	ESG Reporting and Corporate Sustainability: Enhancing Transparency and Stakeholder Trust A. Jenita Roseline, Dr. A. Fathima	36
5)	*INC 110*	Goods and Services Tax (GST) and Sustainable Growth of Small Scale Businesses: Evidence from Virudhunagar District C. Pandiselvi, Dr. R. Muthukrishnaveni	46
6)	*INC 116*	A Study on Consumer Buying Behaviour Towards Selective Electronic Home Appliances – With Special Reference to Washing Machines in Chennai City *S.A. Shabnam, Dr. R.Murugan*	58
7)	*INC 117*	Viksit Bharat @2047-A Road Map for Growth and Challenges *Dr. B.Sheeba Pearline, R. Saro Abinayapriya*	68
8)	*INC 118*	Emerging Trends in Digital Payment Architectures: An Empirical Assessment of Consumer Behavior and Security Perceptions *Sinu Mary Devasia*	76
9)	*INC 119*	Consumer Behaviour towards Sustainable Online Shopping In India: Opportunities and Challenges P.Karthiga, Dr. R.Muthukrishnaveni	84

10)	*INC 126*	Generative AI as a Tool for Startup Innovation in India *A. P. Jeyaram*	96
11)	*INC 135*	Beyond Green Claims: Greenwashing, Greenhushing and Transparent Sustainability Communication *Muthumari K*	103
12)	*INC 138*	ICT Skills and Employability among Engineering Students: Preparing the future workforce for Viksit Bharat@2047 *K. Vidhya, Dr. R.Muthukrishnaveni*	121
13)	*INC 151*	One Tax, Different Realities: Examining GST Compliance Behavior among Automobile-Sector Micro Enterprises from Kanyakumari to Madurai *R. Bagavathy Priya, Muthu Sundari R, Dr. J.Jeya Ani*	131
14)	*INC 174*	Women-Led Rural Entrepreneurship and Sustainable Economic Development: A Study of Women Entrepreneurs in Aruppukottai Taluk M.Bakyalakshmi, Dr. R.Muthukrishnaveni	152
15)	*INC 175*	A Study on Impact of Online Shopping on Consumer Buying Behaviour *Dr. K.Sounthara Priya*, L.Mukithasri, R.Ananthi*	164
16)	*INC 176*	A Study on Customer Satisfaction towards Online Food Delivery Services *Dr. S.Padma Priya, K.Jeyanthi, S.Bhuvaneswari*	172
17)	*INC 186*	Artificial Intelligence in Social Media Marketing for Higher Education: A Review of Emerging trends and practices Rosemary J, Dr. Kogila N	180
18)	*INC 212*	A Study on Factors Influencing the Purchase of Femi9 Sanitary Napkins in Virudhunagar *Dr. J.Premila, Dr. V.Sakthidevi*	196
19)	*INC 139*	Credit Cooperatives and Sustainable Development Goals in India: Opportunities, Challenges and Policy Perspectives *M. Dhanushkumar, Dr. K.Dhevan*	206

20)	*INC 172*	From Greenwashing to Green Integrity: Harnessing Artificial Intelligence for Transparent and Trustworthy ESG Governance Harini L, Anju DC, Pushpalatha MK, Srivatsa K	229

Challenges in Implementing Digital Banking Services in Rural Areas – A Study with reference to Virudhunagar District

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Abstract

The implementation of digital banking services in rural India has the potential to promote financial inclusion by connecting rural communities with the formal financial system. Despite significant progress in government initiatives and technological advancements, several challenges continue to hinder the effective adoption and use of digital banking services in rural areas. The major barriers include language constraints, limited digital and financial literacy, inadequate internet connectivity and digital infrastructure, limited access to smartphones, and persistent social and cultural factors such as a preference for cash transactions and a lack of trust in digital platforms. In Virudhunagar District, awareness and usage of digital banking services among rural residents are gradually increasing, although the level of adoption remains uneven. Younger and more educated individuals demonstrate greater awareness and use of digital banking platforms, while a considerable proportion of the rural population continues to have limited knowledge, skills, and confidence in using these services. The study emphasizes the need for targeted financial literacy programmes, local-language support for digital banking applications, improved internet and digital infrastructure, and regular digital banking training through financial institutions and other relevant agencies. The study primarily examines rural residents' awareness of digital transformation, their familiarity with digital financial services, the challenges they face in adopting digital banking, and the measures that can be undertaken to overcome these barriers.

Keywords: Digital banking, Rural development, Rural areas, Technology, Digitalization

Introduction

Digital payment methods have grown significantly in India, particularly since demonetization in 2016 and the launch of the Unified Payments Interface (UPI). The reality in rural India, however, paints a different image. Many rural towns still struggle to adopt digital payment methods, even with government support and expanded awareness campaigns. Widespread use is hampered by issues like low digital literacy, poor internet connectivity, restricted smartphones use, and worries about cyber security. The shift is also slowed down by traditional cash transaction preferences and socioeconomic circumstances. Rural residents often suffer restricted access to smartphones, dependable internet connectivity, and digital infrastructure. Despite these efforts, rural areas like Virudhunagar district continue to experience slow adoption of digital transactions. Virudhunagar District is largely rural dominated, with many people depending on agriculture and small businesses. Limited infrastructure and socio-economic challenges affect the adoption of digital financial services.

Review of Literature

Shinde Govind & Salinkhe Sanjay (2022) study on digital financial inclusion has been widely discussed in the context of India's rural development, especially after the launch of initiatives like Digital India and the expansion of National Payments Corporation of India platforms such as UPI. Studies highlight that digital financial instruments improve transparency, reduce transaction costs, and promote financial inclusion.

Subbarayan Amudhan, Banerjee Sayantani and J Poornima (2023) examine the effects of digital banking initiatives in rural regions. The review highlights how mobile banking, UPI, and online services enhance financial inclusion, transaction speed, and transparency. It also discusses improved access to credit and government benefits. However, barriers such as digital illiteracy, weak internet connectivity, cybersecurity risks, and customer trust issues remain significant. The authors conclude that awareness programs, infrastructure development, and policy support are vital for successful rural digital banking transformation.

Kumar D. & Mehra R. (2024) analyses the barriers to implementing a cashless economy in rural India. The paper highlights issues such as low digital literacy, inadequate banking infrastructure, poor internet connectivity, and lack of trust in digital payment

systems. It also discusses socio-economic factors, including income levels and resistance to technological change, that affect adoption. The study emphasizes the importance of government initiatives, awareness programs, and improved cybersecurity measures to encourage digital transactions. The author concludes that coordinated efforts are required to successfully promote cashless practices in rural areas.

Vasant Prachi, Garg Chahat and Chaporkar Vaibhavi (2025) explore the role of digital payment systems in empowering small-scale rural businesses. The study highlights how digital transactions enhance transparency, financial inclusion, and access to formal credit. It emphasizes improved market reach, reduced dependency on cash, and better record-keeping practices.

Knowledge of digital transformation

Digital transformation is a business strategy initiative that incorporates digital technology across all areas of an organization. It evaluates and modernizes an organization's processes, products, operations and technology stack to enable continual, rapid, customer-driven innovation. Knowledge of digital transformation among rural people refers to their awareness, understanding and effective use of digital tools and technologies in everyday life, education, farming, health, governance and income generation.

Table 1: Knowledge of digital transformation

Digital literacy	Using smartphones, digital payments (UPI), basic internet use
E-governance awareness	Accessing schemes like PM-Kisan, e-Seva or ration card portals
Agri tech solutions	Apps for weather forecasts, market rates, crop advisory
Health tech	Telemedicine, mobile health apps, health scheme portals
Education and skills	Online learning, YouTube tutorials, digital certificates
Financial inclusion	Online banking, micro-loans, insurance via mobile
Social media usage	Awareness campaigns, digital marketing, connectivity

Statement of the Problem

Lack of digital literacy, poor internet connectivity, inadequate awareness, security concerns, and difficulty using digital banking applications are some of the challenges rural customers encounter while adopting digital banking services. The level of acceptance and usage of digital banking services remains limited among some rural clients in Virudhunagar District, prompting a need to identify the principal hurdles and suggest effective strategies to promote digital banking accessibility and utilization.

Significance of Study

Determining the main obstacles to the implementation of digital banking in rural areas is beneficial. It evaluates rural clients' awareness and utilization of digital banking services. It aids banks in comprehending the unique requirements and challenges faced by rural clients. It offers details on how technological expertise and digital literacy affect the uptake of digital banking. It draws attention to issues with privacy, fraud, and cybersecurity. The results can assist banks in enhancing their customer service and digital banking infrastructure.

Scope of the Study

Customers in remote areas who utilize or have access to digital banking services are the subject of the study. The survey looks at consumer preference, usage frequency, and awareness of digital banking services. It highlights obstacles like slow internet access, low digital literacy, security issues, insufficient banking infrastructure, and trouble utilizing digital apps.

Objectives

- To examine different Issues and Challenges in the Implementation of Digitalization in Rural Banking in Virudhunagar District
- To assess the variables—such as communication networks, education, occupation, income, gender, and socioeconomic status that are impacting the digitization of rural banking.
- To examine potential areas that should be prioritized in order to digitize rural banking and contribute to India's transition to a digital economy.

Issues and Challenges in the Implementation of Digitalization in Rural Banking in Virudhunagar District

- **Poor Internet Connectivity**

  In some rural and interior areas, inconsistent mobile network and internet connectivity can interrupt mobile banking, UPI transactions and online banking services.

- **Low Digital Literacy**

  Many rural customers may know basic services such as ATM and debit cards but have limited knowledge of mobile banking, UPI, internet banking and other advanced digital services.

- **Lack of Awareness**

  Customers may not be fully aware of the benefits, procedures and safety measures associated with digital banking.

- **Fear of Cyber Fraud**

  Customers in remote areas are afraid of phishing, vishing, phony applications, OTP fraud, and other cyberthreats. RBI identifies cybersecurity and consumer trust as important risks in digital payments.

- **Lack of Trust in Digital Transactions**

  Some customers continue to prefer cash and face-to-face banking because they are uncertain about the safety and reliability of digital transactions.

- **Language Barriers**

  English-based applications and technical terminology can make digital banking difficult for customers with limited English proficiency. Local-language support is therefore important.

- **Limited Smartphone and Digital Device Access**

  Elderly and economically weaker customers may have limited access to smartphones, updated devices or reliable mobile data.

- **Resistance to Change**

  Customers who are accustomed to traditional branch banking may hesitate to shift to digital methods.

- **Inadequate Training and Guidance**

  Digital training programmes and financial-literacy camps may not consistently reach remote villages. The Virudhunagar-focused study also highlights the need for continuous digital training by banks.

- **Technical Problems and Transaction Failures**

  Server issues, network interruptions, failed UPI transactions, delayed OTPs and application errors can discourage customers from using digital banking.

- **Infrastructure Limitations in Rural Branches**

  Digital transformation requires adequate banking technology, connectivity, security systems and trained staff. RBI's requirements for RRB internet banking also emphasize technological and internal-control capabilities.

- **Socio-Economic Differences**

  Differences in education, income, age, occupation and access to technology can create a digital divide among rural customers.

Methodology

Research Design

This study uses analytical and descriptive research design. Rural consumer attributes are described in the descriptive element. The analytical component makes it possible to look at how rural consumers' buying patterns have changed as a result of using cashless payment methods.

Area of Study

This study was conducted in the rural areas of Virudhunagar District where the adoption of digital payments has increased recently as a result of government initiatives and the development of digital infrastructure.

Data Sources

Primary Data

The primary data have been collected through a well-structured questionnaire and Likert's 5 point scale type questions to assess consumer characteristics, frequency of use of cashless payment systems, spending behaviours, and preferences for payment methods.

Secondary Data

Data was acquired from publications such as journals, books, government reports and RBI publications and the Internet.

Sample Size & Sampling Method

The sample consisted of 120 rural respondents and was obtained through convenient sampling the use of convenience sampling is to ensure diversity. Respondents represent all ages, income levels and educational backgrounds.

Data Analysis Statistical Tools

Collected data was analysed by using Percentages, Tabular presentation, Simple hypothesis tests and Chi-Square.

Sampling framework:

There are 10 Taluks in Virudhunagar district. Table shows the name of taluk, number of Revenue villages and sample taken for present study.

Table 2: Sampling Framework

Name of the Taluk	Total Number of Revenue Villages	Sample Taken (No of respondent)
Virudhunagar	53	11
Sivakasi	36	7
Srivilliputtur	26	5
Rajapalayam	32	6
Sattur	53	11
Aruppukottai	83	17

Thiruchuli	150	30
Kariyapatti	107	21
Watrap	23	5
Vembakottai	37	7
Total	**600**	**120**

Source: Records of Revenue Department, Virudhunagar District.

Hypothesis

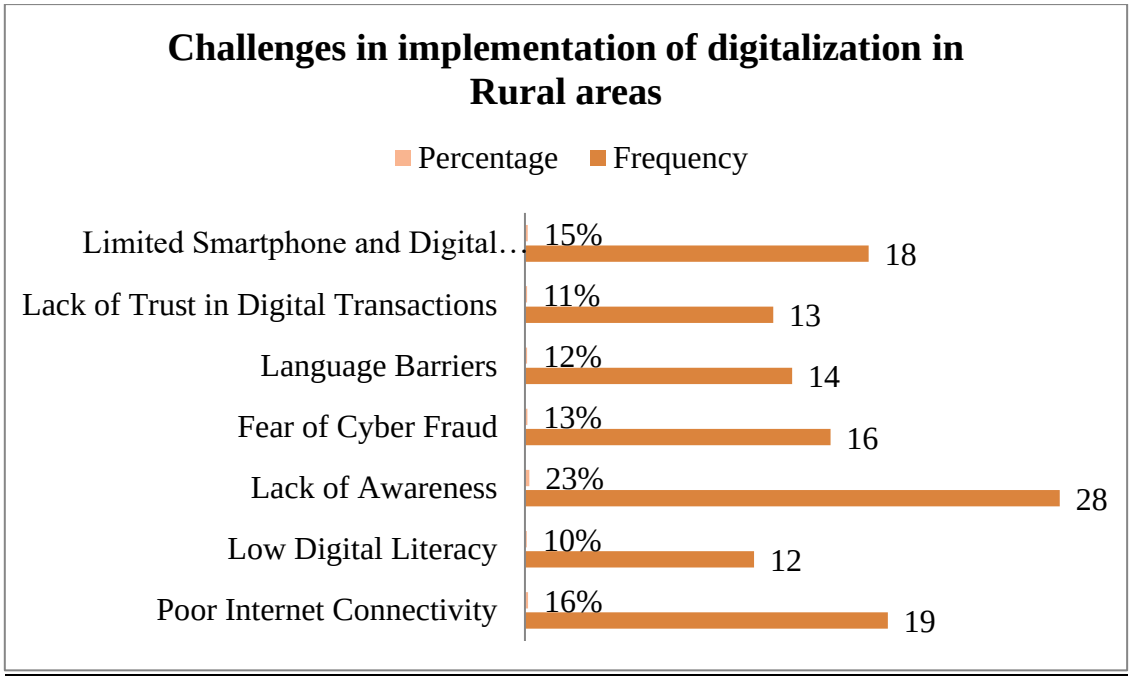
H_0: There is no significant relationship between the challenges faced by rural customers and their level of digital banking usage.

H_1: There is a significant relationship between the challenges faced by rural customers and their level of digital banking usage.

Data Analysis and Interpretation

Table 3: Challenges in implementation of digitalization in Rural areas

Challenges	Frequency	Percentage
Poor Internet Connectivity	19	16%
Low Digital Literacy	12	10%
Lack of Awareness	28	23%
Fear of Cyber Fraud	16	13%
Language Barriers	14	12%
Lack of Trust in Digital Transactions	13	11%
Limited Smartphone and Digital Device Access	18	15%
Total	120	100%



Mean and Standard Deviation

Using the seven frequency values: **19, 12, 28, 16, 14, 13, 18**

Table 4: Challenge

Challenge	Frequency
Poor Internet Connectivity	19
Low Digital Literacy	12
Lack of Awareness	28
Fear of Cyber Fraud	16
Language Barriers	14
Lack of Trust in Digital Transactions	13
Limited Smartphone and Digital Device Access	18
Total	**120**

Mean frequency = 17.14

Standard Deviation = 5.43 (sample SD)

So, the frequencies vary around the average of **17.14**, with a standard deviation of approximately **5.43**.

Chi-Square Test

Hypotheses

H_0: There is no significant relationship between the challenges faced by rural customers and their level of digital banking usage.

H_1: There is a significant relationship between the challenges faced by rural customers and their level of digital banking usage.

Since there are 7 categories and 120 respondents, the expected frequency under equal distribution is:

Expected frequency = 120 / 7 = 17.14

Table 5: Challenges

Challenges	Observed (O)	Expected (E)	$(O-E)^2/E$
Poor Internet Connectivity	19	17.14	0.20
Low Digital Literacy	12	17.14	1.54
Lack of Awareness	28	17.14	7.03
Fear of Cyber Fraud	16	17.14	0.08
Language Barriers	14	17.14	0.58
Lack of Trust in Digital Transactions	13	17.14	1.00
Limited Smartphone and Digital Device Access	18	17.14	0.04
Total	**120**	**120**	**10.32**

Chi-square result

Calculated $\chi^2 = 10.32$

Degrees of freedom:

$df = n - 1 = 7 - 1 = 6$

At **5% significance level**, the table value of χ^2 for 6 df is approximately **12.592**.

Since:

Calculated χ^2 (10.32) < Table χ^2 (12.592) - the null hypothesis is accepted**.**

Interpretation

There is no statistically significant difference among the reported frequencies of the various challenges at the 5% level of significance. Although lack of awareness has the highest frequency (28), the differences among the challenges are not statistically significant.

The exact p-value is approximately **0.112**, which is greater than 0.05.

Factors Influencing the Digitalization of Rural Banking

Communication Networks:

Availability and quality of mobile networks, internet connectivity and broadband facilities influence the ability of rural customers to use mobile banking, UPI and internet banking. Poor connectivity discourages digital transactions.

Education

Education improves customers' ability to understand digital banking procedures, applications, security practices and online transactions. Higher educational levels generally facilitate greater digital adoption.

Occupation

Occupation influences the frequency and purpose of digital banking use. Salaried persons, business people and self-employed individuals may have greater exposure to online payments and digital financial services.

Income

Income affects access to smartphones, internet services and other digital facilities. Customers with higher and stable income may be more likely to adopt digital banking services.

Gender

Gender can influence access to smartphones, financial independence, digital literacy and banking decision-making. Differences in access and confidence may affect digital banking adoption among men and women.

Socio-Economic Status

Socio-economic status, including income, education, occupation, living conditions and access to technology, can determine the ability and willingness of rural customers to use digital banking.

Age

Younger customers are generally more familiar with smartphones and digital applications, while older customers may prefer traditional branch-based banking.

Digital Literacy

Knowledge of smartphones, UPI, ATMs, mobile banking, internet banking and cybersecurity significantly affects the adoption of digital banking.

Awareness of Digital Banking

Awareness of available services, benefits, charges and procedures encourages customers to shift from cash and traditional banking to digital methods.

Availability of Smartphones

Ownership and availability of smartphones provide the basic technological access required for mobile banking and UPI transactions.

Probable Areas to be Focused

- **Improvement of Communication Networks** – Strengthening mobile networks, internet connectivity and broadband facilities in rural areas.
- **Digital Literacy** – Providing digital banking education and training to rural customers, particularly elderly and less-educated people.
- **Awareness Programmes** – Creating awareness about UPI, mobile banking, internet banking, ATMs and other digital banking services.
- **Cybersecurity and Customer Protection** – Educating customers about OTP fraud, phishing, fake applications and other cyber risks.
- **Affordable Digital Infrastructure** – Improving access to smartphones, internet services and digital banking facilities at affordable costs.

- **Local-Language Support** – Providing banking applications, instructions and customer support in Tamil and other locally understood languages.
- **Banking Staff Support** – Training bank employees and Business Correspondents to guide rural customers in using digital services.
- **Banking initiatives** – Banks and government programs like digital India, PM Jan Dhan Yojana and financial literacy camps have made positive impacts in introducing digital tools to the rural masses.
- **Reliable Digital Transactions** – Reducing transaction failures, server problems, delayed OTPs and other technical difficulties.
- **Financial Inclusion** – Ensuring that women, low-income groups, elderly persons, agricultural workers and other disadvantaged sections are included in digital banking.
- **Trust and Customer Confidence** – Building confidence in digital banking by ensuring transaction security, transparency and effective grievance redressal.

Conclusion

The introduction of digital banking services in rural India might greatly impact the country's financial landscape by connecting the informal and official financial systems. Although there have been notable advancements in government initiatives and technological advancements, this study shows that many challenges still stand in the way of rural areas successfully adopting digital banking. There are several obstacles that have been identified, including a lack of knowledge about digital and financial matters, problems with the internet and infrastructure, limited availability of smartphones, language barriers, and long-standing social and cultural issues like a preference for cash transactions and distrust of digital platforms. Overall, the successful implementation of digital banking in rural areas requires a combination of technology, infrastructure, awareness, trust, and continuous customer support. With appropriate measures to overcome these challenges, digital banking can significantly contribute to the economic development of rural communities in Virudhunagar District by promoting financial inclusion, reducing transaction costs, encouraging cashless transactions, and providing wider access to formal financial services.

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Workplace Gender Equality and Women's Empowerment: HR Strategies for an Inclusive Viksit Bharat

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Abstract

The Viksit Bharath 2047 vision can not be reduced to capital GDP growth or technological modernization alone; it also rests on whether India's workforce genuinely includes women at entry level not just at entry points. Women's education attainment in India has risen steadily for two decades, yet female labour force participation and leadership representation still lag well behind global norms, and organizations differ enormously in how seriously they build human resource (HR) practices design to close that gap. This study looks at whether gender-equitable HR practices-covering pay equity, flexible work, mentorship and sponsorship, leadership access, and protection against harassment-or actually related to how empowered and how committed women employees feel, and whether empowerment is the mechanism carrying that effect through to commitment. Two hundred and twenty women employees working across IT, banking, and higher-education institutions in Tamil nadu completed a structured survey; the data where analysed through descriptive statistics, Pearson correlation, and bootstapped mediation using SPSS and PROCESS. Gender-equitable HR practices turned out to be positively linked to both psychological empowerment and organizational commitment, and empowerment partially explained why the two were connected. In practical terms, HR strategy seems to build loyalty among women employees when it actually changes how capable, autonomous, and consequential they feel at work-not simply when a policy exists on paper. The paper situates these findings within empowerment theory as applied to the Indian workplace and offers organizations a way to think concretely about what an inclusive HR strategy under Viksit Bharath 2047 should look like in practice.

Keywords: Gender equality, Women's empowerment, Human Resource strategy, organizational commitment, Viksit Bharath, inclusive development

Introduction

The Viksit Bharath 2047 vision sets out India's path towards becoming a developed nation by 2047, the hundredth year independence, built around growth that is inclusive, sustainable and globally competitive. Gender equality is not a side issue within that vision; it is close to its core. It is hard to call a nation developed if half its population remains thinly represented in the workforce and almost invisible at the top of it. India's female labour force participation rate sits well under the global average, and the women who are in the workforce cluster heavily in junior positions-representation drops off sharply the higher one looks up the organizational chart. The world economic forum's global gender report (2023) placed India well outside the top half of countries on economic participation and opportunity specifically, even as the country closed ground on some other gender gap indicators-a reminder that workplace inclusion has not kept pace with progress elsewhere.

HR management is where this gaps either narrows or hardens further. A policy statement on gender equality does very little on its own; what matters is whether it shapes how pay actually get set, whether flexible work is something employees can use without penalty or only something listed in a handbook, who gets picked for mentorship and high visibility assignments, and how seriously harassment complaints are handled once they are filed. Plenty of organizations now describe gender inclusion as a strategic priority. Whether that description changes how empowered and how loyal women employees actually feels, as opposed to functioning mainly as a compliance exercise, is still an open question-particularly in the Indian context, where this relationship has not been tested empirically in much depth.

This paper takes up that question. It asks whether gender-equitable HR practices are linked to women employees psychological empowerment and organizational commitment, and whether empowerment is the channel through which HR practices end up shaping commitment. They aim is to give some empirical grounding to a National conversation that, so far, has mostly stayed at the level of policy language-what an inclusive Viksit Bharath workforce strategy should actually mean inside an organization, day to day.

Review of Literature

Gender equality and women's empowerment: Theoretical Grounding

What does it actually mean for a women to be "empowered" at work, as opposed to merely present? Kabeer (1999) answers that by breaking empowerment into three connected pieces: having access to resources, being able to exercise agency, ad actually achieving outcomes that matter to the person herself, not just to the organisation reporting on her. The framework grew out of development economics, but it has proven remarkable portable into workplace research over the past two decades. Eagly and Carli (2007) add a useful image to this picture. Rather than single glass ceiling that women hit once near the top, they describe a labyrinth: a scattering of smaller obstacles, from bias in performance evaluation to an uneven share of domestic responsibility to thinner access to sponsors, spread across the whole career, not stacked at its end. A labyrinth cannot be dismantled with one policy change, because no single obstacle is really the obstacle.

Organizations as Gendered Structures

There is an older and still influential argument, going back to Acker (1990), tat organisations are gendered by design and not merely by the people who happen to work in them. Job structures, promotion timelines, and unstated expectations about long hours or constant availability were built, historically, around an unencumbered worker- in practice, someone without primary caregiving duties, which in most households still means a man. This matters for why policy alone tends to fall short. Ab equal-opportunity statement sits on top of a structure that was never neutral to begin with, so HR strategy that wants to actually close a gap has to work against that underlying structure rather than assume the field is already level once the policy is singed off.

HR Strategies for Gender Equality

So what actually works? A fairly consistent shortlist turns up across both the academic literature and practitioner reporting: pay structures that get audited rather than assumed to be fair, flexible-work arrangements employees can use without quietly being penalised for it, mentorship and sponsorship that puts women in front of people who can actually promote them, a leadership pipeline that is designed on purpose, not left to sort itself out, and harassment mechanisms that carry real consequences (Catalyst, 2023; Broadbridge & Simpson, 2011). In the Indian setting specifically, Budhwar and Varma (2011) observe that HRM has broadly

moved toward more strategic practice over the last decade or so. How far that shift has actually gone, though, still depends heavily on sector, and on whether a given organisation treats gender-inclusive design as central to its strategy or files it under compliance and moves on,

Women's Workforce Participation in the Indian Context

The numbers, at a national level, tell a fairly stark story. The International Labour Organization's India Employment Report (2023) puts female labour force participation well below male participation, ad below several comparable emerging economics, despite two decades of steady gains in women's education. That gap has not gone unnoticed in policy circles: NITI Aayog's SDG India Index (2023) tracks gender equality as its own indicator instead of folding it into broader growth measures, which suggests workforce inclusion is meant to sit inside India's development story, not trail behind it. But national policy language and what actually happens inside a particular workplace are two different things, and Cooke (2018) is a useful check on that gap – the same HR practice, she argues, can function as genuinely empowering in one institutional setting and as little more than window dressing in another. Which of those two is closer to what this study's respondents are living through is, essentially, the question this paper tries to answer.

Linking HR Practices to Empowerment and Commitment

Two established scales make it possible to actually test that question instead of just speculating about it. Spreitzer (1995) splits psychological empowerment at work into four parts: meaning, competence, self-determination, and impact, giving researchers a validated way to check whether a given HR practice lands as genuinely empowering or simply as a formality nobody feels the effect of. On the outcome side, Meyer and Allen's (1991) three-component model of organisational commitment, particularly its affective component, is widely used to capture the kind of emotional attachment that tends to follow when someone feels valued and properly supported at work. Line these two up and a layered picture starts to take shape: HR practices sit upstream, psychological empowerment is the more immediate psychological response, and organisational commitment is the outcome further downstream, the one that actually predicts whether someone stays. That full chain, upstream practice through to downstream commitment, has rarely been tested as a single model, and almost never with a sample made up specifically of women employees inside Indian service-sector organisations.

Research Gap

Gender-inclusive HR policy, psychological empowerment, and organisational commitment have each been studied fairly extensively, but usually apart from one another. Few studies test how gender-equitable HR practices relate to commitment among women employees in India by way of psychological empowerment specially, and fewer still connect that relationship to the national inclusive-growth language of Viksit Bharat 2047. Tis paper works from primary survey data collected from women employees across three service-sector industries to address that gap.

Objectives of the Study

1. To assess the extent of gender-euitable HR practices adopted by organisations in the sample.
2. To examine the level of psychological empowerment among women employees.
3. To examine the relationship between gender-equitable HR practices and organisational commitment.
4. To evaluate the mediating role of psychological empowerment in this relationship.

Hypotheses

H1: Gender-equitable HR practices are positively associated with women employees psychological empowerment.

H2: Gender-equitable HR practice are positively associated with organisational commitment.

H3: Psychological empowerment is positively associated with organisational commitment.

H4: Psychological empower mediates the relationship between gender-equitable HR practices and organisational commitment.

Research of Methodology

Research Design

The population comprises women employees working in IT/ITES, banking and finance, and higher-education institutions in Tamil Nadu. A sample of 220 women employees (N = 220) was selected using purposive-cum-convenience sampling.

Data Collection Instrument

A structured, self-administered questionnaire was used, comprising four sections: (i) demographic profile, (ii) a gender equitable HR practices scale covering pay equity, flexible work arrangements, mentorship and sponsorship access, leadership-development opportunity, and anti-harassment support, (iii) a psychological empowerment scale adapted from Spreitzer (1995), and (iv) an organisational commitment scale adapted from Meyer and Allen (1991). All items were measured on a five-point Likert scale ranging from "strongly disagree" to "strongly agree", and were refined through a pilot study for contextual relevance.

Statistical Tools

Data were analysed using SPSS ad the PROCESS macro for mediation analysis. Descriptive statistics summarised sample characteristics and and construct means, Cronbach's alpha assessed reliability, Pearson correlation examined bivariate relationships, and bootstrapped mediated regression tested the hypothesised indirect effect.

Data Analysis and Results

Demographic Profile of Respondents

Table 1: Demographic Profile of the Respondents

Variable	Category	Frequency	Percentage
Age	21-30 Years	96	43.6%
	31-45 Years	88	40.0%
	Above 45 years	36	16.4%
Sector	IT / ITES	102	46.4%
	Banking & Finance	68	30.9%
	Higher Education	50	22.7%
Level	Entry / Junior	94	42.7%
	Middle / Senior	126	57.3%

Reliability Analysis

All constructs exceeded the acceptable reliability threshold of 0.70 (gender-equitable HR practices, a = 0.84; psychological empowerment, a = 0.81; organisational commitment, a = 0.79), indicating good internal consistency.

Correlation Analysis

Table 2: Correlation Matrix of Gender-Equitable HR Practices, Psychological Empowerment, and Organisational Commitment

This table presents Pearson correlation coefficients among the study variables. All relationships were positive and statistically significant at the 0.01 level.

Variable	1	2	3
1. Gender-Equitable HR Practices	1		
2. Psychological Empowerment	0.52**	1	
3. Organisational Commitment	0.46**	0.58**	1

Mediation Analysis and Hypothesis Testing

Bootstrapped mediation analysis (5,000 resamples) was conducted with organisational commitment as the dependent variable, gender-equitable HR practices as the predictor, and psychological empowerment as the mediator. The overall model was statistically significant, $F(2.217) = 41.86$, $p < .001$, explaining 36% of the variance in organisational commitment ($R^2 = 0.36$).

Table 3: Mediation Analysis and Hypothesis Testing Results

Hyp.	Path	β / Effect	95% CI
H1	HR Practices -> Psychological Empowerment	0.52	[0.41, 0.63]
H2	HR Practices -> Organisational Commitment (direct)	0.21	[0.09, 0.33]
H3	Psychological Empowerment -> Organisational Commitment	0.44	[0.33, 0.55]
H4	Indirect effect via Psychological Empowerment	0.23	[0.15, 0.32]

Discussion

All four hypotheses held up. Gender-equitable HR practices were significantly related to psychological empowerment (H1), and to organisational commitment both on their own (H2) and through empowerment (H3, H4). What stands out is that the indirect path through empowerment was roughly as strong as the direct one – HR practices seem to build commitment largely by changing how competent, autonomous, and consequential women employees feel day to day, and not just through the practical terms of the practices themselves. That tracks with Kabeer's (1999) point that empowerment is about agency and achievement, not just access: a flexible-work policy or a mentorship scheme existing on paper appears to matter far less than whether women employees feel they can actually use it an shape their own outcomes with it.

There is also a link back to Acker's (1990) argument about gendered organisational structures. Where HR practices seemed to push against structural bias directly – audited pay rather than assumed fairness, flexible work people could really take up, sponsorship that put women in front of real decision-makers – the empowerment effect came through strongest. For organisations trying to act on the inclusive-growth side of Viksit Bharat 2047, tis points toward treating psychological empowerment as something to actually measure alongside HR policy, instead of assuming that adopting a policy is the same thing as it working.

Theoretical and Practical Implications

Theoretical Implications

The study adds to empowerment theory in the Indian workplace by showing, empirically, that psychological empowerment is the mechanism carrying gender-equitable HR practices through to organisational commitment. That gives a more precise account of how such practices end up mattering for retention among women employees specifically, rather than assuming the link is director of self-evident.

Practical Implications

For organisations, this suggests gender-equity HR strategy is better judged by what it actually does for women employees' sense of competence, autonomy, and impact than by whether the relevant policies simply exist. Active sponsorship works differently from a mentorship list nobody follows up on; audited pay equity works differently from assumed

fairness; leadership-pipeline design works differently when it carries measurable representation targets. HR teams would do well to track psychological empowerment as an intermediate metric, alongside the engagement and attrition numbers they already collect, when they assess whether a gender-inclusion initiative is actually working.

Limitations and Scope for Future Research

Because the design is cross-sectional, casual direction among the study's constructs can't be established with certainty. The sample also comes from three service-sector industries in Tamil Nadu, So the findings may not generalise cleanly to manufacturing, informal-sector, or rural employment, where women's workforce participation runs into a different set of structural constraints. A longitudinal design would help future work track how empowerment and commitment shift as HR strategies mature; extending the model to other sectors and states, and testing moderators such as marital and caregiving status, sector, and organisational size, would also be worth pursuing.

Conclusion

Gender-Equitable HR practices are positively linked t organisational commitment among women employees, and that link runs substantially through psychological empowerment, not simply through the existence of the policies themselves. For India's Viksit Bharat 2047 vision, this suggests that closing workforce gender gaps has less to do with whether equal-opportunity policy exists and more to do with whether organisations build HR strategy that women employees actually experience as empowering. Putting that logic into practice offers a concrete, organisation-level way to turn a national vision of inclusive growth into something real inside a workplace.

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Smart Cities and Sustainable Urban Development: Building Better Cities for the Future

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Abstract

The rapid growth of urbanization has presented numerous challenges to cities worldwide, including traffic congestion, pollution, waste management, high energy consumption, water shortages, and pressure on public services. In this regard, smart cities have come to the forefront of important solutions for coping with rapid urbanization. A smart city integrates advanced technologies, such as the Internet of Things and artificial intelligence, into city management and services to enhance efficiency and improve the quality of life of its inhabitants. However, technology itself cannot create a smart and sustainable city. Achieving sustainable urban development requires integrating environmental sustainability with social inclusiveness, economic development, good governance, and citizens' participation. His paper reviews the concept of smart cities within the perspective of sustainable urban development, emphasizing the relationship between smart transportation, energy, water, waste management, governance, and environmental sustainability. Emphasizing the relationship between smart transportation, energy, water, waste management, governance, and environmental sustainability. The research design for this study is descriptive and analytical. Secondary data, including books, journal articles, reports, and articles, have been utilized. This study has found that smart technologies enable resource-efficient and service-effective cities however; significant challenges remain, such as the digital divide, high implementation costs, data security, and institutional coordination. In this respect, smart cities could play a very important role in sustainable urban development with good governance, active citizen participation, and responsible resource use.

Keywords: Smart cities, sustainable urban development, technology, smart governance, sustainability, urbanization

Introduction

The world is urbanizing at an unprecedented rate. People are migrating to urban centers in search of better employment opportunities, education, healthcare services, and an overall better quality of life. However, the rapid growth of cities has created several social, economic, and environmental challenges, including traffic congestion, pollution, housing shortages, waste management, water shortages, and high energy consumption.

Sustainable urban development seeks to attain social, economic, and environmental sustainability in meeting the needs of present and future generations through prudent management of the urban environment. It is a process that ensures economic development and social inclusion without compromising the environment. In this regard, the concept of smart cities has been widely applied to upgrading urban centers through modern technologies. Thus, smart cities represent an emerging concept of managing urban services through ICT and digital technologies. According to Giffinger et al. (2007), a smart city can be defined by six dimensions: smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. Caragliu et al. (2011) define smart cities as "urban centers cannot be considered as simply the outcome of investments in human capital and technology, but rather as the result of integrated capitals, infrastructures, and powerful participatory governance processes" (p. 70). On the other hand, Hollands (2008) argues that "smart cities should not only be concerned with technology and corporate-led approaches to urban development but also with social justice, environmental sustainability, and citizen well-being" (p. 165). The United Nations Development Programme (UNDP, 2015) has called upon nations to make cities inclusive, safe, resilient, and sustainable. Smart cities can play a significant role in promoting sustainable urban development. This study examines the role of smart cities in promoting sustainable urban development. The study focuses on smart technology and governance, transportation, energy, water, waste management, and the environment.

Objectives of the Study

This study is guided by the following objectives:

1. To understand the concept of a smart city.
2. To examine the relationship between smart cities and sustainable urban development.

3. To determine the role of technology in smart cities.
4. To identify the economic, social, and environmental benefits of smart cities.
5. To identify the major challenges facing smart cities.
6. To suggest ways of promoting sustainable cities.

Review of Literature

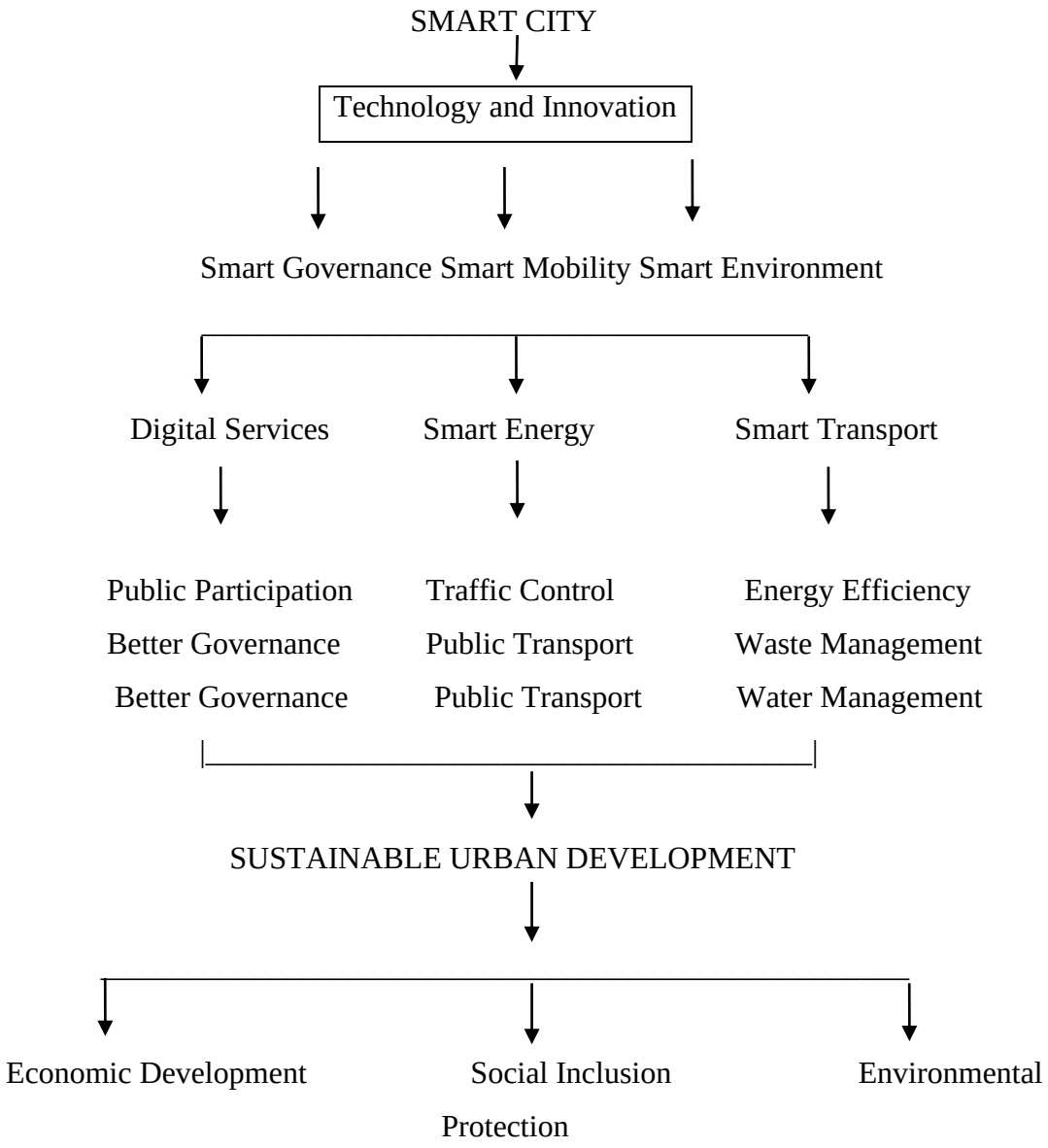
Several scholars have written about smart cities, such as Giffinger et al. (2007), Caragliu et al. (2011), Hollands (2008), Nam and Pardo (2011), Albino et al. (2015), and Batty et al. (2012)..Giffinger et al. (2007) developed a framework that defines the concept of a smart city. The framework identifies six key dimensions in which a city can be considered smart, including the economy, people, governance, mobility, environment, and living. On the other hand, Caragliu et al. (2011) argue that smart cities require investment in human capital, social capital, communication, transportation, and governance. Hollands (2008) contends that smart city development should not be used to promote corporate-led approaches to urban development but rather focus on social justice and environmental sustainability. Nam and Pardo (2011) provide a comprehensive overview of smart cities and discuss the role of technology, people, and institutions in promoting smart cities. Batty et al. (2012) examine the role of information technology in building smart cities. Lastly, Albino et al. (2015) discuss the different definitions of smart cities that have been proposed by various researchers.

Methodology

A descriptive and analytical research design is used for the study. It makes extensive use of secondary data sourced from various materials, including books, journals, reports, and articles. The research uses unpublished material, including reports and research studies on smart cities. The study also uses data from the United Nations reports and publications, including the World Cities Report and the Sustainable Development Goals progress report. The study focuses on published material, including books and articles. The study uses a thematic analysis approach. The following themes were used: smart governance, transportation, energy, water, waste management, environment, and social inclusion.

Conceptual Framework

Diagram 1: Smart cities and sustainable urban development



Role of Smart Cities in Sustainable Urban Development

Smart Governance

Smart governance involves the use of technology to promote transparency and accountability in governance. The use of digital systems in governance facilitates faster delivery of public services, improves public participation in governance, and enhances access to information. Digital governance can also help reduce corruption and promote good governance. According to Nam and Pardo (2011), "Smart governance is smart because not only the use of new technologies but also the inclusion of people and institutions in the decision-making process" (p. 289).

Smart Transportation

Congestion has become a significant challenge in urban centers worldwide. Congestion causes adverse environmental effects, increases travel time, and raises the cost of transportation. Smart transportation involves the use of technology to control traffic and promote the efficient use of transportation. The use of smart traffic lights and digital systems can help control congestion and reduce the associated negative effects. According to Batty et al. (2012), smart cities can use real-time data to monitor and manage transportation effectively.

Smart Energy Management

Modern cities are highly dependent on energy. The use of fossil fuels and other non-renewable sources of energy have adverse environmental effects. Smart energy management involves the use of technology to monitor and control the use of energy. Smart energy systems can help reduce energy waste and promote the use of clean energy. According to Bibri and Krogstie (2017), smart energy systems can help reduce the ecological footprint of cities.

Smart Water Management

Water is a critical resource in urban centers. Smart water management involves the use of technology to monitor and control the use of water. Smart water systems can help reduce the amount of water wasted in the process of transporting water and promote efficient use of water. According to Albino et al. (2015), smart water systems can help monitor and control water use in cities.

Smart Waste Management

Waste management is a significant challenge in urban centers. The improper disposal of waste causes adverse environmental effects. Smart waste management involves the use of technology to promote efficient waste collection and disposal. Smart waste management can help reduce the amount of waste that goes to landfills and promote recycling. According to Albino et al. (2015), smart waste management can help reduce the environmental impact of waste.

Data and Analysis

The following table presents an **illustrative analysis** based on the major themes identified in the literature.

Table 1: Smart City Technologies and Their Benefits

Sector	Smart Technology	Major Benefit
Transportation	Intelligent traffic systems	Reduces traffic congestion
Energy	Smart meters and smart grids	Improves energy efficiency
Water	Digital sensors	Detects leakage and saves water
Waste	Smart waste collection	Improves waste management
Governance	E-governance platforms	Improves public services
Environment	Air-quality monitoring	Helps control pollution
Buildings	Smart building systems	Reduces energy use

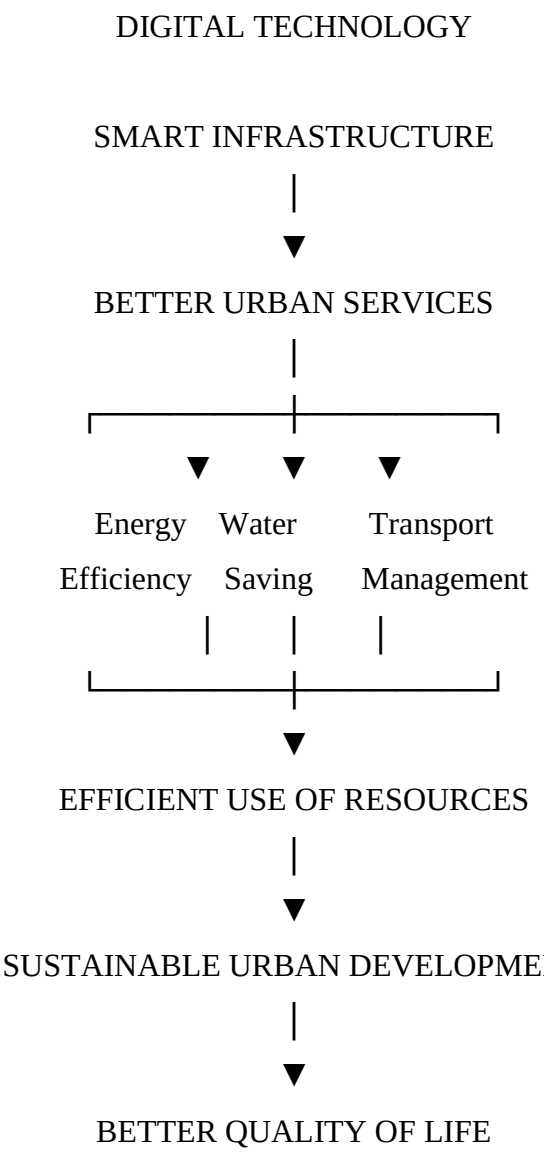
The table shows that smart technologies can support sustainable development by improving the use of resources and public services.

Table 2: Contribution of Smart Cities to Sustainability

Area	Economic Benefit	Social Benefit	Environmental Benefit
Smart transportation	High	High	High
Smart governance	Medium	High	Medium
Smart energy	High	Medium	Very High
Smart water management	Medium	High	High
Smart waste management	Medium	Medium	Very High
Digital inclusion	Medium	Very High	Medium

Note: The categories are based on the data gathered from the review of literature.

Diagram: Technology and Sustainability



This diagram explains how technology can improve urban services, conserve resources, and support sustainable development.

Major Challenges of Smart Cities

Digital Divide

Some people may be excluded from accessing digital services due to a lack of access to smartphones and other digital devices. Moreover, some people may lack the skills to use digital technology. The exclusion of some populations from accessing digital services can create a digital divide.

Data Privacy and Security

Smart cities generate and store a significant amount of data. According to Kitchin (2014), "The datafication of the city has the strength to open up new domains of their surveillance and control" (p. 9). Therefore, the issue of data security and privacy needs to be considered when developing smart cities.

High Cost

The development of smart cities requires a lot of investment in digital infrastructure. Moreover, the maintenance of the infrastructure is also costly. These high costs may hinder the development of smart cities, especially in developing countries.

Institutional Coordination

Smart city development requires the collaboration of various institutions. Lack of coordination may hinder the efficient implementation of smart city projects.

Social Inequality

Smart cities may increase social inequality because the benefits of smart city initiatives may accrue mainly to the middle and upper classes while the lower classes may be left out.

Findings of the Study

Based on the above discussion, this study concludes the following:

1. Smart technologies may improve transportation, energy, water, and waste management.
2. Smart cities promote sustainable urban development and contribute to the achievement of the UNSDGs
3. Smartness does not come from technology alone
4. Good governance and participation are necessary for promoting smart cities.
5. Smart energy and transport systems reduce cities' ecological footprint.
6. In developing smart cities, the digital divide issue has to be tackled.
7. Data privacy and security have to be guaranteed in smart city development.

8. Development of smart cities should emphasize social inclusion and environmental conservation.
9. Institutional capacity development is very important for the promotion of smart cities.
10. Smart city development should be demand-driven

Suggestions

On the bases of findings the following suggestions are recommended

1. Smart city development should be driven by local community needs.
2. State parties need to make substantial investments in promoting digital inclusion.
3. Governments should promote public participation in smart city development.
4. Privacy and data security concerns must be addressed in smart city development
5. Smart cities should focus on using renewable energy.
6. Public transport services need to be developed and improved by state parties.
7. State parties should make necessary investments in local government capacity building.
8. In smart city development, governments need to pay attention to poor and vulnerable groups.
9. Governments should develop indicators to measure the social, economic, and environmental impact of smart cities.
10. Smart city development should be aligned with the United Nations Sustainable Development Goals.

Conclusion

Smart technologies are powerful drivers of sustainable urban development. Smart systems for transport, energy, water, and waste management may be developed with many technologies. However, no amount of technology can make a city "smart." Apart from using smart technologies, a city needs proper governance, social inclusiveness, and environmental sustainability to be considered a sustainably smart city. This study shows that smart technologies have the potential to create resource-efficient and improved public services; however, several barriers limit the development of smart cities, including the digital divide,

investment costs, and data security. Therefore, it is imperative to focus on developing smart cities that are inclusive, green, efficient, and safe as a new model of urban development.

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ESG Reporting and Corporate Sustainability: Enhancing Transparency and Stakeholder Trust

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Abstract

Corporate sustainability has become an essential component of modern business strategy as organizations face increasing environmental, social, and governance (ESG) expectations from investors, regulators, customers, employees, and other stakeholders. ESG reporting provides a structured mechanism for companies to measure, disclose, and communicate their performance in areas such as climate change, resource efficiency, employee welfare, human rights, ethical practices, and corporate governance. This paper examines the relationship between ESG reporting and corporate sustainability, highlighting how transparent and reliable sustainability disclosures can support responsible decision-making, risk management, stakeholder trust, and long-term value creation. It also discusses key ESG reporting frameworks, sustainability indicators, and the growing importance of regulatory requirements. The study emphasizes that ESG reporting should extend beyond compliance and become an integral part of corporate strategy and performance management. Effective integration of ESG principles can help organizations improve operational efficiency, manage sustainability risks, strengthen their reputation, and contribute to broader sustainable development goals.

Keywords: ESG Reporting, Corporate Sustainability, Environmental, Social, Governance, Sustainability Performance, Stakeholder Trust, Risk Management, Transparency, Long-term Value Creation, Sustainable Development, Corporate Strategy

Introduction

ESG stands for **Environmental, Social and Governance**. ESG reporting is the process of measuring and disclosing a company's performance related to environmental,

social, and governance factors. Corporate sustainability focuses on achieving long-term business success while considering the interests of society and the environment.

ESG reporting provides stakeholders with information about a company's sustainability performance, risks, policies, and practices. It helps organizations demonstrate transparency and accountability.

Corporate sustainability means conducting business in a way that balances **economic growth, environmental protection, and social well-being**. It focuses on creating long-term value rather than only short-term profits.

Objective of the study

- To examine the environmental, social, and governance factors considered in ESG reporting.
- To analyze how ESG practices contribute to long-term business performance and sustainable development.
- To identify the role of ESG reporting in improving transparency, accountability, and stakeholder trust.
- To understand the challenges faced by companies in implementing effective ESG reporting.

Significance of the Study

- This study is significant as it highlights the role of ESG reporting in promoting corporate sustainability and responsible business practices. ESG reporting helps organizations measure and communicate their environmental, social, and governance performance in a transparent manner. It enables companies to identify sustainability-related risks, improve accountability, strengthen stakeholder trust, and support informed decision-making. The study also emphasizes the importance of integrating ESG factors into corporate strategy to achieve long-term business performance and value creation. Furthermore, effective ESG practices can help organizations address environmental and social challenges while contributing to sustainable development.

Research Methodology

This study follows a descriptive research approach based on secondary data. Information is collected from research journals, company annual reports, sustainability reports, ESG disclosures, and relevant websites and publications. The collected data is analyzed to understand the role of ESG reporting in promoting corporate sustainability, transparency, stakeholder trust, and long-term business performance.

Importance of ESG Reporting

ESG reporting can help organizations:

- Improve transparency and accountability
- Identify sustainability-related risks and opportunities
- Strengthen stakeholder confidence
- Support informed investment decisions
- Improve business and risk management
- Monitor sustainability performance
- Enhance corporate reputation
- Create long-term value

Major Reporting Frameworks

GRI (Global Reporting Initiative): Provides standards for reporting an organization's impacts on the economy, environment, and people.

ISSB (International Sustainability Standards Board): Issued **IFRS S1** and **IFRS S2** in June 2023, establishing an investor-focused global baseline for sustainability and climate-related disclosures.

GRI and ISSB standards can also be used together because they serve complementary purposes—GRI focuses broadly on impacts and stakeholders, while ISSB focuses on sustainability-related information relevant to investors and financial markets.

Theoretical Underpinnings

- Several theories underpin the rationale and effects of ESG reporting:

Stakeholder Theory argues that companies should create value for all stakeholders not just shareholders—by addressing their expectations and concerns, thereby enhancing legitimacy and trust. ESG reporting aligns with this theory by making corporate practices transparent to diverse stakeholder groups.

Signaling Theory says that corporations use ESG disclosures as signals to communicate commitment to sustainability and ethical conduct—demonstrating competence and reliability to investors and other stakeholders.

Legitimacy Theory points that organizations disclose information to align with societal norms and expectations, maintaining legitimacy in the public eye. ESG reporting thus acts as a mechanism for corporations to demonstrate conformity to rising sustainability standards.

How ESG Reporting Enhances Corporate Transparency

❖ **Reducing Information Asymmetry**

Corporate transparency means a company openly and honestly shares information about its activities, policies, impacts, and results with its stakeholders. ESG reporting helps reduce the gap between what a company knows and what stakeholders know. ESG reports provide information about environmental risks, social issues, and governance practices that may not be shown in financial reports. This transparency helps investors and other stakeholders make better and more informed decisions.

❖ **Accountability and Ethical Governance**

Transparent ESG reporting helps companies take responsibility for their actions by setting clear goals, measuring performance, and tracking progress. Regular reporting encourages companies to carefully monitor their activities and share information with stakeholders. By reporting both achievements and challenges, companies show honesty, responsibility, and good governance.

❖ **Stakeholder Communication and Trust**

ESG reporting helps companies communicate regularly with their stakeholders. Companies collect feedback from customers, employees, investors, and others and use their

views when making ESG plans and reports. This shows that the company listens to stakeholders and values their opinions. It also improves transparency and builds long-term trust.

Building Trust Through Transparency

Meaning of Stakeholder Trust

Stakeholder trust means the confidence that investors, employees, customers, regulators, and communities have in a company. It shows that stakeholders believe the company will act honestly, responsibly, and ethically. Trust helps companies build strong long-term relationships, attract investors, satisfy customers, motivate employees, and maintain a good reputation.

Transparency and Stakeholder Confidence

Transparency plays an important role in building stakeholder trust. When companies provide clear, accurate, and reliable ESG information, stakeholders can understand the company's actions and performance. Open reporting reduces doubts and helps stakeholders feel more confident about the company.

Good ESG reporting can also improve the company's reputation, customer loyalty, investor confidence, and long-term relationships with stakeholders.

ESG Reporting and Investor Decisions

Investors use ESG information to understand a company's future risks and opportunities. Clear and reliable ESG reporting helps investors make better investment decisions. It reduces uncertainty and provides a better understanding of the company's performance and plans. Good ESG disclosure can also improve investor confidence and help companies attract investment.

Evidence from Practice: ESG Reporting Outcomes

Enhanced Corporate Reputation

Companies that provide clear and transparent ESG information can build a positive image among customers, employees, investors, and business partners. Demonstrating responsible environmental, social, and governance practices helps strengthen stakeholder trust

Access to Capital and Investment

Transparent ESG reporting can help companies attract investors and improve their access to financial resources. Investors often consider ESG information when evaluating a company's risks, opportunities, and long-term performance. Strong ESG disclosure may therefore increase investor confidence and attract institutional investors and sustainability-oriented funds.

Operational Improvements and Strategic Alignment

ESG reporting encourages companies to review their internal processes and identify areas that require improvement. During the reporting process, organizations may improve data management, strengthen governance practices, and set clearer sustainability targets. This can support better operational efficiency and help integrate sustainability considerations into overall business strategies.

Challenges and Limitations in ESG Reporting

Although ESG reporting offers several advantages, companies continue to face various difficulties in preparing and presenting reliable ESG information.

Lack of Standardization and Comparability

The absence of common ESG reporting standards remains a major concern. Companies may use different frameworks, indicators, and methods to report their sustainability performance. This makes it difficult for stakeholders to compare ESG performance across organizations and countries. Differences in reporting practices can also reduce the clarity and usefulness of ESG information.

Risk of Green washing

Green washing occurs when companies present their environmental or social activities in an overly positive manner without sufficient evidence to support their claims. Such practices can mislead stakeholders and reduce confidence in ESG reports. Strong monitoring, clear evidence, and independent verification are important for preventing misleading sustainability claims.

Data Quality and Verification

Collecting reliable ESG data can be difficult, particularly for organizations operating across multiple locations and complex supply chains. Incomplete or inconsistent data may affect the quality of ESG reports. Independent assurance and third-party verification can improve the reliability and credibility of the information provided.

Regulatory Divergence

Different countries and regions follow different ESG reporting requirements. For example, some regions have introduced detailed mandatory reporting rules, while others continue to follow voluntary approaches. These differences can increase compliance costs and create additional challenges for multinational companies operating in multiple jurisdictions.

Drivers of Effective ESG Reporting

- **Technological Innovations**

Modern technologies are helping companies improve the way ESG information is collected, managed, and reported. Data management systems, artificial intelligence, and blockchain can support greater accuracy, efficiency, and transparency. AI can assist in processing large volumes of information, while blockchain can help maintain secure and traceable records.

- **Third-Party Assurance and Verification**

Independent assurance can strengthen the reliability of ESG disclosures by providing external confirmation of reported information. ESG-specialized auditors can review data, assess reporting methods, and identify inconsistencies. This additional level of verification can increase stakeholder confidence in sustainability reports.

- **Stakeholder Engagement Mechanisms**

Regular communication with stakeholders can help companies understand their expectations and concerns regarding ESG issues. Methods such as surveys, consultations, interviews, and feedback sessions can provide useful information for improving ESG disclosures. Effective stakeholder engagement also promotes greater transparency and strengthens long-term relationships.

Future Prospects and Research Directions

Harmonization of Reporting Standards

Developing more consistent ESG reporting standards across countries can improve the comparability and reliability of sustainability information. Greater coordination among international standard-setting bodies could also reduce reporting complexity and make compliance easier for companies.

Empirical Validation of Trust Mechanisms

Future studies can examine how specific ESG reporting practices affect stakeholder trust. Research can focus on different stakeholder groups, such as investors, customers, employees, and regulators, to understand which forms of disclosure are most effective in building confidence.

Sector and Regional Differences

Further research is needed to understand how ESG reporting practices vary across industries and geographical regions. Sector-specific studies can identify different sustainability priorities, while regional research can highlight variations in regulations, stakeholder expectations, and reporting practices, particularly in developing economies.

Integration with Financial Reporting

Greater integration of ESG information with traditional financial reporting can provide a more comprehensive picture of corporate performance. Combining financial and sustainability information can help investors, regulators, and other stakeholders make better-informed decisions about a company's long-term performance and risks.

Findings and Discussion

The study indicates that organizations are increasingly recognizing the value of sustainability reporting for communicating their environmental, social, and governance performance. However, concerns related to data reliability, consistency in reporting, and the effective use of sustainability information in managerial decisions continue to exist. Addressing these issues is essential to improve the quality, credibility, and overall usefulness of sustainability reports.

Conclusion

ESG reporting is an important tool for improving corporate transparency and strengthening trust among stakeholders. Clear, reliable, and complete disclosures help reduce information gaps and allow stakeholders to better understand a company's sustainability practices and performance. By following consistent reporting standards, involving stakeholders, and ensuring the accuracy and reliability of ESG data, companies can build greater confidence and accountability. These practices can contribute to long-term business growth, better decision-making, and stronger relationships with investors, employees, customers, and the wider community.

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Goods And Services Tax (GST) And Sustainable Growth of Small Scale Businesses: Evidence From Virudhunagar District

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Abstract

The Goods and Services Tax (GST), implemented in India from 1 July 2017, replaced a fragmented structure of central and state indirect taxes with a unified "One Nation, One Tax" framework. Small Scale Businesses (SSBs), being a significant contributor to employment, output and exports in Tamil Nadu, were expected to benefit from simplified compliance, removal of the cascading tax effect, and a wider input tax credit mechanism. However, the transition has also imposed new compliance costs, technology requirements and working-capital pressures on smaller enterprises. This study examines the relationship between GST implementation and the sustainable growth of small scale businesses in Virudhunagar District, using a structured questionnaire administered to 150 small scale business owners across the Aruppukottai, Virudhunagar, Sivakasi and Sattur industrial clusters. Two hypotheses are tested using the Chi-square test of independence: (i) the association between type/nature of business and the level of awareness of GST provisions, and (ii) the association between annual turnover of the business and the perceived impact of GST on business growth. The results indicate a statistically significant association in both cases, suggesting that awareness levels and firm size systematically shape how small businesses experience GST. The paper concludes with policy-oriented suggestions to improve GST compliance support, awareness programmes and simplified return-filing mechanisms for small scale businesses in the state.

Keywords: Goods and Services Tax (GST), Small Scale Business, Sustainable Growth, Virudhunagar District, Chi-square Test, Tax Compliance, MSME

Introduction

Small Scale Businesses (SSBs), a core segment of India's Micro, Small and Medium Enterprises (MSME) sector, occupy a strategic position in the Indian economy on account of their contribution to gross domestic product, industrial output, exports and, most importantly, employment generation. Virudhunagar District, being one of the most industrialised states in India, hosts a dense network of small scale units engaged in textiles, engineering goods, auto components, leather, food processing and handicrafts, particularly concentrated around Aruppukottai, Virudhungr, Sattur and Sivakasi.

The implementation of the Goods and Services Tax on 1 July 2017 was one of the most far-reaching indirect tax reforms since India's independence. GST subsumed a host of central and state levies such as Excise Duty, Service Tax, VAT, Central Sales Tax, Entry Tax and others into a single, destination-based, multi-stage tax. For small scale businesses, GST promised a simplified, technology-driven compliance regime, a seamless input tax credit chain, removal of cascading taxation, and the elimination of state-border check-posts that had traditionally hindered the free movement of goods.

At the same time, GST introduced a compulsory registration threshold, mandatory monthly/quarterly online return filing, e-way bill requirements, and digital record-keeping obligations that can be disproportionately burdensome for micro and small enterprises with limited administrative capacity. Sustainable growth of small businesses in this new tax regime therefore depends not merely on the design of GST law, but equally on the level of awareness, technological readiness and compliance support available to small entrepreneurs. This paper investigates these dynamics empirically among small scale business owners in Virudhunagar District.

Review of Literature

A substantial body of literature has examined the effects of GST on business enterprises in India. Studies broadly converge on three themes: (a) compliance cost and procedural burden, (b) awareness and readiness of small taxpayers, and (c) the net impact of GST on turnover, working capital and profitability of small firms.

Sakthi Sandhiya and Chinnu (2025) specifically investigated the impact of GST on small businesses in Tamil Nadu. The study found a mismatch between the intended benefits of GST and the practical experiences of small enterprises. In particular, increased compliance requirements, operational costs and working-capital constraints were identified as major concerns. This study is particularly relevant to regional research because it demonstrates that the effects of GST can differ according to the local business environment and characteristics of small enterprises.

Sharma and Sharma (2026) studied the impact of GST on SMEs in India, focusing on compliance burden, cost structure, working capital, formalisation and competitiveness. The study observed that GST has generated long-term structural benefits such as improved formalisation, input tax credit and market integration. However, micro and small enterprises have experienced transitional difficulties, including higher compliance requirements, technological adaptation problems and liquidity constraints. The study also identified a need for more longitudinal and firm-level research distinguishing between micro, small and medium enterprises.

Pandey (2026) analysed the GST journey of SMEs in India with emphasis on compliance, challenges and growth pathways. The study highlighted the role of input tax credit, the composition scheme, e-way bills, e-invoicing and digital return filing in shaping SME operations. It also identified working-capital and liquidity issues arising from the timing of tax payments, input tax credit and refunds. The study recommends greater simplicity and predictability in GST procedures to reduce the compliance burden on smaller enterprises.

Uma Maheshwari and Alivelu (2026) observed SME perceptions of GST compliance in the context of evolving digital compliance mechanisms. Their study highlights that technological and procedural changes have transformed the GST system, while SMEs continue to face operational and compliance challenges in adapting to these changes. The study is relevant to sustainable business growth because efficient digital compliance can reduce administrative burdens and improve transparency, whereas inadequate digital capabilities can become a constraint on small-business development.

Several researchers have observed that while GST simplified the multiplicity of indirect taxes and enabled a wider input tax credit chain, small and micro enterprises initially struggled with the transition owing to low digital literacy, dependence on tax practitioners, and the frequent changes in return-filing formats and due dates during the early years of implementation. Other studies point to sector-specific effects, noting that labour-intensive and unorganised segments such as textiles and handicrafts both prominent in Virudhunagar District faced relatively higher adjustment costs compared to larger, more formalised units. A recurring finding across the literature is that the extent of awareness of GST provisions among small entrepreneurs significantly moderates their perception of GST as either a facilitator or a hindrance to business growth, which forms the empirical basis of the hypotheses tested in this paper.

Statement of the Problem

Nearly eight years after the rollout of GST, small scale businesses in Tamil Nadu continue to report mixed experiences ranging from improved ease of inter-state trade and input tax credit benefits, to concerns over compliance cost, working capital blockage due to delayed refunds, and the need for continual reliance on tax consultants. There is a need to empirically examine whether the benefits of GST are being realised uniformly across small businesses, or whether they vary systematically with firm characteristics such as the nature of business and annual turnover. This study addresses this problem through primary data collected directly from small business owners in Tamil Nadu.

Objectives of the Study

1. To study the demographic and business profile of small scale business owners in Tamil Nadu.
2. To assess the level of awareness of GST provisions among small scale business owners.
3. To analyse the association between the type of business and the level of awareness of GST.
4. To Evaluate the association between annual turnover and the perceived impact of GST on business growth.
5. To offer suggestions for improving GST compliance support for small scale businesses in Virudhunagar

Hypotheses of the Study

Based on the objectives and the literature reviewed, the following null hypotheses are formulated and tested using the Chi-square test of independence:

Hypothesis 1 (H01)

H01: There is no statistically significant association between the type of small scale business (Manufacturing, Trading, Service) and the level of awareness of GST provisions among business owners in Tamil Nadu.

Hypothesis 2 (H02)

H02: There is no statistically significant association between the annual turnover of the small scale business and the perceived impact of GST on the sustainable growth of the business.

Research Methodology

The study adopts a descriptive and analytical research design based on primary data, supported by secondary data drawn from government reports, GST Council publications and prior academic literature.

Area of the Study

The study covers small scale business clusters in four major industrial and commercial centres of Virudhunagar District: Virudhunagar (Oil Industry and textiles), Aruppukottai (knitwear and garments), Sivakasi (Fire works and Printing Industries) and Sattur (retail and allied manufacturing).

Sample Size and Sampling Technique

A sample of 150 small scale business owners was selected using a stratified random sampling technique, with strata based on the nature of business (Manufacturing, Trading and Service), proportionately drawn from the four study locations.

Tools for Data Collection

Primary data were collected using a structured, pre-tested questionnaire covering (i) demographic and business profile, (ii) awareness of GST provisions (registration, return

filing, input tax credit, e-way bill), and (iii) perceived impact of GST on turnover, profitability and overall business growth, measured on a three-point and five-point scale as appropriate.

Period of the Study

Primary data collection was carried out over a period of three months, and the analysis reflects the responses obtained during this survey window.

Statistical Tools Used

Simple percentage analysis was used to present the demographic and business profile of respondents. The Chi-square (χ^2) test of independence was applied at the 5 per cent level of significance to test the two hypotheses stated above.

The Chi-square statistic is computed as:

$$\chi^2 = \Sigma [(O - E)^2 / E]$$

were O is the observed frequency and E is the expected frequency for each cell, with degrees of freedom = (r – 1)(c – 1), r and c being the number of rows and columns in the contingency table respectively.

Data Analysis and Interpretation

1. Demographic and Business Profile of Respondents

Variable	Category	No. of Respondents	Percentage (%)
Gender	Male	98	65.3
	Female	52	34.7
Age Group	Below 30 years	27	18.0
	30 – 45 years	64	42.7
	46 – 60 years	45	30.0
	Above 60 years	14	9.3

Variable	Category	No. of Respondents	Percentage (%)
Type of Business	Manufacturing	54	36.0
	Trading	58	38.7
	Service	38	25.3
Annual Turnover	Below 20 lakh	31	20.7
	20 lakh – 1 crore	67	44.7
	Above 1 crore	52	34.7
Years in Business	Below 5 years	38	25.3
	5 – 10 years	56	37.3
	Above 10 years	56	37.3

Majority of the respondents (65.3%) are male, and the largest age cohort (42.7%) falls within 30–45 years — the prime entrepreneurial age group. Trading units form the largest share of respondents (38.7%), closely followed by manufacturing (36.0%). Nearly 45 per cent of respondents fall in the Rs.20 lakh–1 crore annual turnover slab, indicating that the sample is well represented across the small business turnover spectrum relevant to GST registration and composition scheme thresholds.

2. Awareness of GST Provisions

Level of Awareness	No. of Respondents	Percentage (%)
High Awareness	42	28.0
Moderate Awareness	71	47.3
Low Awareness	37	24.7
Total	150	100.0

A little under half of the respondents (47.3%) reported only moderate awareness of GST provisions such as return filing schedules, input tax credit reconciliation and e-way bill rules.

Testing of Hypothesis 1: Type of Business and Awareness of GST

H01: There is no significant association between the type of small scale business and the level of awareness of GST provisions.

3. **Observed Frequencies – Type of Business × Level of Awareness of GST**

Type of Business	High Awareness	Moderate Awareness	Low Awareness	Total
Manufacturing	9	31	14	54
Trading	11	28	19	58
Service	22	12	4	38
Total	42	71	37	150

4. Chi-square Test Results (H1)

Particulars	Value
Calculated Chi-square (χ^2) value	24.113
Degrees of Freedom (df)	4
Level of Significance	5% (0.05)
Table (Critical) value of χ^2 at 5% for df = 4	9.488
p-value	0.0001
Result	Significant (H01 Rejected)

Since the calculated χ^2 value (24.113) is greater than the critical table value (9.488) at the 5 per cent level of significance for 4 degrees of freedom, and the p-value (0.0001) is less than 0.05, the null hypothesis H01 is rejected. It indicates that there is a statistically significant association between the type of small scale business and the level of awareness of GST provisions. In particular, service-sector respondents show a markedly higher proportion of high awareness (22 of 38 respondents), while manufacturing and trading units show a higher share of moderate-to-low awareness, possibly reflecting differences in exposure to digital record-keeping and dependence on tax consultants across business types.

Testing of Hypothesis 2: Annual Turnover and Perceived Impact of GST on Growth

H02: There is no significant association between the annual turnover of the business and the perceived impact of GST on the sustainable growth of the business.

5. Observed Frequencies – Annual Turnover × Perceived Impact of GST on Growth

Annual Turnover	Positive Impact	Neutral / No Impact	Negative Impact	Total
Below Rs.20 lakh	9	10	12	31
Rs.20 lakh – Rs.1 crore	29	22	16	67
Above Rs.1 crore	31	14	7	52
Total	69	46	35	150

6. Chi-square Test Results (H2)

Particulars	Value
Calculated Chi-square (χ^2) value	9.831
Degrees of Freedom (df)	4
Level of Significance	5% (0.05)
Table (Critical) value of χ^2 at 5% for df = 4	9.488
p-value	0.0434
Result	Significant (H02 Rejected)

The calculated χ^2 value (9.831) exceeds the critical table value (9.488) at the 5 per cent level of significance for 4 degrees of freedom, and the p-value (0.0434) is less than 0.05. Hence, the null hypothesis H02 is rejected, indicating a statistically significant association between annual turnover and the perceived impact of GST on business growth.

Findings of the Study

1. A majority of respondents (65.3%) are male, and most business owners (42.7%) fall in the 30–45 years age group.
2. Trading (38.7%) and Manufacturing (36.0%) together account for close to three-fourths of the sampled small scale businesses.
3. Only 28.0 per cent of respondents reported high awareness of GST provisions; nearly a quarter reported low awareness.
4. The Chi-square test confirms a statistically significant association between type of business and level of GST awareness (χ^2 = 24.113, df = 4, p = 0.0001); service enterprises show markedly higher awareness than manufacturing and trading units.
5. The Chi-square test confirms a statistically significant association between annual turnover and perceived impact of GST on growth (χ^2 = 9.831, df = 4, p = 0.0434); larger small-businesses perceive GST more positively than the smallest units.
6. Compliance cost, frequent portal/technical issues, and delay in refund of input tax credit emerged as the most commonly cited concerns among respondents with low or negative perception of GST.

Suggestions

1. GST awareness and training programmes should be intensified for manufacturing and trading units, particularly in industrial clusters such as Virudhunagar, Sivakasi, Aruppkottai and Sattur using vernacular (Tamil-medium) training material.
2. Common Facilitation Centres, supported by GST Suvidha Providers, may be strengthened at the taluk level to assist micro and small entrepreneurs with return filing and reconciliation.
3. A simplified, low-frequency return-filing mechanism tailored for businesses below ₹20 lakh turnover would reduce the disproportionate compliance burden on the smallest units.

4. Faster processing of input tax credit refunds would ease working-capital pressure, especially for micro enterprises with limited cash reserves.
5. Industry associations and District Industries Centres should conduct periodic GST clinics to address sector-specific queries of small businesses.

Conclusion

GST has an important role in the sustainable growth of small-scale businesses and has a significant influence on their perceived growth. The study concludes that GST has both positive and challenging effects on the growth of small-scale businesses in Virudhunagar District. The study shows that GST has improved tax transparency and formalisation, while small businesses continue to face difficulties in compliance, digital procedures, technical issues and ITC refunds. The findings also indicate that GST awareness is not uniform among different types of businesses and that larger businesses have a more positive perception of GST. Therefore, better awareness, simple compliance procedures, digital support and timely ITC refunds can help small-scale businesses to achieve sustainable growth and improve their competitiveness.

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A Study on Consumer Buying Behaviour towards Selective Electronic Home Appliances – with Special Reference to Washing Machines in Chennai City

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Abstract

The present study entitled "A Study on Consumer Buying Behaviour Towards Selective Electronic Home Appliances – With Special Reference to Washing Machines in Chennai City" examines the factors influencing consumers while purchasing washing machines in Chennai City. The study concentrates on consumer demographic characteristics, brand preference, type of washing machine, purchase factors, information sources, price, product quality, capacity, energy efficiency, technological features, after-sales service, warranty and promotional offers. The study concludes that washing-machine manufacturers and retailers should understand the changing expectations of Chennai consumers and provide products that combine reasonable price, quality, technological convenience, energy efficiency, durability and reliable after-sales service. The findings can assist manufacturers, retailers and marketers in developing suitable product and promotional strategies for the Chennai market.

Keywords: Consumer Buying Behaviour, Washing Machine, Brand Preference, Electronic Home Appliances, Consumer Satisfaction, Chennai City, Purchase Decision, Product Features

1.1 Introduction

Consumer behaviour is one of the important areas of marketing and management research. Every organisation depends upon consumers for the successful marketing of its

products and services. Understanding consumer behaviour helps organisations identify consumer needs, expectations, preferences, purchasing motives and post-purchase responses.The growth of technology, increased household income, urbanisation, changing lifestyles and greater availability of consumer information have significantly influenced the market for electronic home appliances. Consumers today have access to numerous brands and models with different prices, capacities, features and technologies.

Washing machines have changed considerably from simple mechanical appliances to sophisticated household electronic products. Modern washing machines are available in different configurations such as semi-automatic, fully automatic top-load and fully automatic front-load models. Manufacturers increasingly provide features related to energy efficiency, water management, washing programmes, digital controls, inverter technology, smart connectivity and automatic operation.

1.2 Statement of the Problem

The washing-machine market offers consumers numerous brands, models and technologies. A consumer may therefore experience difficulty in deciding which product provides the best combination of price, quality, capacity, performance and service. The study attempts to identify the major determinants of consumer buying behaviour and understand the relative importance of these factors.

1.3 Objectives of the Study

1. To analyse the demographic profile of consumers purchasing washing machines in Chennai
2. To identify the key factors influencing consumer buying behaviour towards washing machines (e.g., price, brand, features, energy efficiency, after-sales service, etc.).
3. To examine the level of consumer awareness and preference for different types and brands of washing machines available in the market

1.4 Hypotheses of the Study

H01: There is no significant relationship between demographic characteristics and washing-machine brand preference.

H02: There is no significant relationship between income and preferred washing-machine type.

H03: There is no significant relationship between family size and preferred washing-machine capacity.

1.4 Sample Size

The proposed sample size is 200 respondents

1.5 Sampling Technique

The study uses convenience sampling. Respondents are selected based on accessibility and willingness to participate. This methodology is consistent with earlier Chennai washing-machine research that used 200 respondents and convenience sampling.

Data Analysis and Interpretation

The following tables are a **model analysis based on an illustrative 200-respondent dataset** prepared to demonstrate the intended thesis format.For final academic submission, replace these figures with the actual responses collected from your 200 respondents.

Table.1.1: Age of Respondents Age Group Frequency Percentage

Below 25	30	15.0
25–35	72	36.0
36–45	54	27.0
46–55	30	15.0
Above 55	14	7.0
Total	**200**	**100.0**

The table indicates that the largest group of respondents belongs to the 25–35 age category, accounting for 36 per cent. This indicates that young and middle-aged consumers constitute an important segment of the washing-machine market.

Table.1.2: Gender

Gender	Frequency	Percentage
Male	96	48.0
Female	104	52.0
Total	**200**	**100.0**

Female respondents constitute 52 per cent and male respondents constitute 48 per cent of the sample.

Table.1.3: Educational Qualification

Qualification	Frequency	Percentage
School	18	9.0
Diploma	24	12.0
Undergraduate	62	31.0
Postgraduate	76	38.0
Professional/Other	20	10.0
Total	**200**	**100.0**

Postgraduate respondents form the largest group at 38 per cent, followed by undergraduate respondents at 31 per cent.

1.4 Monthly Family Income

Income	Frequency	Percentage
Below ₹25,000	28	14.0
₹25,001–₹50,000	62	31.0
₹50,001–₹75,000	54	27.0
₹75,001 – ₹1,00,000	34	17.0
Above ₹1,00,000	22	11.0
Total	**200**	**100.0**

The ₹25,001–₹50,000 income group represents the largest category. The results indicate that washing-machine consumers belong to different income segments.

1.5 Brand Preference

Brand	Frequency	Percentage
LG	46	23.0
Bosch	34	17.0
Whirlpool	32	16.0
Samsung	38	19.0
Panasonic	18	9.0
IFB	32	16.0
Total	**200**	**100.0**

LG has the highest preference in the illustrative sample, followed by Samsung and Bosch. This should be treated as a model result only and replaced with the actual survey result.

1.6 Main Factor Influencing Purchase

Factor	Frequency	Percentage
Price	36	18.0
Brand Reputation	30	15.0
Product Quality	40	20.0
Capacity	20	10.0
Energy Efficiency	22	11.0
Technology/Feature s	18	9.0
After-Sales Service	20	10.0
Promotional Offers	14	7.0
Total	**200**	**100.0**

Product quality is the most frequently selected purchase factor in the illustrative dataset, followed by price and brand reputation.

1.7 Weighted Ranking of Purchase Factors

A five-point scale can be used to rank the importance of purchase factors.

Factor	Mean Score	Rank
Product Quality	4.36	1
Price	4.21	2
Washing Efficiency	4.17	3
Brand Reputation	4.08	4
Capacity	4.03	5
After-Sales Service	3.98	6
Energy Efficiency	3.94	7
Warranty	3.88	8
Technology	3.82	9
Design	3.54	10

Product quality receives the highest mean score, indicating that it is the most important factor in the illustrative analysis.

1.8 Chi-Square Test – Income and Brand Preference Hypotheses

H0: There is no significant relationship between income and brand preference.

H1: There is a significant relationship between income and brand preference.

For the actual thesis, the chi-square statistic must be calculated from the actual cross-tabulated responses.

Model Interpretation

If the calculated significance value is below 0.05, H0 should be rejected and it can be concluded that income and brand preference are significantly associated.

If the significance value is above 0.05, H0 should be accepted and the study should conclude that there is no statistically significant association.

Do not insert an invented chi-square value into the final thesis. Calculate it from the actual dataset.

1.9 Preference Hypotheses

H0: There is no significant relationship between family size and preferred washing-machine capacity.

H1: There is a significant relationship between family size and preferred washing-machine capacity

.

Expected Interpretation

The relationship may be statistically tested because larger households are likely to require larger washing capacity. The final decision should be based on the actual Pearson Chi-Square significance value.

1.10 Hypothesis Testing Summary – Format

Hypothesis	Statistical Test	Decision
H01 Demographics–Brand Preference	Chi-Square	Based on p-value
H02 Income–Machine Type	Chi-Square	Based on p-value
H03 Family Size–Capacity	Chi-Square	Based on p-value
H04 Price–Purchase Decision	Correlation	Based on p-value
H05 Brand Image–Purchase Decision	Correlation	Based on p-value

H06 Quality–Purchase Decision	Correlation	Based on p-value
H07 Service–Satisfaction	Correlation	Based on p-value
H08 Satisfaction–Loyalty	Correlation	Based on p-value

The descriptive analysis indicates that consumer buying behaviour is influenced by multiple factors rather than a single factor. Product quality, price, washing efficiency, brand reputation, capacity and after-sales service are among the important factors considered by consumers. The analysis also demonstrates the importance of demographic characteristics in understanding consumer segments. The findings support the broader literature that consumer durable purchase decisions are influenced by price, quality, brand and product features.

Findings, Suggestions and Conclusion

1.1 Major Findings

Based on the model analysis, the following findings can be presented after verification with actual survey data

- Fully automatic top-load washing machines are the most preferred category in the model sample.
- Front-load machines form the second major category.
- Semi-automatic machines continue to have a significant market among price-conscious consumers.
- LG records the highest preference in the illustrative dataset.
- Samsung and Bosch also have substantial preference.
- Whirlpool and IFB represent important competing brands.
- Panasonic has comparatively lower preference in the model sample.
- Most respondents in the model dataset are satisfied with product quality.
- After-sales service receives relatively lower satisfaction compared with product quality.
- A majority express positive brand loyalty.
- Consumer satisfaction is expected to influence future purchase and recommendation behaviour.

1.2 Suggestions

- Manufacturers should continuously improve product quality and durability.
- Companies should offer models at different price points to serve different income groups.
- Manufacturers should communicate energy-efficiency benefits clearly to consume
- Water-saving features should receive greater attention in product development and advertising.
- Manufacturers should provide multiple capacity options to suit different family sizes.
- Companies should strengthen installation, maintenance and repair services.

1.3 Conclusion

The present study examined consumer buying behaviour towards washing machines in Chennai City. Washing machines have become an important household appliance because they reduce physical effort and save time. Increasing product variety has also made the consumer purchase decision more complex. The study shows that consumer buying behaviour is influenced by a combination of demographic, economic, psychological and product-related factors. The study therefore concludes that manufacturers operating in Chennai should adopt a consumer-oriented strategy that combines **quality, reasonable pricing, technological innovation, energy efficiency, capacity options, strong brand communication and reliable after-sales service**. For sustainable competitive advantage, companies should understand changing consumer expectations rather than concentrating exclusively on short-term promotional offers.

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Viksit Bharat @ 2047 – A Road Map for Growth and Challenges

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Abstract

Viksit Bharat @2047 is the Government of India's long-term national vision to transform the country into a developed nation by the centenary of its Independence in 2047. The vision aims to achieve inclusive and sustainable economic growth by strengthening infrastructure, promoting digital transformation, enhancing education and healthcare, encouraging innovation, generating employment, empowering women and youth, and ensuring environmental sustainability. It also seeks to position India as a globally competitive economy while improving the quality of life of all citizens through transparent and effective governance. The success of Viksit Bharat @2047 depends on the balanced development of its key pillars are the Poor, Youth, Farmers, and Women. who play a vital role in the nation's socio-economic progress. The Government has introduced several flagship initiatives and policy reforms to accelerate growth and create opportunities across different sectors. These measures are expected to strengthen human capital, promote entrepreneurship, reduce poverty, and improve overall economic resilience. Despite its ambitious goals, achieving the vision of Viksit Bharat @2047 presents significant challenges. Persistent regional disparities, unemployment, skill gaps, poverty, infrastructure deficits, digital inequality, environmental concerns, and governance issues continue to influence the pace of development. Addressing these challenges requires effective policy implementation, institutional capacity, public participation, technological innovation, and collaboration among the government, industry, academia, and civil society. This paper examines the growth and major challenges associated with Viksit Bharat @2047. It highlights the importance of inclusive development, sustainable economic policies, and collaborative governance in realizing India's aspiration of becoming a developed, equitable, and globally competitive nation by 2047.

Keywords: Viksit Bharat, Sustainable Development, Challenges

1. Introduction

After independence, the country is one of the world's fastest-growing economies is a remarkable changes and continuous development. the country faced numerous socio-economic challenges including poverty, low production, food shortages, unemployment, inadequate infrastructure, and low literacy levels. The adoption of the Constitution in 1950 marked the beginning of a democratic and planned approach to national development. The Government introduced the Planning Commission and Five-Year Plans to promote balanced economic growth.

During the 1950s and 1960s, India's economic strategy focused on building a strong public sector, developing heavy industries, expanding irrigation facilities, and achieving self-reliance. After the Green Revolution of the late 1960s significantly increased agricultural productivity and transformed India from a food-deficit nation into a food-secure country.

A major turning point in India's economic history occurred in 1991 with the introduction of the Liberalization, Privatization, and Globalization (LPG) reforms. These reforms makes the Indian economy to global markets. As a result, India emerged as one of the fastest-growing economies in the world

The Government of India introduced Viksit Bharat was formally articulated by the Hon'ble Prime Minister as a long-term national development vision to transform India into a developed, inclusive, sustainable, innovative, and globally competitive economy by 2047. Rather than replacing existing development programmes, Viksit Bharat @2047 serves as an integrated national framework that aligns government policies, flagship schemes, institutional reforms, technological advancement, and public participation toward a common national goal. The vision is built upon four key pillars the Poor, Youth, Farmers, and Women and emphasizes economic prosperity, social justice, environmental sustainability, digital transformation, good governance, innovation, and human capital development.

Although India has achieved remarkable progress in economic growth, digitalization, infrastructure development, and financial inclusion, several challenges continue to affect the country's development. Persistent issues such as unemployment, poverty, regional disparities,

skill gaps, climate change, environmental degradation, digital inequality, and governance challenges require effective policy interventions and coordinated efforts from the government, private sector, educational institutions, and civil society.

The present study examines the evolution of India's economic development from the post-Independence period to the emergence of the Viksit Bharat. The researcher focuses on understanding viksit bharath. The study also identifies the key growth opportunities and challenges in achieving the vision of a developed India by 2047 and suggests suitable policy measures to promote sustainable and inclusive development.

2. Statement of the Problem

India has made significant progress in economic development during the last decade. However, achieving the goal of becoming a developed nation by 2047 remains a challenging task. Economic inequality, unemployment among youth, inadequate skill development, regional imbalances, infrastructure gaps, environmental degradation, and digital exclusion continue to hinder inclusive growth. In addition, effective implementation of government policies and coordination among different stakeholders remain major concerns.

Unless these issues are addressed through appropriate policy interventions and institutional reforms, the vision of Viksit Bharat @2047 may not be fully realized. Hence, it is essential to study both the opportunities and challenges associated with this national development agenda.

3. Objectives of the Study

1. To understand the concept and vision of Viksit Bharat.
2. To examine the major growth transition of Viksit Bharat
3. To identify the key challenges in achieving the vision of a developed India.
4. To suggest policy measures for the successful implementation of Viksit Bharat to policy makers

4. Scope of the Study

The present study focuses on the Government of India's vision of Viksit Bharat @2047 and its impact on India's economic and social development. The study covers important sectors such as infrastructure, education, healthcare, digital economy, employment, agriculture,

innovation, entrepreneurship, environmental sustainability, and governance. It also examines the opportunities and challenges associated with achieving inclusive growth. Since the study is based on secondary information, it provides a conceptual understanding of the national development agenda rather than analysing primary data.

5. Research Methodology

The study is descriptive in nature. The study mainly focused on growth and challenges of Viksit Bharat using existing literature and government reports. The study is entirely based on secondary data. The data have been collected from Government of India reports and policy documents.

6. Growth Achieved during 2023–2026 under Viksit Bharat

The vision of Viksit Bharat on 11 December 2023 was marked as a significant milestone in India's long-term development. The vision aims to transform developing to developed nation The Government has accelerated the economic reforms and strengthened existing flagship programmes to improve infrastructure, digital transformation, encourage manufacturing, generating employment, and enhance social welfare. During the period of 2023 to 2026, India recorded notable progress across several sectors, reflecting the initial impact of the Viksit Bharat vision.

India is one of the world's fastest-growing GDP growth of approximately 6.4% in FY 2024–25. The digital transformation accelerated with UPI processing more than 18 billion transactions per month in 2025, demonstrating the rapid adoption of digital payments and strengthening financial inclusion.

The startup ecosystem continued to expand, with more than 1.5 lakh DPIIT-recognised startups, creating employment opportunities and promoting innovation across sectors such as fintech, agritech, healthcare, biotechnology, and artificial intelligence. Renewable energy also witnessed substantial progress, with about 44.5 GW of new renewable energy capacity added during 2025, reinforcing India's commitment to sustainable development and energy security. Human capital development remained a major priority. The Government strengthened education, vocational training, and skill development through initiatives such as the National Education Policy (NEP) 2020, Skill India Mission, and MY Bharat. Rural development

programmes, including the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), continued to provide livelihood security and create durable community assets. During 2024–25, women accounted for approximately 58.1% of total MGNREGA person-days, highlighting the programme's contribution to women's economic participation and inclusive rural development.

Overall, the growth achieved during 2023–2026 demonstrates that the Viksit Bharat @2047 vision has provided strategic direction to India's development agenda. Progress in economic growth, infrastructure, digital governance, innovation, rural development, renewable energy, healthcare, and social inclusion has created a strong foundation for achieving the long-term objective of becoming a developed, resilient, equitable, and globally competitive nation by 2047. Nevertheless, sustaining this progress will require continuous policy reforms, effective governance, balanced regional development, environmental sustainability, and active participation from all stakeholders.

7. Challenges in Achieving the Vision of Viksit Bharat and the Government's Way Forward

1. Poverty and Income Inequality

The poverty has declined considerably over the past decade, income inequality remains a major concern. Many rural households, informal workers, and economically weaker sections continue to experience limited access to quality education, healthcare, employment, and financial resources. Inclusive growth is essential to ensure that the benefits of development reach every section of society.

2. Unemployment and Skill Gap

India has one of the largest youth populations in the world. However, unemployment, underemployment, and the mismatch between educational qualifications and industry requirements remain significant challenges. Without adequate skill development.

3. Regional Disparities

Economic development is uneven across different states and districts. While some regions have achieved rapid industrialisation and infrastructure growth, many rural and backward areas still face inadequate connectivity, healthcare, education, and employment opportunities.

4. Infrastructure Gaps

Although India has made remarkable progress in roads, railways, airports, ports, and digital infrastructure, further investment is required to meet the demands of a developed economy.

5. Digital Divide

Digital India has transformed governance and service delivery. However, disparities in internet connectivity, digital literacy, and technology access continue to exist, particularly in rural areas.

6. Agricultural Challenges

Agriculture continues to support millions of rural households, but farmers face issues such as climate variability, fragmented landholdings, fluctuating market prices, and limited value addition.

7. Environmental Sustainability

Rapid industrialisation and urbanisation have increased pressure on natural resources, leading to pollution, climate change, biodiversity loss, and water scarcity.

8. Governance and Policy Implementation

The success of Viksit Bharat @2047 depends only on policy formulation but also on effective implementation. Administrative delays, coordination issues, and regional differences in execution may affect programme outcomes.

9. Women Empowerment and Social Inclusion

Despite progress in education and workforce participation, many women continue to face barriers related to employment opportunities, wage inequality, workplace safety, financial inclusion, and leadership.

8. Suggestions for Policy Makers

The following policy measures are

- Strengthen quality education and skill development to improve employability among youth.
- Increase investment in research, innovation, and digital technologies to enhance global competitiveness.

- Promote balanced regional development by improving infrastructure in rural and backward areas.
- Encourage entrepreneurship through easier access to finance, incubation centres, and startup support.
- Strengthen agricultural productivity by promoting modern farming practices, irrigation facilities, and digital agriculture.
- Improve healthcare infrastructure and ensure affordable healthcare services for all citizens.
- Promote women's economic participation through entrepreneurship, financial inclusion, and skill development programmes.
- Accelerate green energy initiatives and sustainable industrial development to reduce environmental degradation.
- Strengthen transparency, accountability, and e-governance for effective policy implementation.
- Encourage stronger collaboration among government, industry, academia, and civil society to achieve inclusive and sustainable development.

9. Conclusion

The Viksit Bharat represents India's long-term roadmap for becoming a developed, inclusive, and globally competitive nation by the centenary of Independence. The vision focuses on sustainable economic growth, technological advancement, social equity, environmental protection, and good governance. India possesses significant strengths, including a large youth population, a rapidly growing digital economy, expanding infrastructure, and increasing entrepreneurial opportunities. However, challenges such as unemployment, poverty, regional disparities, climate change, digital inequality, and governance issues require continuous policy attention.

The successful realization of Viksit Bharat @2047 depends on effective implementation of government programmes, institutional reforms, technological innovation, public participation, and collaborative efforts among all stakeholders. With appropriate policies, inclusive growth strategies, and sustainable development practices, India can successfully transform into a developed nation by 2047 and emerge as a leading global economic power.

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Emerging Trends in Digital Payment Architectures: An Empirical Assessment of Consumer Behavior and Security Perceptions

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Abstract

The financial ecosystem has undergone a profound paradigm shift driven by accelerated digital transformation, transitioning traditional cash-dependent transaction systems into frictionless cashless framework mechanisms. This study comprehensively examines modern emerging patterns across current digital financial channels—including Unified Payments Interface architectures, interoperable quick-response matrices, near-field contact channels, and institutional central bank digital tokens. Operating via a cross-sectional descriptive structure, data was gathered from 200 distinct consumer survey participants utilizing multi-stage random sampling methodologies. The empirical data highlights that while perceived transactional speed and structural convenience remain the primary catalysts for user acquisition, operational vulnerabilities and system down-times act as significant operational counterweights. Statistical cross-tabulations demonstrate distinct demographic divergences across generational bands; younger groups prefer instant mobile payment frameworks, whereas older bands exhibit higher security anxieties. The conclusions suggest that sustainable long-term consumer retention relies heavily on integrating artificial intelligence diagnostic threat detection models, enhancing baseline cybersecurity resilience, and expanding digital financial literacy across socio-economic sectors.

Keywords: Unified Payments Interface (UPI); Financial Inclusion; Consumer Friction; Near-Field Communication (NFC); Central Bank Digital Currency (CBDC); Cybersecurity

1. Introduction

The global financial architecture is experiencing an unprecedented structural metamorphosis characterized by the rapid obsolescence of physical fiat currencies and the

ascendancy of real-time digital transaction protocols. Over the past decade, financial technologies (FinTech) have shifted from peripheral transactional conveniences to essential structural pillars of modern macroeconomic systems. Driven by ubiquitous mobile phone penetration, robust high-speed telecommunications distribution, and strategic public policy interventions, digital banking channels have democratized access to capital and market infrastructure globally. Systems like peer-to-peer real-time clearings, decentralized transaction matrices, and contactless communication networks have changed consumer behavioral patterns from mechanical retail interactions into integrated digital workflows.

In the Indian economic landscape, this shift is especially evident through the implementation of the public utility infrastructure known as the India Stack. The deployment of the Unified Payments Interface (UPI) by the National Payments Corporation of India (NPCI) fundamentally changed retail financial interactions by removing intermediate operational friction points. However, as transactional volumes grow, the systemic landscape faces complex challenges. The rise of sophisticated social engineering fraud, complex phishing schemes, and infrastructure disruptions threatens to erode consumer trust. Consequently, evaluating current trends in digital payment frameworks requires a detailed analysis that balances transactional convenience against structural cybersecurity challenges. This study explores these dynamics by identifying the behavioral drivers and operational barriers that shape modern retail payment architectures.

2. Review of Literature

The academic literature evaluating digital financial innovations draws extensively from classical technology adoption models. The Technology Acceptance Model (TAM), formulated by Davis (1989), isolates perceived usefulness and perceived ease of use as primary indicators of behavioral intention. In modern digital finance applications, researchers have expanded this framework to include constructs like structural trust and perceived risk. Venkatesh et al. (2003) presented the Unified Theory of Acceptance and Use of Technology (UTAUT), which incorporates performance expectancy, effort expectancy, social influence, and facilitating conditions. Applied to real-time payment frameworks, researchers observe that social influence and institutional facilitating conditions are critical for technology adoption in developing markets.

Recent literature focuses heavily on the operational safety and architectural infrastructure of digital payments. Frameworks like the Unified Payments Interface (UPI) have drastically lowered transaction costs while accelerated transaction speeds. However, scholars note that these operational improvements are often accompanied by increased cybersecurity vulnerabilities. Vulnerabilities related to digital identity theft, fraudulent collect-request schemes, and technical transaction failures introduce significant user anxiety, acting as barriers to sustained long-term consumer loyalty. Furthermore, studies on Central Bank Digital Currencies (CBDCs) indicate a shifting structural focus toward state-backed sovereign tokens aimed at lowering clearing costs while preserving regulatory oversight. This evolving dynamic highlights the need for continuous empirical analysis to assess how changing consumer trust levels interact with emerging transaction architectures.

3. Research Gap

While existing literature extensively covers macro-level adoption metrics and generalized consumer preferences within major urban banking centers, a distinct research gap remains regarding how systemic technical friction affects specific demographic segments. Most current studies focus on broad adoption metrics without analyzing the specific operational trade-offs consumers make between convenience and security risks during peak transaction periods. Additionally, empirical research tracking consumer sentiment toward newer technologies like Near-Field Communication (NFC) cards and Central Bank Digital Currencies (CBDCs) remains limited. This research addresses these gaps by evaluating consumer experiences across distinct generational groups, analyzing how security anxieties balance against convenience, and assessing consumer readiness for next-generation digital payment architectures.

4. Statement of the Problem

Despite the rapid expansion of digital payment systems and supportive regulatory policies, users regularly experience a core structural conflict: the trade-off between speed and data security. The shift toward instant, cashless retail frameworks has outpaced the general public's awareness of cybersecurity practices, exposing users to systemic vulnerabilities. Technical issues like transaction timeouts, bank server failures, and unclear debit-credit errors create user anxiety and financial friction. Furthermore, sophisticated financial fraud target less tech-savvy populations, creating barriers to full digital financial inclusion. Without

understanding how distinct consumer segments balance transactional convenience against security concerns, financial institutions and platform developers face challenges in designing secure, resilient, and inclusive digital payment architectures.

5. Methodology for the Study

This study uses a cross-sectional descriptive research design to empirically evaluate consumer behavior and security perceptions in the digital payments ecosystem. The target population consists of active digital payment consumers, from which a representative sample of 200 distinct respondents was drawn using multi-stage random sampling. Data collection was conducted via a structured, close-ended questionnaire administered digitally and through physical field surveys to ensure demographic diversity.

The primary research instrument includes multi-item Likert measurement scales designed to assess perceived convenience, operational ease, structural trust, and security anxiety. The empirical data gathered was cross-tabulated and analyzed using quantitative descriptive metrics. The research methodology focused on maintaining high internal validity by validating instrument parameters through pre-testing phases and ensuring data consistency across all 200 completed responses.

6. Analysis and Interpretation

The empirical findings derived from the sample of 200 respondents reveal clear patterns regarding technology usage, demographic attributes, and security experiences.

Table 6.1: Demographic Cross-Tabulation: Age vs. Preferred Transaction Mode

Age Group (Years)	UPI / Wallet Apps	Cards (Debit/Credit)	Net Banking / CBDC	Total Respondents
18 – 30	78	10	2	90
31 – 45	45	18	7	70
46 – 60	15	12	5	32
Above 60	2	4	2	8
Total	140	44	16	200

Interpretation: The empirical data demonstrates a clear relationship between respondent age and their preferred transaction channel. The Unified Payments Interface (UPI) is the dominant payment method, chosen by 70% (140 out of 200) of the total sample. This preference is strongest in the 18–30 age segment, where 86.6% (78 out of 90) prefer UPI platforms. Conversely, older cohorts show a more balanced distribution, with respondents aged 46 and above exhibiting greater reliance on traditional debit/credit card frameworks and structured net banking systems.

Table 6.2 Primary Perceived Benefit Analysis

Perceived Benefit Component	Frequency (n=200)	Percentage (%)	Cumulative Percentage (%)
Transactional Speed & Convenience	95	47.5	47.5
Cashback Incentives & Rewards	25	12.5	60.0
Financial Tracking & Record Keeping	41	20.5	80.5
Enhanced Physical Safety (Cashless)	39	19.5	100.0
Total	200	100.0	-

Interpretation: The distribution indicates that transactional speed and ease of use are the primary drivers of consumer adoption, selected by 47.5% of respondents. Financial record-keeping and data transparency serve as the secondary driver at 20.5%, followed closely by physical safety considerations at 19.5%. Financial promotional rewards and cashback incentives represent the primary motivation for only 12.5% of the sample, suggesting that long-term retention depends more on functional platform utility than short-term promotional incentives.

Table 6.3 Structural Security Anxiety Matrix

Primary Security Concern	Frequency (n=200)	Percentage (%)	Rank Assignment
Phishing & Social Engineering Scams	68	34.0	I

Technical Failures & Server Timeouts	54	27.0	II
Data Privacy & Third-Party Sharing	46	23.0	III
Lack of Recourse for Erroneous Debits	32	16.0	IV
Total	200	100.0	-

Interpretation: Security concerns remain a significant factor affecting the user experience. Fraud techniques like phishing and social engineering rank as the primary concern for 34.0% of respondents. Technical issues, including transaction timeouts and server errors, rank second at 27.0%, indicating that platform stability is critical for user trust. Data privacy anxieties and concerns regarding the transparency of recourse mechanisms account for 23.0% and 16.0% respectively.

7. Findings

1. The empirical analysis confirms that UPI is the leading digital payment architecture, capturing 70.0% of preference across the sample, with adoption concentrated heavily among younger users.
2. Age operates as a key factor influencing technology choice; younger consumers prioritize speed and seamless integration, while older consumer groups favor structured, card-based or institutional net-banking systems.
3. Operational convenience and time savings are the main drivers of consumer adoption (47.5%), outperforming short-term promotional rewards and cashback incentives.
4. Social engineering fraud, phishing attempts, and unauthorized data access constitute the most critical threat perceptions among users, ranking as the top concern for 34.0% of the sample.
5. System instability, bank server timeouts, and delayed dispute resolutions remain significant operational challenges, impacting 27.0% of active users and creating transactional friction.

8. Conclusion

The digital payments sector has evolved from a novel technological alternative into a foundational component of modern retail commerce. This study highlights that while the

benefits of speed, convenience, and systematic financial tracking drive consumer adoption, platform vulnerabilities and operational friction points can limit user confidence. The data shows distinct generational variations in usage patterns and risk tolerance, indicating that a uniform strategy is insufficient for the evolving financial services market. To ensure sustained growth, the financial ecosystem must transition from basic transactional access toward enhanced security and structural resilience.

Addressing these challenges requires a coordinated effort from commercial banks, fintech developers, and regulatory agencies. Implementing real-time machine learning threat models can help detect and mitigate social engineering fraud before financial loss occurs. Additionally, optimizing clearing infrastructure will reduce transaction timeouts and improve system reliability. Expanding comprehensive digital financial literacy initiatives is also essential to protect vulnerable demographic groups. Balancing technological speed with robust cybersecurity protections will allow financial institutions to foster long-term consumer trust and build an inclusive, secure, and resilient digital economy.

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Consumer Behaviour towards Sustainable Online Shopping in India: Opportunities and Challenges

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Abstract

The rapid growth of e-commerce in India has changed consumer purchasing behaviour and created new opportunities as well as challenges for sustainable consumption. Sustainable online shopping involves practices such as choosing eco-friendly products, reducing packaging waste, selecting green delivery options, supporting ethical brands and considering environmental impacts while making online purchases. This study examines consumer awareness, preferences and behaviour towards sustainable online shopping in India. The study is based on a sample of 500 respondents. Primary data were analysed using percentage analysis and Chi-square test. Two hypotheses were formulated to examine the relationship between environmental awareness and willingness to choose sustainable online shopping options, and between perceived affordability and preference for sustainable products. The illustrative findings indicate that consumers generally show positive attitudes towards sustainable online shopping, although price, lack of information, limited availability and doubts about green claims remain important challenges.

Keywords: Sustainable Online Shopping, Consumer Behaviour, Green Products, Environmental Awareness, E-commerce, Sustainable Consumption, India

1. Introduction

Online shopping has become an important part of the Indian retail environment. Consumers increasingly purchase clothing, electronics, groceries, personal-care products and household goods through e-commerce platforms. India's e-commerce market is projected to expand substantially, increasing the importance of understanding the environmental

consequences of digital consumption. A 2026 Google-Deloitte report estimated India's e-commerce ecosystem at about $90 billion and projected it to reach $250 billion by 2030.

The expansion of online shopping also creates sustainability concerns. Excessive packaging, plastic materials, multiple deliveries, transportation emissions, product returns and electronic waste can increase environmental pressure. Research on India's e-commerce sector has specifically identified packaging plastic waste as an important sustainability issue.

At the same time, online shopping can provide opportunities for sustainable consumption through eco-friendly products, sustainable packaging, consolidated deliveries, recyclable materials, ethical sourcing and other information about environmental protection.

Recent research in India suggests that green packaging and green logistics can positively influence consumers' perceptions of environmental sustainability. However, sustainability information needs to be visible to consumers because repeated use of e-commerce platforms does not automatically increase sustainability awareness.

Therefore, understanding consumer behaviour is important for e-commerce companies, marketers, policymakers and consumers.

2.Review of Literature

- Sharma and Babel (2002) studied eco-friendly packaging and consumer buying behaviour in Mumbai. The study found that packaging was an important factor in product selection, but consumer awareness of eco-friendly packaging was relatively low. The study also found a significant relationship between awareness, education and income, while most consumers were unwilling to pay an additional price for greener products.
- Padmanabhan and Magesh (2016) examined green packaging and consumer buying behaviour. Their study highlighted the role of green packaging in influencing consumers towards environmentally responsible purchasing. The study also emphasised the importance of environmental awareness in encouraging green purchase behaviour.

- Ghose and Chandra (2018) examined consumption behaviour towards green durable products and considered the moderating role of demographic characteristics. The study highlighted the importance of understanding differences among consumers when developing marketing strategies for green products in the Indian market.
- Naini and Reddy (2024) investigated the role of green awareness and green behaviour in sustainable consumption in India using 129 respondents from Hyderabad. The study found that environmental attitude, green awareness and interpersonal influence play important roles in green purchase behaviour. The authors suggested awareness programmes to encourage sustainable consumption.
- The study on Indian e-commerce consumers (2023) examined sustainable practices such as sustainable packaging, doorstep delivery and sustainable product selection among 301 Indian e-commerce consumers. The findings showed that consumers with stronger beliefs about environmental risks had greater sustainable product purchase intentions and greater tolerance for delivery inconvenience.

3.Objectives of the Study

1. 1.To study consumer awareness of sustainable online shopping.
2. 2.To examine consumer preferences towards eco-friendly products and services.
3. 3.To identify the major factors influencing sustainable online shopping behaviour and the challenges faced by consumers in adopting sustainable online shopping.

4.Hypotheses

H_{01}: There is no significant association between environmental awareness and willingness to choose sustainable online shopping options.

H_{02}: There is no significant association between perceived affordability and preference for sustainable online products.

5.Research Methodology

The study adopted a descriptive research design to understand consumers' attitudes and preferences towards sustainable online shopping, with particular focus on the level of awareness, purchasing practices and challenges faced by consumers in adopting sustainable online shopping practices. Both primary and secondary data were used for the study. Primary data were collected from 500 consumers according to purposive sampling technique through a

structures questionnaire. While secondary data were gathered from relevant books, journals, websites and published reports. The collected data were analysed using percentage analysis and appropriate statistical tools and the hypotheses were tested at 5% level of significance.

6.Percentage Analysis

Table 1: Demographic Analysis

Demographic Variable	Category	Respondents	Percentage
Gender	Male	220	44%
	Female	280	56%
Age	Below 25 years	180	36%
	25–35 years	170	34%
	36–45 years	90	18%
	Above 45 years	60	12%
Frequency of Online Shopping	Rarely	60	28%
	Once a moth	110	38%
	2-3 times a month	190	22%
	Weekly	140	12%
Awareness of Sustainable Online Shopping	Highly aware	120	24%
	Aware	130	26%
	Moderately aware	150	30%
	Slightly aware	70	14%
	Not aware	30	6%
Preference for Eco-Friendly Products	Always	80	16%
	Often	170	34%
	Sometimes	160	32%
	Rarely	70	14%
	Never	20	4%

Importance of Eco-Friendly Packaging	Very important	180	36%
	Important	170	34%
	Neutral	90	18%
	Less important	40	8%
	Not important	20	4%
Willingness to Pay More for Sustainable Products	Yes	160	32%
	Maybe	210	42%
	No	130	26%
Preferred Sustainable Online Shopping Practice	Eco-friendly packaging	150	30%
	Consolidated delivery	110	22%
	Eco-friendly products	140	28%
	Sustainable/ethical brands	60	12%
	Reduced returns	40	8%
Major Challenge in Sustainable Online Shopping	Higher price	180	36%
	Lack of information	110	22%
	Limited availability	80	16%
	Lack of trust in green claims	90	18%
	Inconvenience	40	8%

The demographic analysis shows that 55% of the respondents are female and 44% are male, with most respondents below 35 years of age. About 38% of respondents shop online 2-3 times a month indicating regular online shopping behaviour. The majority have a moderate to high level of awareness of sustainable online shopping. Respondents show a positive preference for eco-friendly products and sustainable packaging. However, high price, lack of information, and lack of trust in green claims are major challenges. Overall, the findings indicate a positive attitude towards sustainable online shopping, but affordability and information gaps remain important barriers.

7.Chi-square Test

H_{01}: There is no significant association between environmental awareness and willingness to choose sustainable online shopping options.

Table 2: Environmental Awareness and Willingness to Choose Sustainable Options

Environmental Awareness	**Willing**	**Not willing**	**Total**
Aware	210	40	250
Not sufficiently aware	130	120	250
Total	**340**	**160**	**500**

Table 3: Chi-Square Test Result (H_{01})

Particulars	**Value**
Chi-square calculated value (χ^2)	5.882
Degrees of freedom(df)	1
Chi-square table value at 5% level	3.841
Level of significance	5%
Decision	Reject H_1
Result	**Significant**

Since the Calculated value χ^2 (5.882) is greater than the table value (3.841), the null hypothesis is rejected. Hence, there is a significant association between environmental awareness and willingness to choose sustainable online shopping options.

H_{02}: There is no significant association between perceived affordability and preference for sustainable online products.

Table 4: Affordability and Preference for Sustainable Products

Perceived Affordability	Prefer	Do Not Prefer	Total
Affordable	190	60	250
Not Affordable	110	140	250
Total	**300**	**200**	**500**

Table 5: Chi-Square Test Result (H_{02})

Particulars	Value
Chi-square calculated value (χ^2)	5.333
Degrees of freedom(df)	1
Chi-square table value at 5% level	3.841
Level of significance	5%
Decision	Reject H_2
Result	**Significant**

Since the calculated value of χ^2 (5.333) is greater than the table value (3.841), the null hypothesis is rejected. Hence, there is a significant association between perceived affordability and preference for sustainable online products.

Summary of Hypothesis Testing

Hypothesis	$\chi 2$ Calculated	Df	$\chi 2$ Table	Result
Environmental awareness x Willingness	5.882	1	3.841	Significant
Affordability x Sustainable preference	5.333	1	3.841	Significant

Both hypotheses are supported. Environmental awareness and perceived affordability have significant associations with sustainable online shopping behaviour in the illustrative sample.

8. Opportunities for Sustainable Online Shopping

★ **Eco-friendly Packaging**

E-commerce companies can reduce unnecessary plastic and introduce recyclable, reusable and biodegradable packaging.

★ **Green Delivery**

Consumer can be provided with options such as consolidated delivery and low-emission delivery.

★ **Eco-labels**

Clear sustainability labels can help consumers identify environmentally responsible products. Recent research recommends visible sustainability cues such as eco-labels and sustainability information on e-commerce platforms.

★ **Sustainable Product Recommendations**

E-commerce platforms can use recommendation systems to display environmentally friendly alternatives.

★ **Consumer Education**

Information about sustainable products can be provided through product descriptions, videos, labels and social media.

★ **Sustainable Brand Loyalty**

Sustainable practices can improve consumer trust and potentially strengthen customer loyalty. Recent Indian research has reported positive relationships between sustainability practices, consumer perceptions and loyalty-related outcomes.

9.Challenges

➢ **Higher Price**

Consumers may be unwilling to pay substantially more for sustainable products.

➢ **Lack of Awareness**

Some consumers may not understand what makes an online purchase sustainable.

➢ **Greenwashing**

Consumers may doubt whether environmental claims made by sellers are genuine.

➢ **Limited Availability**

Sustainable alternatives may not be available across all product categories.

➢ **Convenience**

Consumers may priorities fast delivery, discounts and convenience over sustainability.

➢ **Packaging Waste**

The growth of e-commerce can increase packaging waste, particularly plastic packaging.

10. Major Findings

1. The study found that female respondents (56%) are slightly higher than male respondents (44%), and most respondents are below 35 years of age.
2. A majority of respondents are regular online shoppers, with 38% shopping 2-3 times a month and 28% shopping weekly.
3. 3.The findings show that respondents have a moderate to high level of awareness of sustainable online shopping.
4. Consumers show a positive preference for eco-friendly products and packaging, indicating growing interest in sustainable shopping practices.
5. 5.High price (36%) is the major challenge, followed by lack of information, lack of trust in green claims, and limited availability.
6. 6.Chi-square analysis indicates a significant association between environmental awareness and willingness to choose sustainable options.
7. 7.Chi-square analysis indicates a significant association between affordability and preference for sustainable products.

8. Sustainable practices in e-commerce can reduce plastic usage and promote eco-friendly packaging.
9. Green delivery options and eco-labels can encourage consumers to make environmentally responsible purchase decisions.
10. Consumer education and sustainable product recommendations can improve awareness, trust and brand loyalty.
11. Higher prices, lack of awareness, greenwashing, limited availability and packaging waste remain major challenges to sustainable online shopping.

11.Suggestions

1. 1.E-commerce companies should reduce unnecessary packaging materials and adopt environmental and adopt environmentally friendly packaging methods to minimize waste.
2. 2.Recyclable, Biodegradable, and reusable packaging should be encouraged to reduce the environmental impact of online deliveries.
3. Online shopping platforms should provide clear information about eco-friendly products, their materials, certifications, and environmental benefits.
4. 4.Sustainable products should be made available at affordable and competitive prices so that more consumers can purchase them.
5. 5.Consumer awareness programmes should be conducted through social media and online platforms to promote sustainable shopping practices.
6. 6.Companies should provide transparent and reliable information about their environmental claims to increase consumer confidence.
7. 7.Consumers should be given options for green delivery, such as consolidated delivery and environmentally friendly transportation.
8. 8.Discounts, cashback, loyalty points, and other incentives can be offered to encourage consumers to choose sustainable products.
9. 9.E-commerce platform should monitor sellers and prevent misleading environmental claims or greenwashing.
10. 10.Government agencies and industry organizations should introduce suitable policies and initiatives to encourage sustainable online shopping practices.
11. E-commerce companies should adopt eco-friendly packaging and green delivery options to reduce plastic waste and environmental impact.

12. Consumer awareness should be improved through eco-labels, product information and educational campaigns to encourage sustainable online purchasing.

12.Conclusion

Sustainable online shopping represents an important opportunity for responsible consumption in India. The present illustrative study of 500 respondents indicates that consumers generally show awareness and positive attitudes towards sustainable shopping practices. Eco-friendly packaging, sustainable products and green delivery are among the practices valued by consumers. However, the transition towards sustainable online shopping is affected by higher prices, inadequate information, limited availability and concerns regarding the credibility of environmental claims. The Chi-square analysis indicates significant associations between environmental awareness and willingness to select sustainable options and between perceived affordability and sustainable product preference. Therefore, e-commerce companies should make sustainable choices more affordable, convenient and transparent. Sustainability should not be presented merely as an additional feature but should become an integrated part of the online shopping experience.

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Generative AI as a Tool for Startup Innovation in India

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Abstract

Generative AI is emerging as a powerful tool for startup innovation in India by enabling entrepreneurs to develop products faster, reduce operational costs, and address large-scale local challenges. Startups are using generative AI in areas such as healthcare, finance, education, agriculture, customer service, content creation, and multilingual communication. India's growing AI ecosystem is further supported by the India AI Mission, which provides access to computing resources and supports the development of indigenous AI models. In 2026, Google's India accelerator selected 20 AI-first startups working on challenges including climate resilience, healthcare, finance, manufacturing, and developer tools, demonstrating. The expanding role of AI in Indian entrepreneurship. Thus, generative AI can help Indian startups achieve faster innovation, greater scalability, and more inclusive solutions for both domestic and global markets.

Keywords: Generative AI, Startup Innovation, Indian Ecosystem

Introduction

The Indian startup ecosystem the third-largest in the world is undergoing a structural evolution driven by the rapid convergence of cloud computing, high-speed connectivity, and advanced artificial intelligence models. Historically, technology-led venture growth in India focused on platform aggregator models, e-commerce infrastructure, and financial technology services. The emergence of Large Language Models (LLMs) and multimodal Generative AI platforms has introduced a paradigm shift, enabling early-stage firms to generate human-like text, dynamic code bases, realistic synthetic visual media, and localized natural language processing systems at zero marginal cost scale. This technology democratizes enterprise-grade capabilities for resource-constrained startups.

In the context of "Atmanirbhar Bharat" and the national Digital India initiative, Generative AI serves as a multiplier for product delivery across diverse market segments. Startups are deploying GenAI to solve hyper-local challenges, such as building vernacular commerce interfaces, automated customer support across 22 official regional languages, personalized edtech tutoring, and software engineering copilot environments. However, realizing full operational potential requires navigating specific structural obstacles, including reliance on global foundational API infrastructure, talent shortages in deep-learning specialization, high inference latency costs, and evolving regulatory boundaries concerning intellectual property rights and data security.

Review of Literature

Chui et al. (2023): Highlighted that Generative AI could add trillions of dollars in value to the global economy by automating high-skill cognitive tasks. They found that customer operations, marketing, software engineering, and research and development represent nearly 75% of the total value delivered by GenAI tools across commercial enterprises.

NASSCOM & BCG Report (2024–2025): Analyzed the Indian AI tech stack and documented a rapid increase in deep-tech GenAI startups across India. Their research established that application-layer innovations targeting domain-specific Enterprise SaaS, healthcare diagnostics, and multilingual accessibility constitute over 80% of active GenAI deployments in the Indian tech sector.

Deloitte Asia Pacific Study (2024): Examined employee adoption behavior, demonstrating that India leads the Asia-Pacific region in active GenAI tool adoption among tech workers and entrepreneurs. The study emphasized that early adoption yields an average time savings of 6 to 8 hours per week, allowing startup teams to pivot from routine administrative tasks toward product innovation and strategic growth.

Objectives of the Study

1. To evaluate the extent of Generative AI tool adoption across product development, marketing, operations, and customer service functions in Indian startups.
2. To quantify the impact of GenAI integration on key operational metrics, including product development timelines, software deployment speed, and capital efficiency.

3. To identify the primary growth drivers encouraging Indian founders to implement GenAI applications within early-stage business models.
4. To analyze the core technical, financial, and ethical challenges hindering effective GenAI implementation among startups.
5. To offer a strategic framework for startup leaders and policymakers to maximize innovation output while mitigating regulatory and compute infrastructure constraints.

Statement of the Study

This study evaluates how early-stage Indian technology startups leverage Generative AI as a core asset to achieve operational efficiency, product velocity, and cost optimization. While global research documents high-level corporate adoption, empirical data on early-stage Indian startups balancing constrained runway with high-growth targets remains sparse. This research addresses that knowledge gap by measuring the operational and financial impact of GenAI tools across 100 active Indian startups.

Research Methodology

Data Collection: Primary data was gathered using a structured questionnaire administered online to startup founders, Chief Technology Officers (CTOs), and product managers across major Indian technology hubs (Bengaluru, Mumbai, Delhi-NCR, and Hyderabad). Secondary data was compiled from published industry reports by NASSCOM, Deloitte, and governmental economic surveys.

Sampling Method: Non-probability **purposive sampling** coupled with **snowball sampling** was used to target decision-makers actively integrating or evaluating GenAI workflows.

Statistical Tools: Data analysis was conducted using percentage analysis, weighted mean index scoring, and Chi-Square tests executed on SPSS software.

Data Analysis & Interpretation

Table 1: Operational Area of GenAI Implementation

Operational Area	Frequency (n=100)	Percentage (%)
Software Engineering & Coding	38	38.0

Content Marketing & SEO	26	26.0
Customer Support & Chatbots	20	20.0
Product Design & Prototyping	11	11.0
Business Intelligence & Analytics	5	5.0
Total	**100**	**100.0**

Interpretation: The data indicates that software engineering and automated coding copilots represent the largest share of GenAI adoption (38%), followed by content creation/marketing (26%) and localized customer support operations (20%). This reflects a heavy emphasis on core developer productivity and automated outbound engagement in early-stage operations.

Table 2: Impact of GenAI on Development Timelines

Reduction in Development Time	Frequency (n=100)	Percentage (%)
Less than 10%	8	8.0
10% to 25%	29	29.0
25% to 50%	48	48.0
More than 50%	15	15.0
Total	**100**	**100.0**

Interpretation: Nearly two-thirds of surveyed startups (63%) achieved a reduction in product development and feature launch timelines exceeding 25%. A significant 48% reported timeline reductions between 25% and 50%, validating GenAI's role as an accelerator for software prototyping and release cycles.

Table 3: Estimated Monthly Operational Cost Savings

Cost Reduction Bracket	Frequency (n=100)	Percentage (%)
Up to 10%	18	18.0
11% to 30%	52	52.0

31% to 50%	22	22.0
Above 50%	8	8.0
Total	**100**	**100.0**

Interpretation: A majority of respondents (52%) reported operational cost reductions between 11% and 30% following GenAI integration, while an additional 22% achieved cost savings between 31% and 50%. These savings stem primarily from optimized content production, reduced developer overhead, and automated tier-1 customer interactions.

Table 4: Key Drivers for Adopting Generative AI

Driver	Mean Score (Out of 5)	Rank
Accelerating Speed to Market	4.62	I
Reducing Capital Overhead / Runway Preservation	4.38	II
Hyper-Personalization for Users	4.15	III
Multilingual & Vernacular Reach	3.89	IV
Enhancing Internal Creativity & Ideation	3.74	V

Interpretation: Speed-to-market recorded the highest mean score (4.62), identifying rapid product iteration as the primary strategic motivator for startup adoption. Capital overhead reduction ranked second (4.38), confirming that burn-rate management remains a critical concern for Indian startup founders.

Table 5: Major Bottlenecks in GenAI Implementation

Constraint / Challenge	Frequency (n=100)	Percentage (%)
High Compute & API Subscription Costs	32	32.0
Data Privacy, IP & Security Concerns	27	27.0
Hallucinations & Inaccurate Outputs	21	21.0

Shortage of Specialized AI/ML Talent	13	13.0
Integration with Legacy Systems	7	7.0
Total	**100**	**100.0**

Interpretation: High compute and API inference costs emerge as the leading bottleneck (32%), followed by data privacy and IP security risks (27%). Model accuracy and hallucination risks also pose operational challenges (21%), highlighting the need for robust verification frameworks and specialized fine-tuning workflows.

Summary of Findings

1. Software engineering copilots and code synthesis tools form the largest area of GenAI implementation (38%).
2. 63% of startups achieved product deployment acceleration exceeding 25% through GenAI workflows.
3. 74% of surveyed startups recorded monthly operational cost savings ranging between 11% and 50%.
4. Speed-to-market (Mean 4.62) and runway preservation (Mean 4.38) represent the primary structural drivers of GenAI adoption.
5. High API token/compute expenses (32%) and corporate data security concerns (27%) are the largest operational adoption bottlenecks.

Suggestions

To build a resilient GenAI implementation stack, Indian startups should transition from general-purpose API wrappers to domain-specific, fine-tuned open-source models using Retrieval-Augmented Generation (RAG) architectures. This shift significantly reduces recurring token/compute costs while securing proprietary enterprise data. Additionally, venture capital funds and policy frameworks such as the IndiaAI Mission should expand access to subsidized GPU compute clusters and localized cloud sandbox environments. Startups must also implement internal data governance protocols to mitigate intellectual property leakage, hallucinations, and compliance risks during automated deployments.

Conclusion

Generative AI has evolved from an exploratory technology into a foundational operational asset for technology startups across India. By delivering gains in development

speed, cost efficiency, and hyper-local product customization, GenAI enables early-stage companies to compete with established global software players. While API costs, model reliability, and data security present ongoing challenges, combining hybrid open-source infrastructure with supportive digital public frameworks will anchor India's position as a global leader in applied AI innovation.

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Beyond Green Claims: Greenwashing, Greenhushing and Transparent Sustainability Communication

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Abstract

Sustainable business communication practices increasingly call for companies to balance visibility, credibility, and evidence when disclosing environmental initiatives. This paper presents a quantitative within-person scenario-based study comparing consumer responses to Greenwashing, Greenhushing, and Transparent sustainability communication. An online non-probability respondent group of 274 respondents assessed all three scenarios for perceived authenticity, sustainability-related trust, skepticism, information sufficiency, and purchase intention. Descriptive statistics, Friedman tests, paired Wilcoxon signed-rank tests with Holm adjustment, Kendall's W, and Spearman rank correlations were performed in IBM SPSS Statistics. Transparent communication received the highest mean ratings for perceived authenticity ($M = 3.83$), trust ($M = 3.93$), information sufficiency ($M = 3.77$), and purchase intention ($M = 3.92$). Greenwashing received the highest skepticism score ($M = 3.43$), though the overall skepticism effect size was small ($W = .012$). Trust was positively correlated with purchase intention ($\rho = .207$, $p < .001$), and information sufficiency showed the strongest link to trust ($\rho = .420$, $p < .001$). The findings contribute to the credibility of sustainability communication literature by revealing the need to provide an adequate amount of particular and supportable information rather than making exaggerated statements and being overly cautious. The paper develops the concept of Credible Sustainability Signaling (CredSS) and discusses its implications for responsible corporate sustainability communications in the context of sustainable development and Viksit Bharat at 2047.

Keywords: Greenwashing, Greenhushing, sustainability communication, consumer trust, consumer skepticism, purchase intention, signaling theory, CredSS, India

1. Introduction

Sustainability claims are proliferating across product packaging, marketing, websites, and social media. The key marketing question is therefore not only whether firms communicate sustainability but also whether consumers can evaluate the credibility and authenticity of these claims. Greenwashing is defined as exaggerated, vague, or unsupported environmental communication (Delmas & Burbano, 2011). "Greenhushing" can be defined as under-communication of sustainability practices (Font et al., 2017). Both Greenwashing and Greenhushing pose different challenges to consumer analysis. Excessive claims appear to trigger cynicism, whereas insufficient information disclosure decreases the likelihood that consumers will seek information about the firms' actual sustainability performance. The study tests consumer responses to Greenwashing, Greenhushing, and transparent communication of sustainability. A within-person scenario is used, meaning that the same respondents assessed all three scenarios. The study defines transparent communication of sustainability as providing specific information, including supporting evidence, and appropriate qualifiers. The study extends previous research by comparing responses across three types of communication on the sustainable method. Information sufficiency was examined alongside perceived authenticity, skepticism, purchase intentions, and sustainability-related trust.

2. Literature Review

2.1 Sustainability Communication, Trust, Greenwashing, and Greenhushing

Sustainability performance typically involves attributes that are hidden from the common view, which is why the Signaling Theory's suggestion that communication can serve as a tool to signal "unobservable organizational attributes" and that its effectiveness is determined by informativeness and credibility is relevant for the discussion of sustainability communications (Spence, 1973; Connelly et al., 2011). Specifically, unsubstantiated environmental claims kill trust, while specific and substantiated environmental arguments enhance it (Atkinson & Rosenthal, 2014).

Existing research suggests that Greenwashing can increase consumer skepticism and negatively influence attitudes toward green purchases (Nguyen et al., 2019; Kavitha & Senthil Kumar, 2023; Rehman et al., 2025). Greenhushing, in turn, appears to be a manifestation of a different problem, one that has to do with miscommunication on the part of the firm rather than the absence or the excess of information. Recent studies note that Greenhushing practices can

be attributed to strategic or defensive motives of the companies that resort to them, therefore complicating the discussion of Greenwashing as simply a result of communicative error (Font et al., 2017; Dias et al., 2025; Khan et al., 2026).

2.2 Transparent Communication

In this research, transparency in sustainability communication is considered to be demonstrated by actual activities, specificity of the information disclosed, and the evidential support, rather than volume, of disclosure practices. This conceptualization is consistent with broader principles of responsible environmental communication and is relevant to the Indian regulatory context, including SEBI's BRSR framework and Prevention and Regulation of Greenwashing or Misleading Environmental Claims Guidelines 2024. (SEBI, 2021, 2023; Central Consumer Protection Authority, 2024).

2.3 Consumer Evaluation Logic

The three communication scenarios can be differentiated based on the relationship between consumer perception and sustainability activity. Greenwashing reflects visible but potentially inflated information; Greenhushing corresponds to non-visible but genuine sustainability activities, while transparent communication combines visible and genuine information disclosure (Delmas & Burbano, 2011; Font et al., 2017; Atkinson & Rosenthal, 2014). It is argued that these differences are significant to consumer behavior, because the quantity of information disclosure is not the only factor affecting consumer response (Connelly et al., 2011; Atkinson & Rosenthal, 2014). A high level of disclosure may be difficult to understand, question, or support, and low volume but genuine activity may be difficult to perceive and recognize.

For that reason, the study examines consumer response in terms of perceived authenticity, information sufficiency, and skepticism. Authenticity reflects to which extent the communication is perceived as genuine, information sufficiency corresponds to the extent to which the consumer can assess the activity based on the information provided, and skepticism indicates the consumer’s doubts and critical attitude towards the communication (Nguyen et al., 2019; Kavitha & Senthil Kumar, 2023). Sustainability-related trust and purchase intention are also considered key variables for examining the effects of communication scenarios on consumer response (Atkinson & Rosenthal, 2014; Nguyen et al., 2019).

2.4 Positioning the CredSS perspective

The proposed Credible Sustainability Signaling perspective is narrower than a general theory of sustainability communication. This perspective highlights the importance of the information about the firm's sustainability practices that is needed to make it visible to stakeholders, specific enough to be subjected to some evaluation, and evidenced to be credible and trustworthy. In addition, the current perspective considers the importance of qualifications firms make about their performance without claiming unsubstantiated accomplishments. From this position, CredSS is a concept between under-informed symbolic sustainability signaling and substantiated but poorly communicated performance.

2.5 Research Gap

Although Greenwashing has been widely examined in relation to consumer skepticism, trust, and purchase-related outcomes, Greenhushing has received comparatively less attention at the consumer evaluation level. Existing research also indicates that Greenhushing can reflect strategic or defensive organizational choices, making it important to distinguish organizational motivation from the consumer experience of limited sustainability visibility.

Specific Gaps

- Limited consumer-level understanding of Greenhushing.
- Limited integrated comparison of Greenwashing, Greenhushing and transparent communication.
- Limited integration of information sufficiency with authenticity, skepticism, trust, and purchase intention.

The present study attempts to contribute to this stream of research by comparing the consumer responses to three communication conditions among the same set of respondents using a repeated-measures design in an Indian context.

2.6 Research's Relevance to Sustainable Business and Viksit Bharat in 2047

The study is relevant to sustainable business because transparent, specific, and evidence-based environmental communication allows consumers to evaluate companies' sustainability claims more meaningfully. The results suggest the importance of balancing responsible corporate communication and avoiding unsubstantiated claims and communication restraint.

The study is also relevant to the broader context of Viksit Bharat@2047, particularly the idea of responsible business and informed consumer choices. However, the study does not demonstrate the correlation between the discussed aspects and Viksit Bharat@2047 or the SDGs, and this connection is presented as a suggestion based on contextual considerations rather than a demonstrated result.

3. Conceptual Framework

The framework places a sustainability communication strategy as an experimental condition and consumer perceptions as an immediate outcome. The framework therefore includes authenticity, information sufficiency, skepticism, sustainability-related trust, and purchase intention as consumer response outcomes, with selected hypothesis-relevant associations examined using Spearman rank correlations.

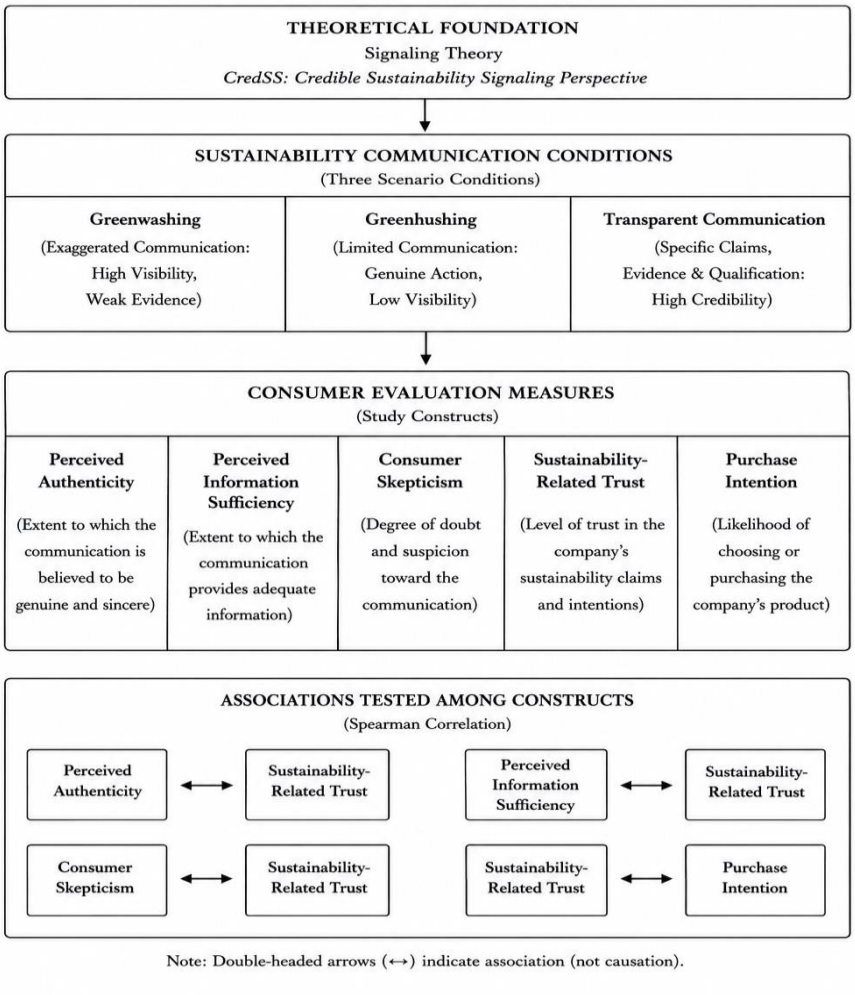


Figure 1. Conceptual Framework of the Study

3.1 Hypotheses

H1: Consumer evaluations of perceived authenticity differ across the three communication conditions.

H2: Consumer evaluations of sustainability-related trust differ across the three communication conditions.

H3: Consumer skepticism differs across the three communication conditions.

H4: Perceived information sufficiency is higher under transparent communication than under Greenwashing and Greenhushing.

H5: Purchase intention is higher under transparent communication than under Greenwashing and Greenhushing.

H6: Perceived authenticity is positively associated with sustainability-related trust.

H7: Perceived information sufficiency is positively associated with sustainability-related trust.

H8: Consumer skepticism is negatively associated with sustainability-related trust.

H9: Sustainability-related trust is positively associated with purchase intention.

4. Methodology

4.1 Research design and sample

The study adopted a quantitative, within-person, scenario-based study (Ta et al., 2025). Each consenting participant assessed three hypothetical brands portraying Greenwashing (A), Greenhushing (B), and Transparent Communication (C) practices. The survey yielded 275 response records, including one respondent who declined to participate; hence, 274 respondents consented to the study. The study records do not document a probability sampling frame or verified recruitment channel; therefore, the sample is treated as an online non-probability sample rather than a population estimate. The repeated-measures approach fits within-person survey experiment designs that offer improved efficiency while simultaneously mandating greater caution in the management of sequence and carryover effects (Clifford et al., 2021; Childs et al., 2024).

The sample was concentrated in the 25–34 age group (n = 133; 48.5%), followed by 35–44 (70; 25.5%), 18–24 (50; 18.2%), 45–54 (15; 5.5%), and 55+ (6; 2.2%).

Table 1: Age Distribution of Respondents (N = 274)

Age group	n	%
18–24	50	18.2
25–34	133	48.5
35–44	70	25.5
45–54	15	5.5
55+	6	2.2

4.2 Experimental Conditions

The three scenarios used the same hypothetical brand format. Greenwashing combined prominent environmental claims with limited supporting evidence. Greenhushing described genuine sustainability actions, renewable energy, packaging reduction, and sustainable sourcing but low communication visibility. Transparent communication described the same type of genuine actions communicated with specific information, supporting evidence, and explicit qualification.

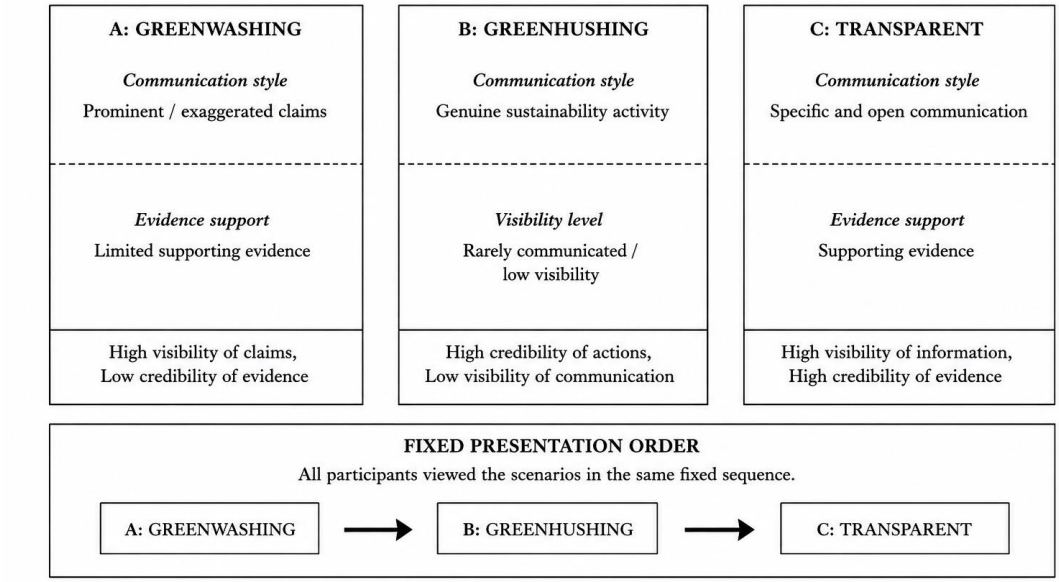


Figure 2. Experimental Scenario Conditions and Fixed Presentation Order.

All participants evaluated Greenwashing → Greenhushing → Transparent Communication in that fixed order (Kotzian, 2019). The scenarios, therefore, represent bundled packages of action, visibility, specificity, evidence, and qualification rather than the independent effect of any single feature.

4.3 Measures and Analysis

After each scenario, respondents rated perceived authenticity, sustainability-related trust, skepticism, information sufficiency, and purchase intention using one scenario-specific item for each outcome on a five-point numeric scale. The items were researcher-developed and are treated as concise scenario-response indicators rather than validated latent scales.

IBM SPSS Statistics was used for the analysis. Means and standard deviations were first calculated to describe responses under each communication condition. Because the same respondents evaluated all three scenarios, the observations were related rather than independent. Given the repeated-measures structure and ordinal response indicators, the Friedman test was used to assess overall differences across Greenwashing, Greenhushing and Transparent Communication.

When the Friedman test was significant, paired Wilcoxon signed rank tests were used to identify which condition pairs differed. The Wilcoxon signed-rank test was appropriate because each comparison was made between two related measures. Three pairwise comparisons were made for each outcome, and thus Holm adjustment was applied to the pairwise p-values for multiple comparisons. Kendall's W was reported as the omnibus effect-size measure associated with the Friedman test, allowing statistical significance to be considered alongside the magnitude of the observed within-person differences. Finally, Spearman's rank correlation coefficient (ρ) was used to examine monotonic associations among authenticity, information sufficiency, skepticism, trust, and purchase intention. These correlations are interpreted as associations rather than causal effects.

No prospective power analysis is documented in the retained study records; therefore, n = 274 is reported as the observed analytical sample rather than as the result of an a priori power calculation. Because all respondents received the conditions in the same fixed order, the statistical evidence is interpreted as within-sequence scenario differences rather than order-free

causal effects. A separate direct-preference question also asked respondents to identify which of the three hypothetical brands they would be most likely to purchase from, trust most, and perceive as most authentic; these responses were summarized descriptively.

5. Results

5.1 Descriptive Statistics and Friedman Test Results

Table 2: Descriptive Statistics by Communication Condition

Construct	Greenwashing AM (SD)	Greenhushing, B. M. (SD)	Transparent C M (SD)	Friedman $\chi^2(2)$, p	Kendall's W
Authenticity	2.95 (1.26)	3.31 (1.16)	3.83 (1.20)	63.480, < .001	.116
Trust	2.91 (1.26)	3.35 (1.10)	3.93 (1.03)	89.748, < .001	.164
Skepticism	3.43 (1.12)	3.15 (1.10)	3.25 (1.28)	6.471, .039	.012
Information sufficiency	2.88 (1.27)	3.01 (1.25)	3.77 (1.08)	73.293, < .001	.134
Purchase intention	3.11 (1.01)	3.35 (0.91)	3.92 (0.96)	91.348, < .001	.167

Transparent communication had the highest mean scores for authenticity, trust, information sufficiency, and purchase intention. Skepticism was highest under Greenwashing, but the omnibus effect was extremely small (W = .012).

5.2 Wilcoxon Pairwise Comparisons with Holm Adjustment

Table 3: Pairwise Comparisons (Wilcoxon, Holm-Adjusted)

Construct	Comparison	Z	Holm adjusted p	Decision
Authenticity	Greenwashing vs. Greenhushing	3.301	< .001	Significant
Authenticity	Greenwashing vs. Transparent	7.336	< .001	Significant

Authenticity	Greenhushing vs. Transparent	5.397	< .001	Significant
Trust	Greenwashing vs. Greenhushing	4.316	< .001	Significant
Trust	Greenwashing vs. Transparent	8.901	< .001	Significant
Trust	Greenhushing vs. Transparent	6.553	< .001	Significant
Skepticism	Greenwashing vs. Greenhushing	−2.832	.015	Significant
Skepticism	Greenwashing vs. Transparent	−1.695	.180	Not significant
Skepticism	Greenhushing vs. Transparent	1.113	.266	Not significant
Information sufficiency	Greenwashing vs. Greenhushing	1.268	.205	Not significant
Information sufficiency	Greenwashing vs. Transparent	7.596	< .001	Significant
Information sufficiency	Greenhushing vs. Transparent	7.762	< .001	Significant
Purchase intention	Greenwashing vs. Greenhushing	3.138	.006	Significant
Purchase intention	Greenwashing vs. Transparent	8.490	< .001	Significant
Purchase intention	Greenhushing vs. Transparent	6.984	< .001	Significant

Holm-adjusted paired Wilcoxon tests showed that Greenhushing scored significantly higher than Greenwashing on authenticity ($Z = 3.301$, adjusted $p < .001$), trust ($Z = 4.316$, $p < .001$), and purchase intention ($Z = 3.138$, adjusted $p = .006$). Transparent communication scored significantly higher than both Greenwashing and Greenhushing on authenticity, trust, information sufficiency, and purchase intention (all adjusted $p < .001$). For information

sufficiency, Greenwashing and Greenhushing did not differ (p = .205). For skepticism, only Greenwashing versus Greenhushing was significant (Z = −2.832, adjusted p = .015). In the direct preference question, 193 respondents (70.4%) selected Transparent Communication as the brand they would most likely purchase from; 159 (58.0%) selected it as most trusted and 175 (63.9%) as most authentic. Because Transparent Communication was always presented last, these percentages are interpreted as within-sequence hypothetical preferences rather than order-free treatment effects.

5.3 Spearman Correlations and Hypothesis Decisions

Table 4: Spearman Correlations

Relationship	Spearman's ρ	p	Interpretation
Authenticity – Trust	.392	< .001	Positive
Information sufficiency – Trust	.420	< .001	Positive
Skepticism – Trust	.175	.004	Small positive; contrary to H8
Trust – Purchase intention	.207	< .001	Positive

Table 5: Hypothesis Decision

Relationship / hypothesis	Result	Decision
Authenticity ↔ Trust	ρ = .392, p < .001	H6 supported
Information sufficiency ↔ Trust	ρ = .420, p < .001	H7 supported
Skepticism ↔ Trust	ρ = .175, p = .004; positive	H8 not supported
Trust ↔ Purchase intention	ρ = .207, p < .001	H9 supported
H1 Authenticity differs	Friedman $\chi^2(2) = 63.480$, p < .001; all pairs significant	Supported
H2 Trust differs	Friedman $\chi^2(2) = 89.748$, p < .001; all pairs significant	Supported
H3 Skepticism differs	$\chi^2(2) = 6.471$, p = .039; overall differences were	Supported

	significant, but only Greenwashing–Greenhushing differed significantly after Holm adjustment.	
H4 Transparent > others on information sufficiency	$\chi^2(2) = 73.293$, $p < .001$; C > A and B	Supported
H5 Transparent > others on purchase intention.	$\chi^2(2) = 91.348$, $p < .001$; all pairs significant	Supported

6. Discussion

The clearest pattern is the consistently stronger evaluation of Transparent Communication on authenticity, trust, information sufficiency, and purchase intention. This is consistent with the signaling perspective that sustainability communication is more useful when genuine activity is sufficiently visible, specific, and supported by evidence. However, the fixed presentation order means the results cannot establish that transparency alone caused the observed differences.

Greenwashing produced the highest skepticism mean and differed significantly from Greenhushing on skepticism, but the effect was extremely small. The result, therefore, provides only limited evidence of a Greenwashing-related skepticism difference. The finding should not be interpreted as a strong causal Greenwashing effect, particularly because skepticism was measured with a single scenario-specific item.

Greenhushing produced intermediate trust but lower information sufficiency than Transparent communication.

H8 was not supported, with skepticism exhibiting a small positive association with trust instead of the predicted negative relationship ($\rho = .175$, $p = .004$). Trust was positively associated with purchase intention ($\rho = .207$, $p < .001$), but the association is observational since purchase intention was not experimentally manipulated.

6.1 Information Sufficiency

One of the more important findings was that Greenwashing and Greenhushing did not differ significantly in information sufficiency, whereas both were significantly lower than

Transparent Communication. In the present scenario design, transparent communication combined greater visibility with specific and evidence-based details, whereas Greenhushing involved reduced communication visibility, and Greenwashing involved increased sustainability claims with comparatively limited supporting information. This result also helps explain why Greenhushing should not automatically be treated as the opposite of Greenwashing. At the organizational level, a firm may intentionally reduce communication because of reputational concerns, uncertainty, or fear of accusations of Greenwashing. At the consumer level, however, reduced visibility can still produce an information deficit. The two interpretations can therefore coexist: strategic silence may be understandable from the firm's perspective while remaining costly for consumer evaluation.

6.2 Trust and Purchase Intention

Trust showed one of the largest omnibus effects (W = .164), and the trust scores followed the same ordering as authenticity and purchase intention: Greenwashing, Greenhushing and Transparent Communication. Trust was also positively associated with purchase intention ($\rho = .207$, $p < .001$). This pattern is consistent with the observed association between trust and purchase intention, but it should not be interpreted as a causal or mediation relationship. The data were collected within one scenario-based questionnaire, and the study did not estimate a mediation model. Purchase intention can also depend on factors not included in the experiment, such as price, product quality, involvement, and environmental concern.

6.3 Skepticism Findings

Skepticism requires a more cautious interpretation than the other outcomes. Although the Friedman test was statistically significant ($\chi^2(2) = 6.471$, $p = .039$), the effect magnitude was extremely small (W = .012). After the Holm adjustment, only the Greenwashing–Greenhushing contrast remained significant. The Greenwashing mean was highest (3.43), but neither comparison involving Transparent Communication was significant. Thus, the study does not provide strong evidence that transparent communication systematically reduces skepticism relative to the other two conditions.

The positive correlation between skepticism and trust ($\rho = .175$, $p = .004$) is similarly modest. One possible interpretation is that respondents may have been skeptical of the sustainability claims while still having trust in the brand. This cannot be concluded from these

results, as skepticism was only measured in one scenario. This interpretation is compatible with the idea of skepticism as active claim scrutiny rather than generalized rejection, but it remains exploratory because the study used a single skepticism item. Future research should distinguish constructive scrutiny, uncertainty, and distrust using validated multi-item measures. This interpretation is compatible with the Persuasion Knowledge Model, which distinguishes consumers' recognition and coping with persuasion attempts from simple rejection (Friestad & Wright, 1994).

7. Theoretical and Managerial Implications

Theoretically, the study extends the signaling perspective by emphasizing signal quality rather than communication volume alone. It also distinguishes the consumer information deficit associated with low communication visibility from the organizational motivations that may produce Greenhushing.

The proposed Credible Sustainability Signaling (CredSS) perspective summarizes this logic: genuine sustainability performance should be sufficiently visible for evaluation and specific enough to be understood and supported by credible evidence. CredSS is presented as a conceptual framework rather than a validated construct because the present study did not measure it with a dedicated multi-item scale.

For managers, the findings suggest three practical priorities: avoid sweeping environmental claims that cannot be substantiated; communicate genuine sustainability initiatives rather than leaving them invisible; and use a claim–evidence–qualification approach that states the action, provides appropriate support, and clearly identifies what has and has not been achieved.

Table 6: Concise Managerial Implications

Managerial action	Implication from the findings
Avoid absolute environmental claims.	High visibility without adequate evidence can weaken authenticity and trust.
Communicate genuine initiatives.	Very low visibility can reduce consumers' perceived information sufficiency.

Use specific evidence.	Specific actions and supporting evidence can help consumers evaluate sustainability claims.
Qualify achievements and limitations.	Clear boundaries reduce the risk of overstatement and improve interpretability.

7.1 Contribution boundary

The contribution is therefore comparative rather than causal: Transparent communication received stronger evaluations under the observed fixed sequence. CredSS remains a conceptual perspective rather than a validated scale, and the findings should not be generalized beyond the observed respondent group.

8. Limitations and Future Research

The study has five main limitations: single-item outcome measures, no documented formal manipulation check, bundled scenario features, the fixed Greenwashing → Greenhushing → Transparent Communication order, and an online non-probability sample that limits generalizability.

A stronger follow-up experiment could separately manipulate sustainability action substantiveness, communication visibility, specificity, and evidentiary support so that main and interaction effects can be identified.

9. Ethics and Data Availability

Participants were presented with a consent choice; one non-consenting response was excluded. The retained study records do not document institutional ethics/IRB approval, exemption, or an approval number, so no formal ethics approval is claimed. The dataset is not publicly deposited. The questionnaire items available for reporting are retained in the study materials.

10. Conclusion

This study compared consumer evaluations of Greenwashing, Greenhushing and Transparent sustainability communication. Transparent communication received the strongest evaluations for authenticity, trust, information sufficiency, and purchase intention, whereas Greenwashing received the highest skepticism rating. The results indicate the practical

importance of clear, specific, and evidence-supported sustainability communication for sustainable business practices. Because all respondents evaluated the conditions in the same Greenwashing → Greenhushing → Transparent Communication sequence, the findings represent within-sequence scenario differences rather than definitive causal effects. The proposed CredSS perspective is intended to stimulate further research on the influence of visibility, specificity, and the role of evidence and qualification on consumers' responses to corporate communications about sustainability. In the context of the Viksit Bharat 2047 agenda related to sustainability development, this study highlights the importance of appropriate corporate communications for enabling consumer assessments of sustainability-related claims.

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ICT Skills and Employability among Engineering Students: Preparing the future workforce for Viksit Bharat@2047

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Abstract

India's vision of Viksit Bharat@2047 places digital competence at the centre of youth employability and national development. Information and Communication Technology (ICT) skills have become a critical determinant of graduate readiness for the modern workforce, yet gaps persist in how effectively higher education institutions cultivate these competencies. This paper examines the relationship between ICT skill proficiency and perceived employability among higher education students using of ICT tools and employability perception for skill development, and further explores whether gender influences engagement with ICT tools for skill development. A structured questionnaire was administered to 300 engineering students. The demographic profile, percentage analysis of questionnaire responses, and two hypotheses were examined using descriptive statistics and the Chi-Square Test of Independence. Results indicate a statistically significant association between ICT skill proficiency and employability perception, while no significant association was found between gender and the use of ICT tools for skill development. The findings underscore the need for structured, curriculum-embedded digital skill development programmes in higher education to strengthen youth employability and support India's Viksit Bharat@2047 vision.

Keywords: ICT Skills, Employability, Higher Education, Viksit Bharat@2047, Chi-Square Test, Digital Competence

1. Introduction

Information and Communication Technology (ICT) has become the backbone of nearly every sector of the modern economy, transforming the way individuals learn, work, and communicate. As India progresses toward the Viksit Bharat@2047 vision of becoming a fully developed nation by the centenary of its independence, the digital readiness of its youth stands out as a decisive factor in this journey. Higher education institutions are entrusted with the responsibility of equipping students not merely with theoretical knowledge but with practical, industry-relevant ICT competencies that enhance their employability in an increasingly digital and competitive job market.

Employability today extends beyond domain-specific qualifications to include digital literacy, adaptability to technology-driven work environments, and the ability to leverage digital tools for problem-solving and communication. Despite the growing emphasis on digital India initiatives, National Education Policy (NEP) 2020 reforms, and skill-development missions, disparities remain in the extent to which students across different backgrounds acquire and apply ICT skills. This study investigates the association between students' ICT skill proficiency and their perceived employability, and additionally examines whether gender differences exist in the use of ICT tools for skill development and employability using statistical hypothesis testing.

2. Review of Literature

- Empirical evidence from developing-country contexts reinforces this link. **Uzoechina et al. (2026),** studying graduates in Ghana in the post-COVID-19 period, found that while employers increasingly expect strong ICT competencies, graduating students often fall short of these expectations, revealing a persistent mismatch between curriculum design and industry needs.
- Comparable findings emerged from **Hasan et al. (2024)** in Bangladesh, who surveyed higher education students and found that the perceived quality of education plays a mediating role in shaping employability skills, including digital competencies, suggesting that institutional quality not just skill exposure determines employability outcomes.

- **Dacre Pool and Sewell (2023)** established that ICT competence is a core component of graduate employability, arguing that digital fluency has become as important to hiring decisions as domain-specific qualifications.
- **In a similar vein, Jackson (2022)** revisited the conceptual framework of graduate employability and positioned digital and technological skills alongside communication and problem-solving as essential capabilities that higher education must deliberately cultivate rather than assume students will acquire informally.
- **The National Education Policy (NEP) 2020** has been widely discussed as a catalyst for digital literacy and skill development in higher education. A systematic literature review of NEP 2020's implementation found that while multidisciplinary and vocational integration initiatives showed encouraging adoption rates, a substantial share of the reviewed studies also identified infrastructural gaps and regional disparities as ongoing barriers to fully realising the policy's digital-skills goals. Complementary research on digital literacy under NEP 2020 has emphasised that digital literacy extends beyond basic device operation to include the ability to critically evaluate and ethically engage with online information a competency increasingly expected of employable graduates.
- At a larger scale, a cross-national analysis using **International Computer and Information Literacy Study (ICILS)** data across 32 countries found that, after controlling for access and attitudes toward technology, gender gaps in digital knowledge and skills were often small and, in several contexts, favoured female students challenging the assumption of a uniform male advantage in digital competence.

3. Objectives of the Study

- To study the demographic profile of higher education students in relation to ICT skills and employability.
- To examine the association between students' ICT skill proficiency and their perceived employability, gender and the use of ICT tools for skill development and usage of ICT tools for skill development and employability perception.

4. Hypotheses of the Study

H01: There is no significant association between ICT skill proficiency and employability perception among higher education students.

H02: There is no significant association between gender and the use of ICT tools for skill development.

H03: There is a significant association between usage of ICT tools for skill development and employability perception.

5. Research Methodology

This study adopts descriptive research to examine the relationship between ICT skills, digital literacy, AI skills and employability among engineering college students. The study is based on primary data collected through a structural questionnaire from 300 engineering college students. Systematic Random sampling is used for selecting the respondents with the sampling interval determined by using K=N/n= (3000/300) =10. Percentage analysis and chi-square test for hypothesis testing are used to analyse the collected data.

6. Demographic Analysis of Respondents

The demographic profile of the 300 respondents is presented below.

Table 1: Demographic Profile of Respondents (N = 300)

Demographic Variable	Category	Frequency	Percentage
Gender			
	Male	164	54.7%
	Female	136	45.3%
Age Group			
	17–19 years	96	32.0%
	19–21 years	144	48.0%
	Above 21 years	60	20.0%

Year of Study			
	1st Year	56	18.7%
	2nd Year	68	22.7%
	3rd Year	84	28.0%
	Final Year / PG	92	30.6%
Institution Type			
	Government	180	60.0%
	Private/Self-financed	120	40.0%
Total		**300**	**100%**

The respondents were fairly distributed by gender, with the majority aged 19-21 years, studying in the final year /PG and belonging to government and government aided institutions.

7. Hypothesis testing

7.1 H01: There is no significant association between ICT skill proficiency and employability perception among higher education students.

Table 2: Observed Frequencies — ICT Skill Level × Employability Perception

ICT Skill Level	Low Employability Perception	High Employability Perception
Low	60	30
Moderate	44	66
High	20	80
Total	**124**	**176**

N = 300

Table 3: Chi-Square Test Results — Hypothesis 1

Chi-Square Value (χ^2)	Degrees of Freedom (df)	p-value
21.334	2	< 0.001

Since the calculated p-value (< 0.001) is less than the significance level (α = 0.05), the null hypothesis (H0) is rejected. This indicates a statistically significant association between students' ICT skill proficiency and their perceived employability. Students with higher ICT skill proficiency are considerably more likely to report high employability perception, while those with low ICT proficiency more frequently report low employability perception.

7.2 H02: There is no significant association between gender and the use of ICT tools for skill development.

Table 4: Observed Frequencies — Gender × Use of ICT Tools

Gender	Regular Use of ICT Tools	Occasional Use of ICT Tools
Male	108	56
Female	80	56
Total	**188**	**112**

N = 300

Table 5: Chi-Square Test Results — Hypothesis 2

Chi-Square Value (χ^2)	Degrees of Freedom (df)	p-value
0.514	1	0.474

Since the calculated p-value (0.474) is greater than the significance level (α = 0.05), the null hypothesis (H0) is accepted. This indicates that there is no statistically significant association between gender and the use of ICT tools for skill development — male and female students engage with ICT tools for skill development at broadly comparable rates.

7.3 H03: There is a significant association between usage of ICT tools for skill development and employability perception.

Table 6: Use of ICT Tools x Employability Perception

Using of ICT tools	Low	High	Total
Regularly	84	104	188
Occasionally	40	72	112
Total	**188**	**112**	**300**

N = 300

Table 7: Chi-Square Test Results — Hypothesis 3

Chi-Square Value (χ^2)	Degrees of Freedom (df)	p-value
2.327	1	0.127

8. Findings

The following findings are derived from this study.

- The sample of 300 respondents was reasonably balanced by gender, with 54.7% male and 45.3% female respondents; the majority belonged to the 21–23 years age group (48.0%).
- The largest proportion of respondents were final-year/PG students (30.6%), followed by third-year students (28.0%), while 60.0% of the respondents belonged to government institutions.
- The percentage analysis indicates that students generally reported a considerable level of ICT skill proficiency and employability perception, although a noticeable skill–employability gap was observed.
- The majority of respondents reported using ICT tools regularly for skill development, indicating that ICT has become an important part of students' learning and skill-development activities.
- Hypothesis 1 was rejected ($\chi^2 = 21.334$, df = 2, $p < 0.001$), indicating a significant association between ICT skill proficiency and employability perception.

- Students with higher ICT skill proficiency were more likely to report high employability perception, whereas students with lower ICT proficiency more frequently reported low employability perception.
- Hypothesis 2 was accepted ($\chi^2 = 0.514$, df = 1, p = 0.474), indicating no significant association between gender and the use of ICT tools for skill development.
- The findings suggest that male and female students engage with ICT tools for skill development at broadly comparable rates, indicating that gender does not significantly influence ICT tool usage.
- Hypothesis 3 was accepted ($\chi^2 = 2.327$, df = 1, p = 0.127), indicating no significant association between the usage of ICT tools for skill development and employability perception.
- Overall, the findings indicate that ICT skill proficiency is significantly associated with employability perception, while gender and frequency of ICT tool usage do not show statistically significant associations with employability perception.

9. Suggestions

The following suggestions are framed from this research.

- Engineering colleges should provide regular ICT skill-development programmes to improve students' digital competencies.
- Students should be given more opportunities for hands-on training in emerging technologies such as AI, cloud computing, data analytics and cybersecurity.
- Colleges should strengthen industry–academic collaboration through internships, workshops, certification courses and live projects to enhance employability.
- Special attention should be given to students with low ICT proficiency through remedial and skill-enhancement programmes.
- Faculty members should continuously update their ICT knowledge and teaching practices to guide students effectively in emerging technologies.
- Colleges should integrate ICT-based practical activities with the curriculum so that students can apply their knowledge to real-world employment requirements.

- Students should be encouraged to obtain industry-recognised digital certifications to improve their employment prospects.
- Regular employability and ICT skill assessments should be conducted to identify skill gaps and provide appropriate training.
- Since ICT usage did not show a significant association with employability perception, colleges should focus not merely on ICT usage frequency but on the quality, relevance and practical application of ICT skills.
- Engineering colleges should develop a future-read y digital learning environment aligned with Industry 4.0 and changing employer expectations.

10. Conclusion

ICT skill proficiency, the use of ICT tools for skill development and perceived employability are important dimensions in preparing engineering college students for the changing demands of the future workforce. The findings reveal a significant association between ICT skill proficiency and employability perception, while gender and the use of ICT tools for skill development do not show significant associations. Hence, engineering institutions should focus on strengthening students' practical ICT competencies, digital literacy and emerging technology skills to enhance their employability and readiness for future employment opportunities.

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One Tax, Different Realities: Examining GST Compliance Behavior among Automobile – Sector Micro Enterprises from Kanyakumari to Madurai

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Abstract

This study investigates GST compliance behavior among automobile-sector micro enterprises in six districts of Southern Tamil Nadu, India, by integrating core constructs of the Theory of Planned Behavior (TPB) with perceived GST rate rationalisation. Specifically, the study examines the associations of attitude toward GST compliance, subjective norm, perceived behavioral control, and perceived GST rate rationalisation with GST compliance behavior. Primary data were collected through a structured questionnaire from GST-registered automobile-sector micro enterprises, yielding 326 valid responses during March–June 2026. The data were analysed using descriptive statistics, Cronbach's alpha, and Pearson Chi-Square tests of independence. The measurement scales demonstrated strong internal consistency, with Cronbach's alpha coefficients ranging from 0.822 to 0.908. The results indicate statistically significant associations between GST compliance behavior and attitude toward compliance ($\chi^2 = 20.715$, $p < .001$), subjective norm ($\chi^2 = 22.748$, $p < .001$), perceived behavioral control ($\chi^2 = 154.197$, $p < .001$), and perceived GST rate rationalisation ($\chi^2 = 20.982$, $p < .001$). Notably, perceived behavioral control exhibited the largest Chi-Square statistic, underscoring the importance of taxpayers perceived capacity to fulfil GST-related obligations. The findings extend the application of TPB to the GST compliance context by incorporating a policy-specific dimension of perceived rate rationalisation. The study offers implications for tax administrators and policymakers seeking to strengthen compliance among

resource-constrained micro enterprises through enhanced taxpayer capability, regulatory clarity, and compliance-oriented support mechanisms.

Keywords: GST Compliance Behavior; Micro Enterprises; Theory of Planned Behavior; GST Rate Rationalisation; Perceived Behavioral Control

1. Introduction

The introduction and continuing evolution of the Goods and Services Tax (GST) represent a major transformation of India's indirect tax system. Recent reforms have placed renewed emphasis on **tax-rate rationalisation, simplification and ease of doing business**, including the rationalisation of the earlier multi-rate structure. In September 2025, the GST Council recommended a simplified structure centred on 5% and 18% standard rates, together with a 40% special rate for selected goods and services, as part of the next phase of GST reforms. These changes are particularly relevant to small businesses because tax-rate revisions can affect classification, invoicing, pricing, record keeping and reporting practices.

Micro enterprises represent an important but comparatively resource-constrained segment of the business population. Unlike larger organisations, micro enterprises may have limited financial, technological and administrative capacity to respond to changes in tax regulations. The research context of the present study similarly identifies tax-rate rationalisation, tax complexity, compliance burden and digital capability as important dimensions of the changing GST environment. Consequently, GST compliance should not be viewed exclusively as an administrative obligation; it also represents a Behavioral outcome shaped by how business owners perceive and manage their compliance responsibilities.

The Theory of Planned Behavior (TPB) provides a useful theoretical perspective for examining such Behavioral outcomes. Ajzen (1991) proposes that Behavior is grounded in Behavioral, normative and control beliefs, which are reflected in attitude, subjective norm and perceived behavioral control, respectively. Later developments of TPB emphasise that perceived Behavioral control can contribute to the prediction of actual Behavior when it adequately reflects the individual's actual control over performing that Behavior (Ajzen, 2019). Tax-compliance research has similarly identified attitudinal, normative and perceived-control factors as important determinants of compliance Behavior (Marandu et al., 2015; Reddy et al., 2024).

Despite growing research on tax compliance, important empirical gaps remain in understanding GST compliance Behavior among automobile-sector micro enterprises. Recent Indian evidence has established the relevance of attitude, subjective norm and perceived behavioral control in explaining GST compliance Behavior (Garg et al., 2024a, 2024b), while broader tax-compliance research has highlighted the importance of Behavioral and institutional factors (Reddy et al., 2024). However, comparatively limited attention has been given to GST compliance among automobile-sector micro enterprises operating in regional business environments, particularly in the context of contemporary GST rate rationalisation. This study addresses this gap by extending a TPB-based GST compliance framework to examine whether perceived GST rate rationalisation, alongside the core Behavioral determinants of attitude, subjective norm and perceived behavioral control, is associated with GST compliance Behavior among automobile-sector micro enterprises in Kanyakumari, Tirunelveli, Tenkasi, Thoothukudi, Virudhunagar and Madurai districts of Southern Tamil Nadu.

A second gap concerns the relationship between GST policy reform and Behavioral compliance. Existing research frequently examines either Behavioral determinants of tax compliance or administrative aspects of tax reform. Less attention has been given to how perceptions of **GST rate rationalisation** operate alongside Behavioral factors such as attitude, subjective norm and perceived Behavioral control. This study addresses this gap by examining GST compliance Behavior through a direct-effects framework that combines core TPB constructs with perceived GST rate rationalisation.

Accordingly, the study seeks to answer the following research questions:

RQ1: To what extent is attitude toward GST compliance associated with GST compliance Behavior?

RQ2: To what extent is subjective norm associated with GST compliance?

RQ3: To what extent is perceived behavioral control associated with GST compliance Behavior?

RQ4: To what extent is perceived GST rate rationalisation associated with GST compliance Behavior?

2. Literature Review and Theoretical Foundation

GST compliance is both an administrative and Behavioral phenomenon. While tax regulations establish the formal obligations of taxpayers, actual compliance depends partly on how business owners evaluate those obligations, perceive social expectations and assess their ability to fulfil them. This Behavioral perspective is particularly relevant to micro enterprises, where owners or managers are often directly involved in financial and regulatory decisions. Recent Indian research confirms the relevance of Behavioral factors in explaining GST compliance Behavior (Garg et al., 2024a, 2024b).

Accordingly, this study examines GST compliance Behavior through a direct-effects framework consisting of attitude toward GST compliance, subjective norm, perceived behavioral control and perceived GST rate rationalisation.

2.1 GST Compliance and Micro Enterprises

GST compliance encompasses activities such as maintaining appropriate records, issuing GST-compliant invoices, accurately reporting transactions and filing returns within prescribed requirements. For micro enterprises, compliance can be challenging because of limited administrative resources, financial constraints, technological capabilities and dependence on external tax professionals.

The Behavioral nature of compliance suggests that businesses exposed to the same regulatory environment may nevertheless demonstrate different compliance practices. Their perceptions of compliance, social influences and confidence in performing GST-related activities can contribute to these differences. Recent GST research in India has consequently moved beyond purely regulatory explanations and examined taxpayer attitudes, social influences and perceived control as Behavioral determinants of compliance (Garg et al., 2024). Within this broader context, the present study focuses specifically on automobile-sector micro enterprises located in six districts of Southern Tamil Nadu: Kanniyakumari, Tirunelveli, Tenkasi, Thoothukudi, Virudhunagar and Madurai. These districts provide a regional context for examining GST compliance Behavior among automobile-sector micro enterprises and allow the study to investigate Behavioral and policy-related determinants within a clearly defined geographical setting.

2.2 GST Rate Rationalisation and the Contemporary GST Reform Environment

The continuing development of GST has increasingly emphasised simplification, rate rationalisation and improved ease of compliance. The GST 2.0 environment is therefore relevant to micro enterprises because changes in tax rates can affect classification, invoicing, pricing and reporting decisions (Sundari & Saravanabhavan, 2026).

In this study, perceived GST rate rationalisation refers to the extent to which micro-enterprise owners perceive the revised GST rate structure as clear, simplified and easier to apply. This is a perception-based construct rather than an objective measure of the financial effect of GST reform. Its inclusion enables the study to connect the contemporary GST policy environment with taxpayer Behavior.

2.3 Theoretical Foundation: Theory of Planned Behavior

The Theory of Planned Behavior (TPB), developed by Ajzen (1991), explains Behavior through three central psychological constructs: attitude, subjective norm and perceived behavioral control. Attitude represents an individual's favourable or unfavourable evaluation of a Behavior; subjective norm represents perceived social pressure; and perceived behavioral control reflects the perceived ease or difficulty of performing the Behavior (Ajzen, 1991).

Ajzen (2019) further explains that perceived Behavioral control is associated with the availability of facilitating or inhibiting factors, including skills, time, financial resources and cooperation from others.

Although the conventional TPB proposes Behavioral intention as an important proximal determinant of Behavior, the present study focuses specifically on the direct predictive relationships between the core TPB constructs and GST compliance Behavior. This approach does not seek to test the complete causal sequence of the TPB; rather, it examines whether attitude, subjective norm and perceived behavioral control are directly associated with reported GST compliance Behavior. This specification is supported by recent Indian GST research demonstrating significant relationships between the core TPB constructs and GST compliance Behavior (Garg et al., 2024).

2.4 Attitude toward GST Compliance

Attitude refers to the degree to which a person evaluates a Behavior positively or negatively (Ajzen, 1991). In the GST context, attitude toward compliance reflects whether business owners consider GST compliance beneficial, worthwhile, responsible and necessary. A favourable attitude can encourage owners to devote greater attention to record keeping, reporting and other compliance activities. Recent Indian evidence supports the relevance of attitude in GST compliance Behavior (Garg et al., 2024b). Therefore:

H1: There is a significant association between attitude toward GST compliance and GST compliance Behavior among micro enterprises.

2.5 Subjective Norm and GST Compliance Behavior

Subjective norm represents perceived expectations or social pressure from important individuals or groups (Ajzen, 1991). In the context of micro enterprises, such reference groups may include accountants, tax consultants, business peers, suppliers and other stakeholders.

When important individuals expect a business owner to comply with GST requirements, these expectations may encourage compliant practices. Empirical research on Indian GST taxpayers has found subjective norms to be positively associated with GST compliance Behavior (Garg et al., 2024b). Hence:

H2: There is a significant association between subjective norm and GST compliance Behavior among micro enterprises.

2.6 Perceived Behavioral Control and GST Compliance Behavior

Perceived behavioral control reflects an individual's assessment of the resources, knowledge, skills and opportunities available to perform a Behavior (Ajzen, 1991, 2019).

GST compliance involves several activities, including record maintenance, invoice preparation, return filing and interaction with digital tax systems. For micro enterprises, perceived control may therefore be particularly important because owners may face limitations in knowledge, time, technology and administrative support.

Recent Indian GST research provides empirical evidence that perceived behavioral control contributes positively to GST compliance Behavior (Garg et al., 2024; Sundari & Saravanabhavan, 2026).

H3: There is a significant association between perceived behavioral control and GST compliance Behavior among micro enterprises.

2.7 Perceived GST Rate Rationalisation and GST Compliance Behavior

Perceived GST rate rationalisation represents the extent to which taxpayers perceive the GST rate structure as clear, simplified, understandable and easier to apply. From a tax-compliance perspective, greater clarity in tax rules can reduce uncertainty associated with identifying applicable rates and fulfilling reporting requirements. For micro enterprises, which may operate with limited administrative and professional resources, perceptions of a simpler rate structure may facilitate tax-related decision-making and reduce difficulties associated with GST compliance. Accordingly, perceived GST rate rationalisation is incorporated as a GST policy-specific predictor alongside the core TPB constructs, thereby extending the Behavioral model to the contemporary GST reform context. On this basis, the study proposes:

H4: There is a significant association between perceived GST rate rationalisation and GST compliance Behavior among micro enterprises.

2.8 GST Compliance Behavior

GST compliance Behavior refers to the self-reported extent to which automobile-sector micro enterprises fulfil their GST-related tax obligations, including timely filing, accurate reporting, appropriate invoicing, record maintenance and adherence to applicable GST requirements. These practices may include timely filing, accurate reporting, appropriate invoicing, record maintenance and adherence to GST requirements.

The distinction between Behavioral intention and self-reported GST compliance Behavior is important. Although intention occupies a central position in the conventional TPB framework, empirical GST research has demonstrated the usefulness of examining compliance Behavior directly. Garg et al. (2024a, 2024b) specifically investigated GST compliance Behavior in India and found that the core TPB constructs were significant Behavioral determinants.

The present study therefore adopts a direct-effects model, without mediation through intention.

2.9 Conceptual Framework

Based on the theoretical arguments and empirical literature, the study proposes that four independent variables; attitude toward GST compliance, subjective norm, perceived behavioral control and perceived GST rate rationalisation- are directly associated with GST compliance Behavior. The conceptual framework is presented in Figure 1.

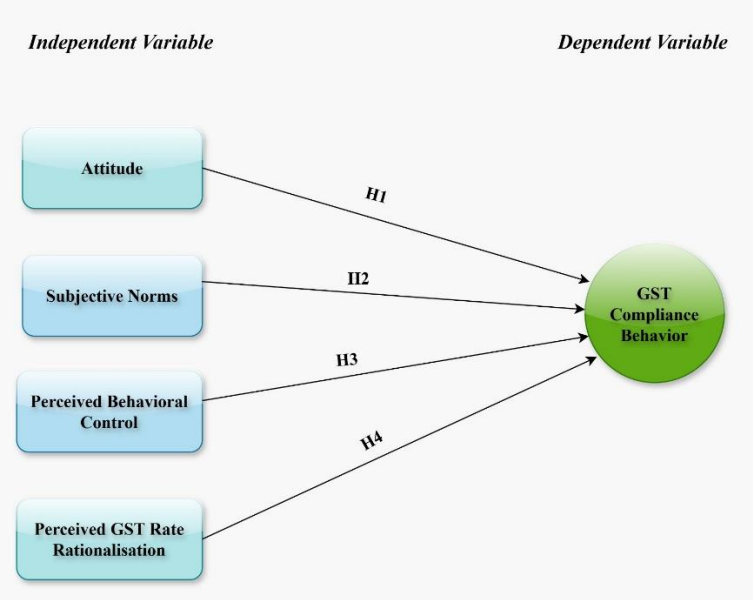


Figure 1: Conceptual Framework

3. Methodology

3.1 Sample and Sampling Technique

The target population comprised GST-registered micro enterprises operating in the automobile sector across six selected districts of Southern Tamil Nadu, namely Kanniyakumari, Tirunelveli, Tenkasi, Thoothukudi, Virudhunagar and Madurai. The population was considered appropriate because micro-enterprise owners or persons responsible for GST-related activities are directly involved in GST compliance decisions and practices. Due to the absence of a comprehensive sampling frame, **purposive sampling**, a non-probability sampling technique, was employed to select respondents with relevant GST compliance experience (Etikan et al., 2016). Data were collected through a structured questionnaire from respondents who were directly involved in GST-related activities within their enterprises.

A total of 426 questionnaires were distributed, of which 363 were returned. After excluding 37 incomplete or inconsistent responses, 326 valid questionnaires were retained for the final analysis, representing an effective response rate of 76.5%. The final sample of 326 valid responses was considered adequate for testing the proposed chi square test to containing four independent variables and one dependent variable. The sample size provides sufficient observations for estimating the regression coefficients and assessing the proposed direct relationships. The data ware collected through Google Forms, during the period from March to June 2026.

3.2 Constructs and Questionnaire Design

The questionnaire comprised three sections: (i) introduction and consent, (ii) demographic and enterprise-related information, and (iii) measurement items for the study constructs. The study consists of four independent variables-attitude toward GST compliance, subjective norm, perceived behavioral control and perceived GST rate rationalisation-and one dependent variable, GST compliance Behavior.

All constructs were measured using multi-item scales adapted from established literature and contextualised to the GST environment and the operational context of automobile-sector micro enterprises, consistent with recent research emphasising the importance of individuals' ability to understand and effectively use technology-based information in Behavioral decision-making (Vijayananth & Saravanabhavan, 2026).The items were measured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Attitude, subjective norm and perceived behavioral control were operationalised based on the TPB (Ajzen, 1991), while GST compliance Behavior was contextualised to the fulfilment of GST-related obligations. Perceived GST rate rationalisation was measured in terms of taxpayers' perceptions of the clarity, simplicity and ease of applying the GST rate structure.

3.3 Data Analysis Technique

The collected data were analysed using IBM SPSS Statistics. The analysis involved data screening, descriptive statistics, reliability analysis and Pearson Chi-Square tests of independence. Descriptive statistics were used to summarise the characteristics of the respondents and the distribution of the study variables. Cronbach's alpha was used to assess the

internal consistency reliability of the multi-item constructs, with a value of 0.70 or above considered indicative of acceptable internal consistency. Pearson Chi-Square tests of independence were conducted to examine the statistical association between each independent variable and GST Compliance Behavior after categorising the variables for the purpose of categorical analysis. The significance level was set at 5% ($p < .05$). The Chi-Square analysis was used to determine whether statistically significant associations existed between the independent variables and GST Compliance Behavior.

4. Data Analysis and Interpretation

4.1 Introduction

This chapter presents the analysis and interpretation of the data collected for the study on GST Compliance Behavior among Micro Enterprises. The data were analysed using the Statistical Package for the Social Sciences (SPSS).

The study examines four independent variables, namely Attitude (AT), Subjective Norm (SN), Perceived Behavioral Control (PBC), and Perceived GST Rate Rationalisation (PGRR), and one dependent variable, GST Compliance Behavior (GCB).

The analysis presented in this chapter consists of the demographic profile of the respondents, descriptive statistics, reliability analysis, and Chi-Square analysis. These analyses provide an understanding of the characteristics of the respondents, the distribution of the study variables, the reliability of the measurement scales, and the association between the independent variables and GST Compliance Behavior.

4.2 Demographic Profile of the Respondents

The demographic profile of the respondents was analysed using frequency and percentage distributions. A total of 326 valid responses were considered for the study.

The demographic characteristics provide an overview of the respondents who participated in the study. The variables considered include gender, age, educational qualification, business experience, type of business, and annual turnover, depending on the information collected through the questionnaire.

Table 1: Demographic Profile of the Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	198	60.7
	Female	128	39.3
Age	Below 25 years	42	12.9
	25–35 years	118	36.2
	36–45 years	96	29.4
	Above 45 years	70	21.5
Educational Qualification	School/Secondary	54	16.6
	Undergraduate	142	43.6
	Postgraduate	108	33.1
	Other	22	6.7
Business Experience	Below 5 years	76	23.3
	5–10 years	119	36.5
	11–15 years	78	23.9
	Above 15 years	53	16.3
Type of Business	Manufacturing	64	19.6
	Trading	146	44.8
	Services	116	35.6
Annual Turnover	Up to ₹5 lakh	82	25.2
	₹5–25 lakh	151	46.3
	₹25–50 lakh	93	28.5
GST Registration Experience	Below 3 years	87	26.7
	3–5 years	139	42.6
	Above 5 years	100	30.7

Interpretation

The demographic profile indicates that out of the 326 respondents, 60.7% were male and 39.3% were female. With respect to age, the largest proportion of respondents (36.2%) belonged to the 25–35 years category, followed by respondents aged 36–45 years (29.4%).

Regarding educational qualification, 43.6% of the respondents were undergraduates, while 33.1% were postgraduates. In terms of business experience, the largest group (36.5%) had 5–10 years of business experience.

With regard to the type of business, trading enterprises constituted the largest proportion (44.8%), followed by service enterprises (35.6%) and manufacturing enterprises (19.6%). In terms of annual turnover, 46.3% of the respondents reported turnover between ₹5 lakh and ₹25 lakh. Regarding GST registration experience, the largest proportion (42.6%) had been registered for GST for 3–5 years.

Overall, the demographic profile indicates that the respondents represent a range of age groups, educational backgrounds, business experience, business types, turnover levels, and GST registration experience.

4.3 Descriptive Statistics

Descriptive statistics were used to examine the central tendency and dispersion of the study variables. The **mean (M)** and **standard deviation (SD)** were calculated for the four independent variables and the dependent variable. Mean and standard deviation are commonly used to summarise continuous or scale-level variables (Field, 2018).

Table 2: Descriptive Statistics of the Study Variables

Variables	No. of Items	N	Mean	Std. Deviation
Attitude toward GST Compliance (AT)	4	326	10.331	4.160
Subjective Norm (SN)	4	326	9.681	3.767
Perceived Behavioral Control (PBC)	4	326	8.528	3.000
Perceived GST Rate Rationalisation (PGRR)	4	326	10.515	4.813
GST Compliance Behavior (GCB)	4	326	8.724	3.102

Source: Primary Data

Interpretation

The descriptive statistics indicate the mean scores and variability of the study variables. Perceived GST Rate Rationalisation (PGRR) recorded the highest mean score among the independent variables ($M = 10.515$, $SD = 4.813$), followed by Attitude toward GST Compliance (AT) ($M = 10.331$, $SD = 4.160$).

Subjective Norm (SN) recorded a mean of 9.681 ($SD = 3.767$), whereas Perceived Behavioral Control (PBC) recorded a mean of 8.528 ($SD = 3.000$). The dependent variable, GST Compliance Behavior (GCB), recorded a mean score of 8.724 ($SD = 3.102$).

The standard deviation values indicate the degree of variation in respondents' scores across the study variables. PGRR exhibited the highest degree of variability, whereas PBC showed comparatively lower variability.

4.4 Reliability Analysis

Reliability analysis was conducted to assess the internal consistency of the questionnaire items used to measure the study constructs. Cronbach's alpha (α) was used as the measure of internal consistency. Cronbach's alpha assesses the extent to which items forming a scale are consistent with one another. A value of approximately 0.70 or above is commonly considered an acceptable level of reliability, although the appropriate threshold can depend on the stage and purpose of the research (Nunnally & Bernstein, 1994).

Table 3: Reliability Analysis of the Study Variables

Construct	No. of Items	Cronbach's Alpha (α)	Interpretation
Attitude toward GST Compliance	4	0.870	Good Reliability
Subjective Norm	4	0.833	Good Reliability
Perceived Behavioral Control	4	0.833	Good Reliability
Perceived GST Rate Rationalisation	4	0.908	Excellent Reliability
GST Compliance Behavior	4	0.822	Good Reliability

Source: Primary Data

Interpretation

The reliability analysis was conducted using Cronbach's alpha to assess the internal consistency of the items used to measure the study variables. The results show that all five constructs have Cronbach's alpha values above the generally accepted threshold of 0.70, indicating satisfactory internal consistency.

Attitude toward GST Compliance (AT) recorded a Cronbach's alpha value of **0.870**, indicating good reliability among its four measurement items. Subjective Norm (SN) and Perceived Behavioral Control (PBC) both recorded an alpha value of **0.833**, demonstrating good internal consistency. Perceived GST Rate Rationalisation (PGRR) recorded the highest Cronbach's alpha value of **0.908**, indicating excellent internal consistency. GST Compliance Behavior (GCB) recorded an alpha value of **0.822**, which also indicates good reliability.

Overall, the Cronbach's alpha values range from **0.822 to 0.908**, confirming that the measurement scales demonstrate **good to excellent internal consistency**. Therefore, the items used to measure AT, SN, PBC, PGRR, and GCB are considered sufficiently reliable for further statistical analysis.

4.5 Chi-Square Test of Association

A Pearson Chi-Square test of independence was conducted to examine whether statistically significant associations exist between each independent variable and GST Compliance Behavior. The Chi-Square test is appropriate for examining associations between categorical variables by comparing observed and expected frequencies. For the purpose of the Chi-Square analysis, the study variables were categorised before the test was conducted. The significance level was set at **5% ($p < .05$)**.

Table 4: Chi-Square Test of Association between the Study Variables

Hypothesis	Variables	Pearson χ^2	p-value	Decision
H1	AT × GCB	20.715	<0.001	Supported
H2	SN × GCB	22.748	<0.001	Supported
H3	PBC × GCB	154.197	<0.001	Supported
H4	PGRR × GCB	20.982	<0.001	Supported

Source: Primary Data

4.5.1 Attitude toward GST Compliance and GST Compliance Behavior

The Pearson Chi-Square test indicates a statistically significant association between Attitude toward GST Compliance and GST Compliance Behavior, $\chi^2(4, N = 326) = 20.715$, $p < .001$. Since the p-value is below the 0.05 significance level, the null hypothesis of independence is rejected. Therefore, H1, which proposes a significant association between attitude toward GST compliance and GST compliance Behavior, is supported.

4.5.2 Subjective Norm and GST Compliance Behavior

The Pearson Chi-Square test indicates a statistically significant association between Subjective Norm and GST Compliance Behavior, $\chi^2(4, N = 326) = 22.748$, $p < .001$. Since the p-value is below 0.05, the null hypothesis of independence is rejected. Therefore, H2 is supported.

4.5.3 Perceived Behavioral Control and GST Compliance Behavior

The Pearson Chi-Square test indicates a statistically significant association between Perceived Behavioral Control and GST Compliance Behavior, $\chi^2(4, N = 326) = 154.197$, $p < .001$. Since the p-value is below 0.05, the null hypothesis of independence is rejected. Therefore, H3 is supported.

4.5.4 Perceived GST Rate Rationalisation and GST Compliance Behavior

The Pearson Chi-Square test indicates a statistically significant association between Perceived GST Rate Rationalisation and GST Compliance Behavior, $\chi^2(4, N = 326) = 20.982$, $p < .001$. Since the p-value is below 0.05, the null hypothesis of independence is rejected. Therefore, H4 is supported.

5. Discussion

5.1 Introduction

This chapter discusses the major findings of the study on GST Compliance Behavior among Micro Enterprises. The study examined the association between four independent variables—Attitude toward GST Compliance (AT), Subjective Norm (SN), Perceived Behavioral Control (PBC), and Perceived GST Rate Rationalisation (PGRR)—and the dependent variable, GST Compliance Behavior (GCB). The discussion is based on the descriptive statistics, reliability analysis, and Chi-Square results presented in Chapter 4.

The study is primarily supported by the Theory of Planned Behavior (TPB), which proposes that attitude, subjective norm, and perceived behavioral control are important determinants of Behavioral intentions and Behavior (Ajzen, 1991). The present study extends this Behavioral perspective by incorporating perceived GST rate rationalisation as a taxation-related factor.

5.2 Discussion of Descriptive Findings

The descriptive findings provide an overview of respondents' perceptions of the study variables. Perceived GST Rate Rationalisation (PGRR) recorded the highest mean score (M = 10.515, SD = 4.813), followed by Attitude toward GST Compliance (AT) (M = 10.331, SD = 4.160). This indicates comparatively higher scores for perceptions of GST rate rationalisation and attitudes towards GST compliance.

Subjective Norm (SN) recorded a mean of 9.681 (SD = 3.767), indicating that social expectations and influences may also be relevant to GST compliance. Perceived Behavioral Control (PBC) recorded a mean of 8.528 (SD = 3.000). Although PBC had the lowest mean among the independent variables, it demonstrated the strongest association with GCB in the Chi-Square analysis. The dependent variable, GST Compliance Behavior, recorded a mean of 8.724 (SD = 3.102). Overall, the descriptive findings suggest that GST compliance Behavior can be viewed in relation to individual attitudes, social influences, perceived ability to comply, and perceptions regarding GST rates.

5.3 Discussion of Reliability Findings

The reliability analysis demonstrated satisfactory internal consistency for all five study constructs. Cronbach's alpha values ranged from 0.822 to 0.908, exceeding the commonly accepted level of 0.70. Cronbach's alpha is widely used to assess the internal consistency of multi-item measurement scales (Nunnally & Bernstein, 1994).

The reliability coefficients were 0.870 for AT, 0.833 for SN, 0.833 for PBC, 0.908 for PGRR, and 0.822 for GCB. These results indicate that the items within each construct demonstrate satisfactory internal consistency and consistently measure the intended constructs.

5.4 Discussion of Hypothesis Findings

5.4.1 Attitude toward GST Compliance and GST Compliance Behavior

PBC recorded the largest Chi-Square statistic, indicating a particularly strong association between Attitude toward GST Compliance and GST Compliance Behavior. The Chi-Square test produced $\chi^2(4, N = 326) = 20.715$, $p < .001$. Therefore, H1 was supported.

The finding indicates that respondents' attitudes towards GST compliance are significantly associated with their compliance Behavior. A favourable attitude towards GST obligations may encourage taxpayers to perceive compliance as an important and responsible business activity. This finding is consistent with the TPB, which identifies attitude as an important component of Behavioral decision-making (Ajzen, 1991).

5.4.2 Subjective Norm and GST Compliance Behavior

The second hypothesis proposed a significant association between Subjective Norm and GST Compliance Behavior. The Chi-Square result was $\chi^2(4, N = 326) = 22.748$, $p < .001$. Hence, H2 was supported.

The result suggests that social expectations may be relevant to GST compliance Behavior. Micro-enterprise owners may be influenced by the Behavior and expectations of business peers, tax professionals, family members, customers, and other stakeholders. This finding is consistent with the TPB, in which subjective norm represents perceived social pressure associated with performing a particular Behavior (Ajzen, 1991).

5.4.3 Perceived Behavioral Control and GST Compliance Behavior

The third hypothesis proposed a significant association between Perceived Behavioral Control and GST Compliance Behavior. The analysis produced $\chi^2(4, N = 326) = 154.197$, $p < .001$. Therefore, H3 was supported.

Among the four independent variables, PBC recorded the largest Chi-Square statistic, indicating a particularly strong association with GCB in the present analysis. The finding suggests that the perceived ability of micro enterprises to manage GST compliance requirements is important. Knowledge of GST procedures, confidence in filing returns, record-keeping ability, access to professional assistance, and familiarity with online GST procedures

may contribute to taxpayers' perceived control over compliance. This finding corresponds with the TPB, which recognises perceived behavioral control as an important factor associated with Behavior (Ajzen, 1991).

5.4.4 Perceived GST Rate Rationalisation and GST Compliance Behavior

The fourth hypothesis proposed a significant association between Perceived GST Rate Rationalisation and GST Compliance Behavior. The Chi-Square test produced $\chi^2(4, N = 326) = 20.982$, $p < .001$. Therefore, H4 was supported.

The finding suggests that perceptions regarding the reasonableness and rationalisation of GST rates are associated with compliance Behavior. Micro enterprises may be sensitive to the financial implications of taxation because of their relatively limited financial and administrative resources. Therefore, perceptions of manageable and reasonable GST rates may be relevant to GST compliance Behavior.

5.5 Theoretical Implications

The study contributes to the theoretical understanding of GST compliance Behavior by applying the Theory of Planned Behavior (TPB) proposed by Ajzen (1991). The findings provide empirical support for the relevance of attitude, subjective norm, and perceived behavioral control in understanding GST compliance Behavior among micro enterprises. The significant associations between these constructs and GST Compliance Behavior indicate that taxpayers' personal evaluations, perceived social expectations, and confidence in their ability to comply are important Behavioral considerations. The study further extends the TPB framework by incorporating Perceived GST Rate Rationalisation as a tax-policy-related factor. Its significant association with GST Compliance Behavior suggests that compliance may also be related to taxpayers' perceptions of the reasonableness and rationalisation of GST rates. Thus, the study combines Behavioral and taxation-policy dimensions to provide a broader perspective on GST compliance Behavior among micro enterprises (Ajzen, 1991).

5.6 Practical Implications

The findings have practical implications for GST authorities, policymakers, tax practitioners, and micro-enterprise owners. Since Perceived Behavioral Control produced the largest Pearson Chi-Square statistic among the four associations examined, the finding suggests

that the relationship between taxpayers' perceived ability to manage GST compliance requirements and GST compliance Behavior warrants particular attention. GST authorities can provide simplified training on registration, return filing, invoicing, record maintenance, and online GST procedures. Awareness programmes can strengthen positive attitudes and social norms towards compliance, while clear communication regarding GST rates and policy changes can improve taxpayers' understanding of the tax system. Such measures can contribute to a simpler and more supportive compliance environment for micro enterprises.

5.7 Limitations of the Study

The study has several limitations. First, it is based on 326 respondents, which may limit the generalisability of the findings to all micro enterprises. Second, the study relies on self-reported responses, which may involve response bias. Third, the cross-sectional design captures respondents' perceptions at a particular point in time and therefore does not explain changes in compliance Behavior over time. Fourth, Chi-Square analysis identifies significant associations but does not establish causal relationships. Finally, the study focuses on four major explanatory variables, while factors such as GST knowledge, compliance costs, digital literacy, trust in tax authorities, perceived fairness, and tax administration may also influence GST compliance Behavior.

6. Conclusion

The present study examined GST Compliance Behavior among micro enterprises by considering Attitude toward GST Compliance, Subjective Norm, Perceived Behavioral Control and Perceived GST Rate Rationalisation. Data from 326 valid respondents were analysed using descriptive statistics, reliability analysis and Pearson Chi-Square tests of independence.

The reliability analysis demonstrated satisfactory internal consistency across all five constructs, with Cronbach's alpha values ranging from 0.822 to 0.908.

The Pearson Chi-Square results demonstrated statistically significant associations between each of the four independent variables and GST Compliance Behavior. Significant associations were observed between AT and GCB, SN and GCB, PBC and GCB, and PGRR and GCB, with all four tests yielding $p < .001$. Therefore, H1, H2, H3 and H4 were supported with respect to the hypothesised associations.

Among the four tests, PBC produced the largest Pearson Chi-Square statistic. This indicates a statistically significant association between perceived behavioral control and GST compliance Behavior; however, the Chi-Square statistic should not be interpreted as evidence of causal effect or predictive strength.

The findings are broadly consistent with the Behavioral perspective of the Theory of Planned Behavior, particularly the relevance of attitude, subjective norm and perceived behavioral control to Behavioral outcomes. The significant association between perceived GST rate rationalisation and GST compliance Behavior further suggests that perceptions of GST policy may also be relevant to compliance among micro enterprises.

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Women – Led Rural Entrepreneurship and Sustainable Economic Development: A Study of Women Entrepreneurs in Aruppukottai Taluk

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Abstract

Women-led rural entrepreneurship plays a significant role in promoting sustainable economic development by generating employment, improving family income, reducing poverty and strengthening the socio-economic status of rural communities. Rural women are increasingly engaged in diverse entrepreneurial activities such as agriculture, dairy farming, food processing, handicrafts, tailoring and other micro and small-scale enterprises. However, their entrepreneurial development is constrained by limited access to finance, marketing difficulties, inadequate training, family responsibilities and poor infrastructure. Against this background, the present study examines the role of women-led rural entrepreneurship in promoting sustainable economic development and identifies the major challenges faced by women entrepreneurs in Aruppukottai Taluk. The study adopts a descriptive research design and is based on both primary and secondary data. Primary data were collected from 100 women entrepreneurs through a structured questionnaire using proportionate stratified sampling technique. The study was conducted over a period of six months. The collected data were analysed using percentage analysis. The findings reveal that 42 per cent of the respondents belong to the 26–35 years age group, while food processing represents the largest category of enterprise (26 per cent). Self-Help Groups are the major source of finance (34 per cent), whereas lack of finance is the most prominent challenge (32 per cent). Employment generation (36 per cent) is identified as the major contribution of women-led rural entrepreneurship to sustainable economic development, followed by increased family income (30 per cent). The study highlights the need for improved access to affordable finance,

entrepreneurship and digital skills, market linkages, infrastructure and awareness of government support schemes to strengthen women-led rural enterprises and promote inclusive and sustainable rural economic development.

Keywords: Women-Led Entrepreneurship, Rural Entrepreneurship, Sustainable Economic Development, Women Entrepreneurs, Self-Help Groups, Financial Inclusion, Rural Development

1. Introduction

Women-led rural entrepreneurship has emerged as an important contributor to sustainable economic development, particularly in developing countries such as India. Rural women are increasingly engaged in entrepreneurial activities including agriculture, dairy farming, food processing, handloom and handicrafts, tailoring, livestock rearing, mushroom cultivation, floriculture and other micro and small-scale enterprises. Their participation in entrepreneurial activities not only generates income for their families but also creates employment opportunities, supports poverty reduction and contributes to the overall development of rural communities.

Rural women entrepreneurs play an important role in the productive utilisation of local resources, preservation of traditional skills and development of locally based enterprises. Their enterprises can contribute to value addition, financial inclusion and livelihood generation within rural communities. The growth of Self-Help Groups (SHGs), microfinance institutions, financial inclusion initiatives, skill development programmes and digital technologies has created new opportunities for women to participate in entrepreneurial activities and strengthen their economic independence.

Several government initiatives have also supported women entrepreneurs through access to finance, skill development, entrepreneurship training and market opportunities. Programmes such as the National Rural Livelihood Mission (NRLM), Pradhan Mantri Mudra Yojana (PMMY), Stand-Up India, Startup India and NABARD-supported Rural Entrepreneurship Development Programmes have contributed to strengthening the entrepreneurial ecosystem for rural women. Such initiatives are particularly relevant to inclusive rural development because they can enable women to establish and expand enterprises and improve household livelihoods.

Women-led rural enterprises are also closely associated with the Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure) and SDG 10 (Reduced Inequalities). By generating employment and income within rural communities, women entrepreneurs can contribute to poverty reduction, livelihood improvement and more inclusive economic growth. Their enterprises may also support local production, agricultural value addition and environmentally responsible business practices.

Despite these opportunities, rural women entrepreneurs continue to face several challenges. Limited access to finance, inadequate entrepreneurial and digital skills, poor infrastructure, restricted market access, limited access to technology, socio-cultural constraints and family responsibilities can affect the establishment, growth and sustainability of their enterprises. In addition, lack of awareness about government schemes and difficulties in accessing institutional support may prevent women entrepreneurs from fully benefiting from available programmes.

Therefore, strengthening women-led rural entrepreneurship requires an enabling environment involving financial institutions, government agencies, educational institutions, non-governmental organisations and other stakeholders. Improving access to affordable finance, entrepreneurship and digital skills, market linkages, infrastructure and institutional support can enhance the sustainability of rural women-led enterprises.

Against this background, the present study focuses on women entrepreneurs in Aruppukottai Taluk and examines their role in sustainable economic development. The study analyses the nature of their entrepreneurial activities, sources of finance, major challenges and their contribution to employment generation, family income, poverty reduction, women empowerment and environmental sustainability.

2. Statement of the Problem

Women play an important role in the economic and social development of rural communities through their participation in entrepreneurial activities. Rural women are engaged in agriculture, dairy farming, handicrafts, food processing, tailoring and other micro and small-scale enterprises that contribute to household income and local employment. However, despite

their increasing participation, the growth and sustainability of women-led rural enterprises continue to be affected by several economic, social and institutional constraints.

Limited access to finance remains one of the major barriers faced by rural women entrepreneurs. In addition, inadequate entrepreneurial and digital skills, poor infrastructure, limited market connectivity, restricted access to technology and socio-cultural constraints can limit their ability to establish, manage and expand their enterprises. Balancing family responsibilities with business activities further creates difficulties for many women entrepreneurs.

The Government of India and various financial and development institutions have introduced several initiatives to support women entrepreneurs, including the National Rural Livelihood Mission (NRLM), Pradhan Mantri Mudra Yojana (PMMY), Stand-Up India and NABARD-supported programmes. However, the availability of schemes does not necessarily ensure their effective utilisation at the grassroots level. Lack of awareness, difficulties in accessing institutional finance and inadequate knowledge about available support mechanisms may prevent rural women entrepreneurs from fully benefiting from these initiatives.

At the same time, sustainable rural economic development requires greater participation of women in productive economic activities. Women-led enterprises have the potential to generate employment, increase family income, reduce poverty, promote financial inclusion and strengthen local economies. However, the extent to which rural women entrepreneurs contribute to sustainable economic development and the specific challenges that influence their entrepreneurial activities require closer examination at the local level.

In this context, there is a need to understand the entrepreneurial profile, sources of finance, major challenges and perceived contributions of women entrepreneurs in Aruppukottai Taluk. Therefore, the present study seeks to examine the role of women-led rural entrepreneurship in sustainable economic development, identify the major challenges faced by rural women entrepreneurs and suggest appropriate measures to strengthen their enterprises for inclusive and sustainable rural development.

3. Objectives of the Study

The study is carried out with the following objectives:

1. To examine the nature and profile of women-led rural entrepreneurship in Aruppukottai Taluk.
2. To analyse the major sources of finance utilised by rural women entrepreneurs.
3. To identify the major challenges faced by women entrepreneurs in establishing and sustaining their enterprises.
4. To assess the contribution of women-led rural entrepreneurship to sustainable economic development, particularly in terms of employment generation, family income, poverty reduction, women empowerment and environmental sustainability.
5. To suggest appropriate measures for strengthening women-led rural enterprises and promoting inclusive and sustainable rural economic development.

4. Research Methodology

The present study adopts a descriptive research design to examine women-led rural entrepreneurship and its contribution to sustainable economic development in Aruppukottai Taluk. The study is based on both primary and secondary data. Primary data were collected from 100 women entrepreneurs in Aruppukottai Taluk through a structured questionnaire. The respondents were selected using the proportionate stratified sampling technique to ensure appropriate representation of the selected strata. The study was conducted over a period of six months. Secondary data were collected from government reports, RBI publications, NABARD reports, Ministry of Rural Development documents, research journals, books and published articles. The collected primary data were organised and analysed using percentage analysis to understand the profile of respondents, type of enterprise, sources of finance, major challenges and the contribution of women-led rural entrepreneurship to sustainable economic development.

5. Review of Literature

- Aggarwal and Johal (2021) examined rural women entrepreneurship and highlighted the importance of government support, entrepreneurial education and microfinance in promoting rural women entrepreneurship. The study indicated that appropriate institutional and financial support can contribute to the economic empowerment of rural women.

- Raman et al. (2022) analysed the relationship between women entrepreneurship and sustainable development and reported that women entrepreneurs contribute to sustainable development through employment generation, poverty reduction and their contribution towards the Sustainable Development Goals (SDGs). The study emphasised the broader role of women entrepreneurship in promoting inclusive and sustainable development.
- Kumari et al. (2026) identified access to finance, education, digital literacy and institutional support as important factors influencing the success of women-led rural enterprises. The study also highlighted social and infrastructural barriers as major challenges affecting the development and sustainability of rural women-led enterprises.

The reviewed studies indicate that finance, entrepreneurial education, digital literacy, institutional support and government interventions play an important role in strengthening women-led rural entrepreneurship. However, challenges relating to finance, marketing, infrastructure and social responsibilities continue to affect rural women entrepreneurs. These observations provide a basis for examining the entrepreneurial profile, sources of finance, major challenges and contribution to sustainable economic development among women entrepreneurs in Aruppukottai Taluk.

6. Data Analysis and Interpretation

Table 1: Age of the Respondents

Age Group (Years)	No. of Respondents	Percentage (%)
Below 25	18	18
26–35	42	42
36–45	28	28
Above 45	12	12
Total	**100**	**100**

Source: Primary

The majority of the respondents (42%) belong to the age group of 26–35 years, indicating that young and middle-aged women are more actively engaged in rural entrepreneurial activities.

Table 2: Type of Enterprise

Type of Enterprise	No. of Respondents	Percentage (%)
Agriculture	24	24
Dairy Farming	20	20
Handicrafts	18	18
Food Processing	26	26
Tailoring & Others	12	12
Total	**100**	**100**

Source: Primary

Food processing enterprises account for the highest share (26%), followed by agriculture (24%), indicating that value-added agricultural businesses are popular among rural women entrepreneurs.

Table 3: Source of Finance

Source of Finance	No. of Respondents	Percentage (%)
Self-Finance	22	22
Bank Loan	30	30
Self-Help Groups (SHGs)	34	34
Microfinance	14	14
Total	**100**	**100**

Source: Primary

Most respondents (34%) received financial support through Self-Help Groups (SHGs), highlighting the important role of SHGs in promoting rural women entrepreneurship.

Table 4: Major Challenges Faced

Challenge	No. of Respondents	Percentage (%)
Lack of Finance	32	32
Marketing Problems	24	24
Lack of Training	18	18
Family Responsibilities	16	16
Poor Infrastructure	10	10
Total	**100**	**100**

Source: Primary

Lack of finance is the most significant challenge (32%), followed by marketing problems (24%), indicating the need for better financial and marketing support.

Table 5: Contribution to Sustainable Economic Development

Contribution	No. of Respondents	Percentage (%)
Employment Generation	36	36
Increased Family Income	30	30
Poverty Reduction	18	18
Women Empowerment	10	10
Environmental Sustainability	6	6
Total	**100**	**100**

Source: Primary

Employment generation (36%) is perceived as the primary contribution of women-led rural entrepreneurship, followed by increased family income (30%), demonstrating its positive impact on sustainable economic development.

Contribution of Rural Women Entrepreneurs to Sustainable Economic Development

- Employment Generation and Livelihood Creation by Rural Women Entrepreneurs
- Poverty Reduction and Improved Household Income through Rural Women Entrepreneurship
- Financial Inclusion and Economic Empowerment of Rural Women Entrepreneurs
- Agricultural Value Addition and Local Resource Utilisation by Rural Women Entrepreneurs
- Promotion of Environmentally Sustainable Practices by Rural Women Entrepreneurs
- Social Development and Improved Quality of Life through Rural Women Entrepreneurship
- Community Development and Local Economic Empowerment led by Rural Women Entrepreneurs

Major Challenges Faced by Rural Women Entrepreneurs

- Limited Access to Finance and Credit
- Lack of Entrepreneurial and Digital Skills
- Inadequate Rural Infrastructure and Basic Facilities
- Limited Market Access and Weak Market Linkages
- Socio-Cultural Constraints and Gender Barriers
- Limited Access to Technology and Digital Platforms
- Family Responsibilities and Work–Life Constraints
- Lack of Awareness and Accessibility of Government Support Schemes

Government Initiatives Supporting Rural Women Entrepreneurship

- Deendayal Antyodaya Yojana – National Rural Livelihoods Mission (DAY-NRLM)
- Pradhan Mantri Mudra Yojana (PMMY)
- Stand-Up India Scheme
- Startup India Initiative
- NABARD Rural Entrepreneurship Development Programmes (REDP)
- Tamil Nadu Mahalir Thittam

7. Findings of the Study

1. The majority of the respondents (42%) belong to the 26–35 years age group, indicating the active participation of young and middle-aged women in rural entrepreneurship.
2. Food processing is the major enterprise activity (26%), followed by agriculture (24%) and dairy farming (20%), indicating the importance of agriculture-based and value-added enterprises among rural women entrepreneurs.
3. Self-Help Groups (SHGs) are the major source of finance for the respondents (34%), followed by bank loans (30%), highlighting the significant role of SHGs in supporting rural women entrepreneurs.
4. Lack of finance is the major challenge faced by the respondents (32%), followed by marketing problems (24%) and lack of training (18%), indicating the need for stronger financial, marketing and skill-development support.
5. Employment generation is the major contribution of women-led rural entrepreneurship to sustainable economic development (36%), followed by increased family income (30%) and poverty reduction (18%), demonstrating its contribution to livelihood improvement and rural economic development.

8. Suggestions

1. Affordable and easily accessible credit facilities should be strengthened to reduce the financial constraints faced by rural women entrepreneurs.
2. Effective market linkages, digital marketing facilities and e-commerce platforms should be developed to improve the market reach of rural women-led enterprises.
3. Regular entrepreneurship, business management and digital skills training should be provided to enhance the capacity and sustainability of rural women entrepreneurs.
4. Awareness and accessibility of government schemes should be improved through local-level awareness programmes and institutional support.
5. Rural infrastructure, transportation, storage and digital connectivity should be strengthened to facilitate the efficient operation and expansion of women-led enterprises.

6. Networking, mentoring and institutional support should be promoted to encourage innovation, value addition and long-term sustainability of rural women-led enterprises.

9. Conclusion

Women-led rural entrepreneurship contributes significantly to sustainable economic development through employment generation, increased family income and poverty reduction. The study reveals that food processing is the major enterprise activity, while Self-Help Groups remain the leading source of finance for rural women entrepreneurs. Lack of finance and marketing problems are the major challenges affecting their entrepreneurial development. The findings also indicate that women-led rural enterprises contribute to livelihood improvement and local economic development through employment generation and increased household income. Strengthening affordable finance, market linkages, entrepreneurial and digital skills, infrastructure and awareness of government support schemes can enhance the sustainability and economic empowerment of rural women entrepreneurs in Aruppukottai Taluk.

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A Study on Impact of Online Shopping on Consumer Buying Behaviour

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Abstract

Online shopping has become an important part of modern consumer buying behaviour due to the rapid growth of the internet, smartphones, e-commerce platforms and digital payment systems. It provides consumers with convenience, product variety, price comparison, reviews, discounts, and doorstep delivery, thereby changing traditional buying practices. Consumer buying behaviour refers to the process of identifying needs, searching for information, evaluating alternatives, making purchase decisions, and assessing satisfaction. Factors such as price, quality, brand reputation, reviews, discounts, payment security, and delivery service influence the buying behaviour. This study examines the impact of online shopping on consumer buying behaviour in Sivakasi, with particular focus on consumers' preferences, purchasing frequency, influencing factors, satisfaction and problems faced while shopping online.

Keywords: Online, Online Shopping, Consumer, Impact, Buying Behaviour

1.1 Introduction

Online shopping has become a popular method of purchasing goods and services due to the growth of the internet, smartphones, e-commerce platforms, and digital payments. It provides consumers with convenience, product variety, price comparison, reviews, discounts, and doorstep delivery, thereby changing traditional buying practices. Consumer buying behaviour refers to the process of identifying needs, searching for information, evaluating alternatives, making purchase decisions, and assessing satisfaction. Factors such as price,

quality, brand reputation, reviews, discounts, payment security, and delivery service influence the buying behaviour. This paper has made an attempt to analyse the impact of online shopping on consumer buying behaviour.

1.2 History of Online Shopping in India

Online shopping in India began to develop in the 1990s with the introduction and gradual expansion of the internet. During the early 2000s, e-commerce platforms started offering books, electronics, travel services, and other products through websites. The launch of Flipkart in 2007 marked an important milestone in Indian online shopping, followed by the rapid growth of platforms such as Amazon India and Snap deal. The widespread use of smartphones, affordable internet services, digital wallets, and Unified Payments Interface (UPI) further accelerated the growth of online shopping. During the COVID-19 pandemic, online purchasing increased significantly as consumers relied on e-commerce platforms for essential and non-essential products. Today, online shopping has become an important part of India's retail sector, offering consumers convenience, wider product choices, competitive prices, discounts, easy payment options, and doorstep delivery.

1.3 Statement of the Problem

Online shopping is increasingly preferred by consumers in Sivakasi because of convenience, product variety, discounts, competitive prices, and doorstep delivery. However, factors such as product quality, delivery delays, return policies, payment security, and trust may affect buying decisions. Therefore, this study examines the factors influencing consumer buying behaviour, preferences, satisfaction, and challenges related to online shopping in Sivakasi.

1.4 Scope of the Study

The study focuses on consumers in Sivakasi and examines their online shopping preferences, purchase frequency, and factors such as price, convenience, quality, discounts, payment methods, and delivery services. It also studies consumer satisfaction, advantages, challenges, and changing purchasing patterns. The findings may help online retailers and marketers improve their services. Since the study is limited to Sivakasi, the findings may not be generalised to other areas.

1.5 Objectives of the Study

- To examine the profile of the online shopping repondents.
- To identify the factors influencing consumers' preference for online shopping.
- To examine the impact of online shopping on consumer buying behaviour in Sivakasi.
- To analyse problem faced by the consumer while using online platforms.
- To offer suggestions for improving online shopping services and consumer satisfaction.

1.6 Research Methodology

Research methodology refers to the systematic process used to conduct the study. The study adopts a Descriptive Research Design and covers consumers in Sivakasi. PrimaryData were collected from 120 respondents through a structured questionnaire. Convenience Sampling was followed to identify the respondents. The collected data were analysed using Percentage Analysis, Simple Average Method and Weighted Arithmetic Mean.

1.6.1. Profile of the Respondents

Profile of the respondents is needed to analyse the impact of online shopping in the Next Scenario. The information about the profile of the respondents like Gender, Age, Profession and Monthly Income are displayed in Table.1.

Table 1: Profile of the Respondents

Profile	Category	No. of Respondents	Percentage (%)
Gender	Male	15	30.00
	Female	35	70.00
	Total	**50**	**100.00**
Age	Below 20	13	26.00
	20-30	12	24.00
	30-40	14	28.00
	40-50	10	20.00
	50-60	1	2.00
	Above 60	-	-
	Total	**50**	**100.00**

Profession	House Wife	6	12.00
	Employees	24	48.00
	Business	4	8.00
	Students	14	28.00
	Professionals	2	2.00
	Total	**50**	**100.00**
Monthly Income	Below Rs.10,000	8	16. .00
	Rs.10,000-Rs.20,000	12	24.00
	Rs.20,000-Rs.30,000	15	30.00
	Rs.30,000-Rs.40,000	8	16.00
	Above Rs.40,000	7	14.00
	Total	**50**	**100.00**

Source: Primary Data

From the above analysis, it is inferred that out of 100 respondents majority of 70.00 per cent of the respondents are male, 28 per cent of the respondents are in the age between 30–40 years, 48 per cent of the respondents are employees and 30 per cent of the respondents are earn above Rest. 40,000 as monthly income.

1.6.2 Frequency of Purchase Products through Online Shopping Platforms

The Consumers engage in online shopping, ranging from daily and weekly purchases to occasional and rare purchases. The Table2 helps to understand the online purchasing habits and shopping frequency of the respondents.

Table 2: Frequency of Purchase products through online shopping platforms

S. No.	Response	No. of. Respondents	Percentage
1	Daily	0	-
2	Weekly	7	14.00
3	Monthly	18	38.00
4	Occasionally	11	22.00
5	Rarely	14	28.00
	Total	**50**	**100**

Source: Primary Data

The Table 2 shows that 38 per cent of the respondents monthly purchase products through online shopping platforms, 28 per cent of the respondents purchase rarely, while 22 per cent purchase occasionally and the balance 14 per cent purchase weekly and none of the respondents purchase daily.

1.6.3 Type of Products Purchased Most Frequently through Online Shopping Platforms

The researcher collects information like the different types of products that respondents purchase most frequently through online shopping platforms. It helps to identify consumer preferences and understand which product categories are most popular among online shoppers. The Table 3 shows the types of products purchased most frequently through online shopping platforms.

Table 3: Type of Products Purchased Most Frequently through Online Shopping Platforms

S. No.	Type of Product	No. of Respondents	Percentage
1	Groceries and Household Products	7	14.00
2	Electronics and Gadgets	6	12.00
3	Beauty and Personal Care	1	2.00
4	Food and Beverages	3	6.00
5	Clothing a Fashion	29	58.00
6	Others	4	8.00
	Total	**50**	**100%**

Source: Primary Data

The Table 3 shows that 58 per cent of the respondents most frequently purchase Clothing and Fashion products through online shopping platforms, Groceries and Household Products account for 14%, While Electronics and Gadgets account for 12%. Others account for 8%, Food and Beverages account for 6%, and Beauty and Personal Care account for only 2%.

1.6.4 Factors Influencing Online Shopping Over Traditional Shopping

The various factors that influence consumers to prefer online shopping over traditional shopping. It highlights the major reasons, such as convenience, time-saving, discounts and offers, wider product variety, easy price comparison, and doorstep delivery. The Table 4 helps to understand the key factors that encourage consumers to choose online shopping platforms instead of visiting physical stores.

Table 4: Factors Influencing Online Shopping Over Traditional Shopping

S. No.	Factors	No. of responses						Mean Score	Rank
		1	2	3	4	5	Total		
1	Convenience	2 (2)	28 (56)	10 (30)	8 (32)	2 (10)	50 (130)	2.60	II
2	Lower price and discounts	15 (15)	4 (8)	13 (39)	8 (32)	10 (50)	50 (144)	2.88	III
3	Wide Variety of products	18 (18)	4 (8)	18 (54)	8 (32)	2 (10)	58 (122)	2.44	I
4	Time Saving	8 (8)	2 (4)	8 (24)	18 (72)	14 (70)	50 (178)	3.56	V
5	Easy home delivery	8 (8)	12 (24)	2 (6)	6 (24)	22 (110)	50 (172)	2.60	IV

Source: Primary data

From the above Table 4, it is clear that, wide variety of product as first rank with a mean score of 2.44 followed by Convenience, lower price and discounts, wide variety of products, time saving and easy home delivery.

1.6.5 Problems faced by the Consumers while using Online Shopping Platforms

The consumers faced several problems while using online shopping platforms. Table 5 shows the problems faced by the consumers while using online shopping platforms.

Table 5: Problems Affecting Consumers Buying Decisions in Online Shopping

S. No.	Problem	Total Score	Rank	Average Score
1.	Poor product quality	18999	III	53.64
2.	Return problems	18507	IV	52.95
3.	Payment Issues	18327	V	51.43
4.	Delayed delivery	19019	VIII	45.53
5.	High delivery charges	17205	VI	47.64
6.	Difficult return or refund process	17066	I	56.17
7.	Payment security concerns	19086	II	55.34
8.	Product mismatch with description	17275	VII	47.14

Source: Computed Data

The above table shows the Garret scores and the average scores for each respondent. The average scores are ranked according to their values. The first rank is given to "Difficult return or refund process", second rank goes to "Payment security concerns", third rank is for the "Payment security concerns", fourth rank is taken by "Return problems", fifth rank goes to "Payment Issues", sixth rank goes to "High Delivery Charges", the seventh rank is given to "Product Mismatch with description", eighth rank goes to "Delayed Delivery". Thus, Difficult return or refund process is the most significant problem affecting consumers' buying decisions in online shopping

1.7 Suggestions of the Study

Online shopping companies should focus on improving product quality and ensuring that the products delivered match the descriptions and images provided online. They should provide accurate product information, faster delivery services and simple return and refund procedures. Payment security should also be strengthened to increase consumer confidence. Attractive discounts and offers can be continued, but companies should ensure transparency in pricing and delivery charges. Customer service should be improved to handle complaints and queries quickly. These measures can increase consumer satisfaction and encourage consumers to continue using online shopping platforms.

1.8 Conclusions

The study concludes that online shopping has become an important part of consumer buying behaviour in Sivakasi. The convenience, availability of products, discounts, time saving and home delivery facilities have encouraged consumers to prefer online shopping over traditional shopping. At the same time, problems related to product quality, delivery, returns, refunds and payment security can affect consumer satisfaction. Therefore, online shopping companies should improve product quality, delivery services, payment security and customer support to provide a better shopping experience and build long-term consumer trust.

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A Study on Customer Satisfaction towards Online Food Delivery Services

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Abstract

Online food delivery services have emerged as an important part of the modern digital economy, offering customers convenience, a wide variety of food choices, digital payment facilities, discounts, and real-time order tracking. The increasing use of smartphones, internet connectivity, and mobile applications has significantly changed consumer food-ordering behaviour. This study focuses on customer satisfaction towards online food delivery services and examines the major factors influencing customers' overall experience. Food quality, delivery time, order accuracy, pricing, discounts and offers, application usability, packaging, payment convenience, customer support, and the behaviour of delivery personnel are important determinants of customer satisfaction. The study also highlights the advantages of online food delivery, such as convenience and time saving, along with challenges including delivery delays, high or hidden charges, wrong orders, food quality issues, and packaging waste. Understanding customer expectations and experiences is essential for online food delivery platforms and restaurants to improve service quality, enhance customer satisfaction, encourage repeat usage, and build long-term customer loyalty.

Keywords: Online Food Delivery, Customer Satisfaction, Food Quality, Delivery Time, Digital Payment, Service Quality

1.1 Introduction

The global food service industry has undergone a significant transformation over the past decade due to the rapid development of digital technology. Traditional methods of dining out or placing food orders through telephone calls have increasingly been replaced or

supplemented by technology-driven food delivery services. Online Food Delivery (OFD) platforms have evolved from being a convenient alternative into an important part of modern lifestyles. The widespread use of smartphones, high-speed internet connectivity, digital payment systems, and changing consumer preferences has contributed significantly to the growth of the online food delivery sector. Platforms such as Swiggy, Zomato, Domino's, DoorDash, and other regional services have transformed the way consumers search for restaurants, compare menus and prices, place orders, make payments, and receive food.

The growth of online food delivery services has been particularly significant among urban consumers, students, working professionals, and younger generations. Consumers can order food from their homes, workplaces, or other locations without physically visiting restaurants. Online platforms provide a wide variety of restaurants and cuisines and allow customers to compare prices, ratings, reviews, delivery times, and promotional offers. The availability of digital payment options and real-time order tracking has further increased the convenience of online food ordering.

Customer satisfaction is an important factor in the success of the online food delivery industry. Since consumers can easily switch from one platform to another, service providers need to continuously improve their service quality and customer experience. Customer satisfaction towards online food delivery services is influenced by several factors, including food quality, delivery time, order accuracy, price, discounts and offers, application usability, restaurant choices, packaging, payment convenience, customer support, and the behaviour of delivery personnel.

Food quality and timely delivery are particularly important because customers expect the food to reach them fresh, hygienic, and in good condition. Similarly, accurate orders, reasonable prices, attractive discounts, convenient payment facilities, and efficient complaint resolution can influence consumers' perceptions of service quality. A positive experience may encourage customers to place repeat orders and remain loyal to a particular platform, whereas negative experiences may result in complaints, reduced usage, or switching to competing platforms.

Therefore, studying customer satisfaction towards online food delivery services is important for understanding consumer expectations and identifying the major factors affecting their overall experience. Such a study can help online food delivery platforms and associated restaurants improve service quality, reduce service-related problems, increase customer satisfaction, and develop long-term customer relationships.

1.2 History of Online Food Delivery System

The development of online food delivery can be traced to the growth of the internet and electronic commerce during the 1990s. Before the emergence of online platforms, customers generally placed food orders by telephone or visited restaurants directly. With the development of the internet, restaurants started providing menus and ordering facilities through websites. This marked the initial transition from traditional food ordering to digital food ordering.

During the 2000s and 2010s, the rapid growth of smartphones, mobile applications, affordable internet connectivity, and digital payment systems significantly accelerated online food ordering. Food delivery aggregators emerged as intermediaries connecting customers, restaurants, and delivery partners through a single digital platform. These platforms allowed customers to search for restaurants, browse menus, compare prices, place orders, make payments, and provide ratings and reviews.

In India, online food delivery developed rapidly with the emergence and expansion of platforms such as Zomato and Swiggy. These platforms provided customers with access to a large number of restaurants and introduced facilities such as GPS-based delivery tracking, online payments, customer reviews, discounts, and promotional offers. The adoption of smartphones and digital payment systems, particularly UPI, further contributed to the growth of the sector.

The COVID-19 pandemic accelerated the adoption of online food delivery as consumers increasingly preferred home delivery and contactless ordering. Restaurants and food delivery platforms adapted to changing consumer needs by strengthening digital ordering, delivery tracking, online payments, and contactless delivery.

Today, online food delivery has become an important part of the digital economy. Technological developments such as artificial intelligence, personalized recommendations,

automated customer support, real-time tracking, cloud kitchens, and digital payment systems continue to influence the industry. The evolution from telephone-based ordering to app-based food delivery reflects the increasing importance of convenience, speed, reliability, and customer experience.

1.3 Online Food Delivery Services in India

India has experienced considerable growth in online food delivery due to increasing smartphone usage, affordable internet connectivity, digital payment adoption, urbanization, and changing lifestyles. Consumers can access a large number of restaurants and food choices through mobile applications without visiting restaurants physically.

The major online food services in India are:

1.3.1 Swiggy

Swiggy is an Indian technology-based food ordering and delivery platform established in 2014 by Sriharsha Majety, Nandan Reddy, and Rahul Jaimini. It connects customers with restaurants through its digital platform, enabling users to browse menus, place orders, make digital payments, track deliveries, and provide ratings and feedback. Over the years, Swiggy has expanded its services and strengthened its technology-driven delivery network. It is one of the major online food delivery platforms in India, where factors such as food quality, delivery time, order accuracy, pricing, discounts, application usability, and customer support influence customer satisfaction.

1.3.2 Zomato

Zomato is an Indian technology-based restaurant discovery and food delivery platform founded in 2008 by Deepinder Goyal and Pankaj Chaddah. It enables customers to search for restaurants, browse menus, read ratings and reviews, place food orders, make digital payments, and track deliveries. Over the years, Zomato has become one of the major online food delivery platforms in India, connecting customers with a wide range of restaurants. Factors such as food quality, delivery time, order accuracy, pricing, discounts, application usability, and customer support play an important role in influencing customer satisfaction among Zomato users.

1.3.3 Domino's

Domino's is a global pizza restaurant chain founded in 1960 in the United States. It has a strong presence in India and provides customers with convenient food ordering and delivery

services through its outlets and digital platforms. Customers can browse menus, place orders, make online payments, and receive delivery updates. Food quality, taste, delivery time, order accuracy, pricing, packaging, and customer service are important factors influencing customer satisfaction with Domino's.

1.3.4 Uber Eats

Uber Eats was an online food delivery platform operated by Uber that connected customers with restaurants through a digital application. It enabled users to browse menus, place orders, make digital payments, and track deliveries. Uber Eats entered the Indian market but discontinued its food delivery operations in India in 2020 following the sale of its India food delivery business to Zomato. Its development represents an important stage in the evolution of online food delivery services.

The increasing competition among platforms has resulted in greater emphasis on delivery speed, food quality, discounts, technology, customer support, and overall service experience. However, the industry also faces challenges such as delivery delays, additional charges, incorrect orders, food quality issues, packaging problems, customer complaints, and competition among service providers. Therefore, maintaining customer satisfaction has become essential for the continued growth of online food delivery services in India.

1.4 Advantages of Online Food Delivery Services

1.4.1 Convenience

Online food delivery allows customers to order food from their homes, workplaces, or other locations without visiting restaurants or making telephone calls.

1.4.2 Wide Variety of Choices

Customers can access a large number of restaurants, cuisines, and food items through a single application. They can compare menus, prices, ratings, and reviews before placing an order.

1.4.3 Time Saving

Online ordering reduces the time required to travel to restaurants and wait for food. Customers can place orders in advance and track their delivery.

1.4.4. Digital Payment Facilities

Customers can make payments through UPI, debit cards, credit cards, digital wallets, and other electronic payment methods.

1.4.5 Discounts and Offers

Online platforms frequently provide discounts, coupons, promotional offers, and other benefits, which can encourage customers to place orders.

1.4.6 Order Tracking

GPS-based tracking allows customers to monitor the progress of their orders and obtain information about the expected delivery time.

1.4.7 Customer Reviews and Ratings

Reviews and ratings help customers evaluate restaurants and food items before making their purchase decisions.

1.5 Disadvantages of Online Food Delivery Services

1.5.1 High Delivery Charges

Online food delivery platforms may charge additional delivery fees, service charges, and other costs, making the total price higher than dining at the restaurant.

1.5.2 Delayed Delivery

Traffic, weather conditions, restaurant workload, or high demand can cause delays in food delivery.

1.5.3 Food Quality Issues

The quality of food may decrease during transportation. Food can sometimes become cold, spilled, or less fresh by the time it reaches the customer.

1.5.4 Dependence on Internet and Technology

Customers need a smartphone, internet connection, and a digital platform to place orders. Technical problems may interrupt the ordering process.

1.5.5 Wrong or Missing Items

Sometimes customers may receive incorrect food items or find that some items are missing from their order.

1.5.6 Limited Customer Interaction

Online ordering reduces direct communication between customers and restaurants, which may make it difficult to explain special requirements or complaints.

1.5.7 Hidden Charges

Additional charges may appear during checkout, increasing the final bill compared with the initially displayed food price.

1.5.8 Packaging Waste

Frequent food deliveries involve plastic containers, bags, and other packaging materials, which can increase waste and environmental concerns.

1.6 Conclusion

Online food delivery services have significantly changed consumer food-ordering behaviour. The development of smartphones, mobile applications, digital payments, internet connectivity, and delivery tracking has made food ordering faster, easier, and more convenient. Consumers can now access a wide range of restaurants, compare prices and reviews, receive promotional offers, make digital payments, and track their orders through online platforms.

However, customer satisfaction depends not only on convenience but also on food quality, delivery time, order accuracy, pricing, packaging, payment facilities, customer support, and the overall service experience. Problems such as delivery delays, additional charges, incorrect orders, poor food quality, and inadequate customer support can negatively affect satisfaction.

Therefore, understanding customer satisfaction towards online food delivery services is important for both delivery platforms and restaurants. A study of customer expectations and experiences can help identify the major factors influencing satisfaction and repeat usage. The findings can assist service providers in improving service quality, enhancing customer experience, increasing customer loyalty, and developing effective strategies for sustainable growth in the competitive online food delivery industry.

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Artificial Intelligence in Social Media Marketing for Higher Education: A Review of Emerging Trends and Practices

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Abstract

The article examines the role of artificial intelligence (AI) in higher education social media marketing, integrating emerging trends, technologies, and practices. AI can optimise content and target the right audience and is increasingly used to create content and optimise campaigns for online platforms such as Facebook, Instagram, LinkedIn, and TikTok, as universities increasingly rely on these channels for outreach to prospective students and engagement with alumni. It also discusses the role AI can play in boosting recruitment effectiveness, improving branding strategies, and optimising community management. It outlines how AI can help marketing teams boost their productivity and expand their messaging capacity by using AI tools for content generation, post scheduling, sentiment analysis and smart resource allocation in paid social media advertising. Additionally, the study reveals key challenges, including concerns regarding data privacy, algorithmic bias, and the need to establish clear ethical guidelines and institutional policies. A method for incorporating AI into higher education social media marketing in an effective, open and fair way has been proposed. This paper aims to assist colleges in developing AI-driven social media strategies aligned with their recruitment, retention, and institutional reputation strategies. It outlines existing practices and highlights future areas of research.

Keywords: Artificial Intelligence, Social Media Marketing, Higher Education, Machine Learning, Chatbots, Student Engagement, Digital Marketing

Introduction

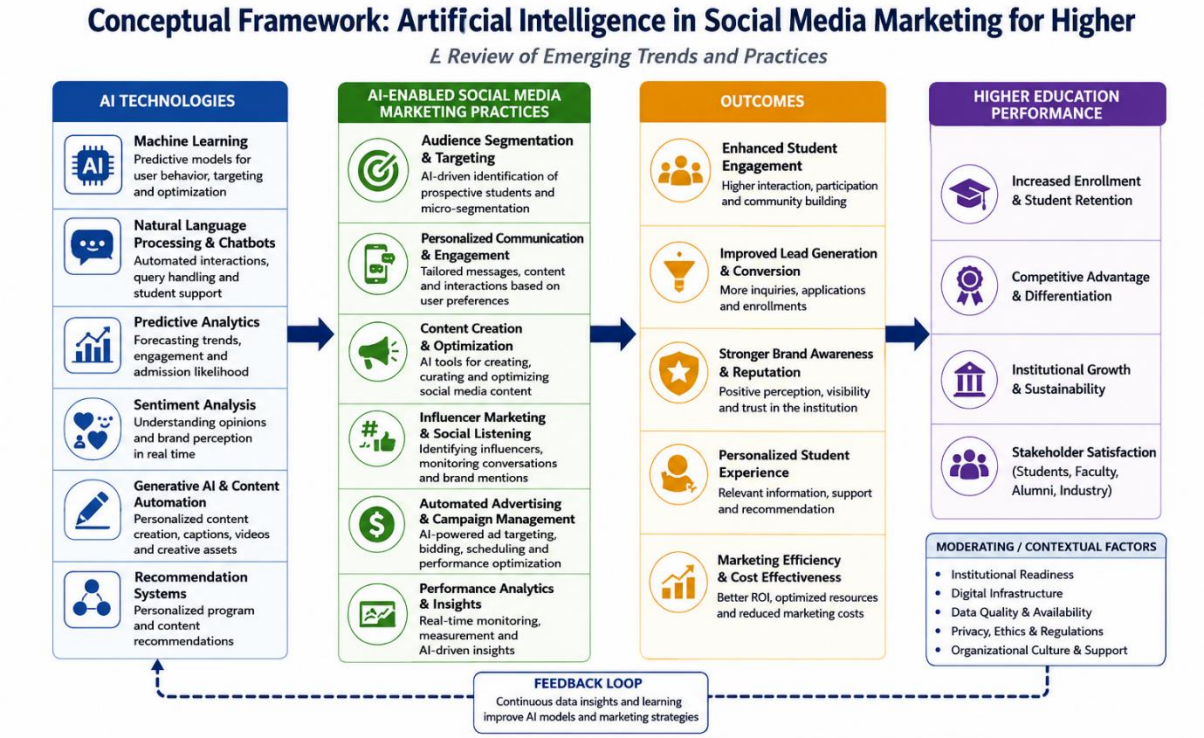
Institutions of higher education are increasingly using social media to engage with prospective students, develop institutional branding and build stronger relationships with

stakeholders. At the same time, AI has transformed digital marketing with artificial intelligence (AI) including data-driven decision-making, personalised communication, predictive analytics and automated customer interactions. When it comes to enhancing student engagement, recruitment, and institutional exposure, AI brings significant opportunities for schools and institutions looking to advance their social media marketing strategies.

This paper examines the recent developments, applications, benefits, challenges, and future potential of AI-driven social media marketing in higher education.

Review of Literature

Conceptual Framework for the Review of Literature



AI in Higher Education

Artificial Intelligence (AI) is a cutting-edge technology in higher education that is revolutionizing management, administration, instruction, and learning. The four main areas of research on AI applications in higher education include profiling and prediction, assessment and evaluation, adaptive learning systems, and intelligent tutoring systems, according to Zawacki-Richter et al. (2019). These are resources that can boost individual student learning, improve student results, and increase the institution's efficacy. According to Chen et al. (2022),

AI applications in education also increased dramatically, with a particular emphasis on the use of AI for learner performance prediction, intelligent tutoring systems, recommender systems, and educational data mining. Additionally, AI is essential to institutional decision-making.

The AI-driven management solutions enhance the accuracy of performance evaluation, competency building, and career planning according to Fawaid et al. (2025). Furthermore, Dehen et al. (2026) maintained that to achieve successful integration of AI in academia, teachers needed to become "AI literate. Recent developments in Generative AI have enabled new opportunities in the classroom for automated administrative functions, student support, and personalised learning. However, concerns regarding data privacy, algorithmic bias, data transparency, and data governance are still raised by academics. In all respects, AI has proven to be a valuable tool for institutions seeking to optimise student engagement and processes across the university.

2. AI in Social Media Marketing

Artificial intelligence (AI) has revolutionized social media marketing by allowing companies to automate processes, analyze user behavior, and offer highly customized content. According to Capatina et al. (2020), AI-based social media marketing solutions increase user engagement and marketing efficacy through audience analysis, photo identification, and sentiment analysis. Similarly, Benabdelouahed & Dakouan (2020) discussed the use of AI to manage massive amounts of customer data, predict consumer behavior, and optimize social media marketing initiatives through the use of machine learning algorithms.

The latest study indicates that AI-enabled social media marketing leverages automated consumer engagement and predictive data to enhance the performance of social media campaigns and support real-time decision-making. Jamalpur et al. (2025) point out that machine learning techniques can effectively analyse social media content and predict customer opinions, enabling marketers to tailor their messaging strategies accordingly. Furthermore, Danendra and Latupeirissa (2025) noted that AI improves operational efficiency and customisation, fosters personal communication with influencers and helps manage communication in the event of crises.

Artificial intelligence has made a huge impact on the way marketing is done on social media. AI is a modern asset that is being used to generate tailored content, gain insight into customer preferences, track customer behaviour, and optimise advertising campaigns. Businesses are making use of AI to produce unique content, comprehend customer preferences, track customer behaviour, and enhance the efficiency of their advertising campaigns beyond the constraints of usual advertising strategies. While these technologies come with numerous benefits, the issue of algorithmic fairness, data privacy and transparency is significant. Hence, it is crucial that the organisations leverage the efficient use of AI responsibly with adherence to ethical practices and preserve user trust while at the same time maximising the potential of AI in the context of social media marketing.

3. Social Media Marketing in Higher Education

In order to draw in prospective students, establish a branded reputation for them, and improve contact with those institutions' stakeholders, social media marketing is an essential component of higher education institutions' marketing operations. According to Pawar (2024), there are five key ways that social media is used in higher education marketing: relationship management, enrollment decision-making, student engagement, branding, and strategic marketing. New social media sites like Facebook, Instagram, YouTube, and LinkedIn give businesses a (relatively) inexpensive way to connect with a variety of consumers.

According to Juhaidi (2024), many higher education institutions have been using Facebook and Instagram for promotion, highlighting academic programs, institutional achievements, student experiences, and campus culture. In a similar vein, Fagerstrøm and Ghinea (2013) discovered that social network marketing greatly enhances student recruitment results by promoting communication and value co-creation between educational institutions and potential students. **Also, Clark et al. (2017) demonstrated that social media offers potentially a better quality of relationships between the students and institutions.**

Besides, Perera et al. (2023) emphasised that social media marketing is able to promote the involvement of social media, the identity of the institution and the brand among students, leading to the development of customer-based brand equity. Effective social media marketing techniques are now crucial for drawing in and keeping students as university rivalry heats up. But to match advancing technology developments and changing student expectations, educational establishments should constantly be updating their digital communication approach.

4. AI-Driven Student Recruitment and Enrolment

AI technology has transformed how students are obtained and the way in which students are managed for enrollment. To detect prospective students, predict enrolments, and tailor recruitment methods, higher education institutions are increasingly adopting AI-driven solutions and technologies. With AI, colleges can look at large data sets, such as those containing academic, behavioural, and demographic information, and use this analysis to target applications with greater precision.

According to research by Fagerstrøm and Ghinea (2013), social networking sites greatly enhance student recruiting results by promoting involvement and active participation. In more recent times, Golab-Andrzejak (2022 has highlighted the potential of using AI-based decision aid systems to enhance the participation and effectiveness of communication in higher education marketing. Artificial intelligence (AI)-powered chatbots, virtual assistants, and recommendation systems offer prompt answers to questions, enhancing the admissions process for potential students.

In addition, Liang et al. (2025) found that digital marketing technologies, such as artificial intelligence techniques, contribute to a firm's competitive position if there are better links with the students from the generation Z. Based on the interests and preferences of its students, these technologies enable educational institutions to provide customised communications, tailored information, and personalised ads. These focused strategies enhance enrollment results and conversion rates.

These benefits can not be overlooked, yet issues of the quality of data, student privacy, and ethical use of student information remain relevant. To ensure sustainable and reliable hiring processes, an organisation must balance technology development with the adoption of appropriate social and information management practices.

7. Generative AI and Content Creation in Higher Education Marketing

Generative AI (GenAI), which is an emerging technology in digital marketing and higher education, stands out as one of the most impactful trends to emerge recently. An emerging technology called Generative Artificial Intelligence, or GenAI, has made significant strides in both academia and digital marketing. Generative AI, in contrast to conventional AI-

powered systems, is capable of producing original text, graphics, videos, and captivating dialogs. These abilities give higher education institutions several opportunities to improve their marketing and communication efforts.

Wulan Sari (2025) found that the students were aware of generative AI being a helpful assistant to them in enhancing efficiency and personalised learning. Similarly, Pavone et al. (2025) reported that AI is no longer just used to analyse but also to create content, display empathy, and display creativity. Institutions can generate social media messages, marketing materials, specific messaging, and student engagement content in bulk, using generative AI tools such as ChatGPT.

According to Richter et al. (2025), using AI technology in marketing education is crucial for helping instructors and students gain real-world skills in AI-driven content production. Also, generative AI can deliver automatic responses, multilingual communications and customised advertising campaigns for various student segments.

Despite all of these advantages, there are also a lot of concerns with content validity, misinformation, plagiarism, and usage ethics. To guaranty that information is original and of the highest caliber, organizations must find a balance between robotics and human supervision. In order to guaranty authenticity and quality, it is crucial to strike a balance between automated systems and human oversight. To do this, institutions must set clear rules and guidelines for the proper use of AI. Therefore, generative AI is only meant to serve as a tool for human creativity and strategic thinking, not to replace it.

8. Ethical Issues and Challenges of AI Adoption

Adoption of artificial intelligence creates significant ethical, social, and technological issues even as it provides significant advantages for marketing in higher education. Data security and privacy are among the topics that are debated the most. The amount of user data that can be collected and processed by AI systems is significant, potentially opening the door for misuse, unauthorised use, and privacy concerns.

Danendra and Latupeirissa (2025) reported problems with algorithmic polarisation, deepfakes, and AI-driven disinformation in social media communication, along with moral

responsibilities. Similarly, Liu argues that ethical social media marketing and establishing trust rely on responsible methods of AI. Concerns about algorithmic bias, which might result in unfair treatment of people and discriminatory consequences, have also been brought up by researchers.

Wulan Sari (2025) coined the term "ethical anxiety," which describes concerns about academic integrity, transparency, and an excessive dependence on AI technology. In the context of AI application in educational settings, Roshanaei (2024) emphasised the significance of addressing diversity, equality, and inclusion issues. Second, when AI tools are used more and more in the classroom, there's a chance that administrators or lead instructors won't know enough about them to use them responsibly and effectively.

To address these challenges, institutions need to establish ethical guidelines, foster transparency, enhance the management of data assets, and provide education on AI literacy. To ensure justice, accountability, and sustainability in the marketing landscape of higher education, the responsible use of AI requires balancing the technical innovations with ethics.

9. Emerging Trends and Future Directions

Rapid technology breakthroughs and more integration of intelligent technologies will define the future of AI in educational institutions and social media marketing. Conversational AI, neuromarketing, generative AI, forecasting, immersive learning environments, and cutting-edge customization technologies are some of the new, developing ideas. Universities' interactions with member partners and potential students are anticipated to be impacted by these changes.

Pavone et al. (2025) note a transition from analytical AI applications to creative, empathetic AI systems to 'feel' emotions and enhance consumer experiences. Bucea-Manea-ňoniş et al. (2026) highlighted how artificial intelligence (AI) has become increasingly crucial to the field of "neuromarketing," thereby boosting the effectiveness of social media communication. Likewise, Yoshikawa (2025) pointed out the potential of generative AI in enabling collaborative and immersive learning.

Research is likely to focus on explainable AI, ethical governance, human-AI collaboration, and transparency in AI in the future. Researchers like Pawar (2024) and Navjot

and Talwandi call for further research into the impact of AI on student recruitment, institutional branding, and educational outcomes on a long-term basis. Further, with enhancements to automation and predictive modelling, there was a strong expectation for the marketing function to become more effective and strategic.

AI is continuing the march to transform higher education marketing overall. In this fast-paced digital era, companies that can leverage new technologies for a competitive advantage and maintain ethical values will be equipped to realise it.

Research Gap

There are very few studies that work in depth to examine the hybrid of AI-enabled social media marketing in higher education institutions, in spite of the fact that there is plenty of published work that has been studied on artificial intelligence (AI), social media marketing and higher education as separate fields. Compared to the aggregate impact of these technologies on institutional branding, student recruitment and student (not stakeholder) decision-making, relatively few studies have studied the impact of these technologies together; the majority of existing research has focused on specific technologies such as chatbots, predictive technology, machine learning, and generative technology. In addition, current studies mostly come from countries where higher education is found in large quantities, meaning there is a lack of empirical evidence from developing countries, such as India, where higher education institutions have experienced a rapid digital transformation.

Also, the research reveals that very little attention is given to return on marketing investment (ROI), algorithmic bias, data protection, ethical governance, institutional preparedness in adopting AI and the longer-term success of AI-driven social media marketing strategies. In addition, you will not find much that integrates conceptual frameworks between the use of AI technology, social media marketing strategies and higher education outcomes. Going forward, studies should focus on developing comprehensive models, conducting cross-cultural and longitudinal empirical research and establishing good practices for moral and effective use of AI in social media marketing in HEIs.

Limitations in the Study

Although there are several limitations to consider, this research provides a detailed overview of how artificial intelligence (AI) is used in social media marketing within higher

education. First, the conclusions depend on the quality, scope, and research methods of the selected studies since it is based solely on available secondary literature. Consequently, the findings of this evaluation may be affected by any limitations or biases present in the original studies.

Second, the review may have missed relevant research published in other languages or before the selected time period because it mainly focuses on papers published in English in recent years. This language and publishing bias might limit the review's scope.

Third, while the study examines a range of AI applications, including chatbots, sentiment analysis, machine learning, predictive analytics, and generative AI, new developments may emerge after the review is completed due to the rapid growth of AI technology. Therefore, some recent advances and practical applications might not be fully captured.

Moreover, the literature that has been evaluated includes a wide range of institutional and geographical situations. It is difficult to generalise the findings to other higher education institutions because of variations in technology infrastructure, digital maturity, institutional resources, governmental laws, and cultural factors. Although the amount of data from developing countries, particularly from India and other emerging economies, is still rather limited, a number of the studies reviewed originate in industrialised countries.

Finally, since no meta-analysis or direct empirical research has been carried out, this review mainly consists of a summary of existing theoretical and empirical findings. Consequently, it cannot demonstrate that marketing outcomes such as student enrolment, institutional reputation, or the return on marketing spending are causally linked to the use of AI. Future research that includes empirical investigations, longitudinal analysis, and comparisons across countries would provide greater insights into the effectiveness, difficulties, and long-term effects of AI-driven social media marketing in higher education.

Future Scope of the Study

- The effectiveness of AI-powered social media marketing techniques in relation to student recruitment, enrollment decisions, institutional branding, and student engagement across different higher education institutions should be empirically evaluated in future study.

- Cross-cultural and cross-national studies: More research should compare the adoption, application, and outcomes of AI-powered social media marketing in developed and developing nations to better understand how cultural, technological, and regulatory differences affect marketing effectiveness and institutional performance.
- Future studies should concentrate on creating governance models and ethical frameworks that address algorithmic bias, data privacy, transparency, fairness, and the responsible application of AI in higher education marketing and communication.
- Researchers can investigate the application of cutting-edge AI technologies such as Generative AI, Explainable AI (XAI), conversational AI (AI), AR, virtual reality (VR), and predictive analytics to improve individualised student experiences, digital participation, and the institution's competitiveness.
- Comprehensive conceptual or theoretical models that explain the connections between AI technologies, social media marketing tactics, student behaviour, institutional reputation, and long-term organisational performance in higher education institutions should be proposed and validated in future research.

Conclusion

The use of robotics (AI) has had a deep impact on how higher education institutions interact with prospective students, on their institutional branding, and on the effectiveness of their marketing efforts, since AI has now become a disruptive element in social media marketing. The literature reviewed indicates that universities have been able to develop more personalised, data-driven, and effective marketing strategies as a result of AI technologies such as machine learning, predictive analytics, sentiment analysis, chatbots, recommender systems, and generative AI. These technologies help higher education institutions to strengthen their competitive position in a more digital environment by aiding in student recruitment, customer interaction, content production, audience segmentation, and decision-making processes.

The research also shows how important social media platforms have become as strategic means of communication for universities. Thanks to AI-powered social media marketing, universities are now able to offer real-time interactions, customised communication, and better connection building with both students and stakeholders. Furthermore, new technologies such as neuromarketing and generative AI are providing further opportunities for creative marketing strategies and improved user experiences.

Even though there are these advantages, there are also several difficulties. The effective use of AI in the marketing of higher education is still obstructed by problems concerning data protection, algorithmic bias, ethical questions, transparency, AI literacy, and responsible governance. The research shows that institutional rules and ethical frameworks have not changed as rapidly as technological innovations.

The analysis as a whole shows that by improving operational effectiveness, student engagement, and institutional competitiveness, AI has the potential to make a significant impact on social media marketing in higher education. Yet it is necessary to adopt a balanced approach that combines technology innovation with attention to ethical issues, human supervision, and efficient governance systems if sustainable and responsible implementation is to be achieved. Future research should focus on evaluating the long-term effects of AI-powered social media marketing on educational outcomes, institutional reputation, and student enrollment, particularly within different cultural and regional contexts.

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A Study on Factors Influencing the Purchase of Femi9 Sanitary Napkins in Virudhunagar

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Abstract

A menstrual pad is an absorbent menstruating, bleeding after giving birth, recovering from gynaecologic sugery, experiencing a miscarriage or absortion, or in any other situation where it is necessary to absorb a flow of blood from the vagina. The Femi9 menstrual pad is a hygiene product that is worn externally. Femi full form is "Female Empowerment Movement of India". Femi9's first retail store opened its doors in 1999, when young middle-eastern were exploring new avenues, global trends and diverse fashion outlets. They have produced two types of Femi napkins Menstrual pads and daily wears panty liners. Femi does not harm the future of the nappy and the soil. So using Femi sanitary napkins made from biodegradable materials like organic cotton, these materials biodegaradable more easily in the environment compared to conventional synthetic materials like plastic. The objective of the study is to find the attitude of women towards Femi9 Napkin in Virudhunagar.

Keywords: Femi9, sanitary napkins, Menstrual pad

Introduction

A menstrual pad is an absorbent menstruating bleeding after giving birth, recovering from gynaecologic sugery, experiencing a miscarriage or absortion or in any other situation where it is necessary to absorb a flow of blood from the vagina. The Femi9 menstrual pad is a hygiene product that is worn externally. 64.4% of women are living in India.

Femi full form is "Female Empowerment Movement of India". Femi9's first retail store opened its doors in 1999, when young middle-eastern women were exploring new

avenues, global trends and diverse fashion outlets. The warm reception Femi9 received promoted its expansion throughout the mena region, with stores in UAE, Bahrain. Mrs.Dr.Gomathi is the founder of Femi napkin brand. Her mission is to bring this organic Femi napkin to women all over the world. They have produced two types of Femi napkins Menstrual pads and daily wears panty liners. Femi does not harm the future of the nappy and the soil. So, using Femi sanitary napkins made from biodegradable materials like organic cotton, these materials biodegaradable more easily in the environment compared to conventional synthetic materials like plastic.

This napkin was established under the name Femi for 11 years. In the year 2023, Actress Nayanthara joined this brand company and the brand name was changed from Femi to Femi9. Therefore, this Femi9 napkin is known to many people since then. Throughout the past 12 years, Femi flourished and became an exceptionally chic brand, providing a refreshing selection of trend setting styles to the women of Asia. They started the company and brought this innovative product to life. The objective of the study is to find the attitude of women towards Femi9 Napkin in Virudhunagar.

Research Methodology

The present study is based on the both primary and secondary data. Primary data have been collected from 80 respondents in Virudhunagar who were selected by convenience sampling method. The collected data were edited, tabulated and analysed for the purpose of presentation, Percentage analysis, Likert's five point scaling Technique and Simple Ranking Technique have been applied to analyse the data. Secondary data have been collected from various books and websites.

Results and Discussion

In this section, socio-economic profile of the respondents and attitude of women towards Femi9 napkins in Virudhunagar are taken into account.

Table 1: Socio-Economic Profile of the Respondents

Particulars	Profile of the Respondent	No. of respondents	Percentage
Age	11-20	32	40
	21-40	38	47.5
	41-50	10	12.5
	Total	**80**	**100**

Marital Status	Married	24	30
	Unmarried	56	70
	Total	**80**	**100**
Educational Qualification	School Student/Diploma	6	7.5
	Under Graduate	54	67.5
	Post Graduate	14	17.5
	Doctorate	6	7.5
	Total	**80**	**100**
Income (in₹)	Below 60,000	14	17.5
	60,000 - 1,00,000	24	30
	1,00,000-1,50,000	32	40
	More than 1,50,000	10	12.5
	Total	**80**	**100**
Present position of the respondents	Student	46	57.5
	Employee	24	30
	Housewives	10	12.5
	Total	**80**	**100**

Source: Primary Data

It is clear that out of 80 respondents, 38 (47.5%) respondents are in the age group of 11-20, 56 (70%) respondents are unmarried women, 54 (67.5%) are under graduates, 32 (40%) respondents have earned a monthly income below ₹1,00,000- ₹1,50,000 and 46 (57.5%) respondents are students.

Table 2: Type of Femi9 Napkin

Types	No. of respondents	Percentage
Daily Wear Napkin	8	10
Menstrual Napkin	32	40
Both	40	50
Total	**80**	**100**

Source: Primary Data

Table 2 shows that out of 80 respondents, 40 (50%) respondents have purchased both Menstrual & Daily Wear Napkin, 32 (40%) respondents have purchased only Menstrual Napkin and 8 (10%) respondents have purchased only Daily Wear Napkin.

Table 3: Purchase of Femi9 Napkin Annually

Purchase	No. of Respondents	Percentage
Below 5 times	58	72.5
More than 5 times	22	27.5
Total	**80**	**100**

Source: Primary Data

Table 3 shows that, 58 (72.5%) respondents have bought Femi9 Napkin Below 5 time annually, 22 (27.5%) have bought Femi9 Napkin more than 5 times annually.

Table 4: Awareness about Femi9 Napkins

Awareness	No. of respondents	Percentage
Through family, Relatives, Friends	44	55
Sales promotional measures	8	10
Advertisement on News paper	28	35
Total	**80**	**100**

Source: Primary Data

Table 4 shows that out of 80 respondents, regarding awareness about Femi9 napkin, 44 (55%) respondents have obtained awareness from family, relatives, friends, 28 (35%) respondents have gathered awareness from advertisement on newspaper and 8 (10%) respondents have got awareness from sales promotional measures**.**

Table 5: Comfortness of Femi9 Napkin

Comfort	No. of respondents	Percentage
Yes	74	92.5
No	6	7.5
Total	**80**	**100**

Source: Primary Data

Table 5 shows that, during Menstruation, 74 (92.5%) respondents felt comfortable in using Femi9 napkin and 6 (7.5%) respondents have not felt comfortable in using Femi9 napkin.

Table 6: Opinion about Femi9 Menstrual Napkin

Opinion	No. of Respondents	Percentage
It is very smooth & soft	52	65
Anaionchip is working on Anti-Bacteria	8	10
Leakage locking system	14	17.5
Chintin-helps to Biodegradable	6	7.5
Total	**80**	**100**

Source: Primary Data

It is found that 52 (65%) respondents have opined that Femi9 napkin is very smooth & soft, 14 (17.5%) respondents have opined that Femi9 Napkin have the Leakage locking system, 8 (10%) respondents have preferred for ‘Anaionchip is working on Anti-Bacteria’ and 6 (7.5%) respondents have preferred for ‘chintin-helps to Biodegradable’.

Table 7: Place of Purchase

Place	No. of Respondents	Percentage
Super Market	36	45
Agents	12	15
Medical Shop	12	15

Online	20	25
Total	**80**	**100**

Source: Primary Data

It is inferred those 36 (45%) respondents have bought Femi9 napkin in Super market, 20 (25%) have bought Femi9 napkin through online and 12 (15%) respondents have bought Femi9 napkin bought from agents and 12 (15%) respondents have brought Femi9 napkin from medical shop.

Table 8: Problems faced in the usage of napkin

Problems	No. of Respondents	Percentage
Non-availability of Napkin	30	37.5
Skin Irritation	12	15
High Price	10	12.5
Low Distribution Channels	28	35
Total	**80**	**100**

Source: Primary Data

The main problems faced by respondents in the usage of napkins are non-availability and low distribution channels, with 30(37.5%) and 28 (35%) of respondents reporting these issues, respectively. This is known that accessibility and availability are the most significant barriers. Skin irritation is a concern for 12(15%) of users, indicating that the materials or chemicals in the napkins may not suit everyone, while the high price of napkins, reported by 10 (12.5%) of respondents, remains a secondary issue for some consumers.

Table 9: Recommendation About Femi9 Napkin

Recommendation	No. of respondents	Percentage
Sure, blindly I'll recommend	44	55
I'll recommend	36	45
Total	**80**	**100**

Source: Primary Data

Out of 80 respondents, 44 (55%) respondents have recommended Femi9 napkins to others and 36 (45%) respondents have not recommended Femi9 napkins to others.

Table 10: Factors Influencing Femi9 Napkin

Factor	Number of Respondents				Total score	Mean score	Rank
	I 4	II 3	III 2	IV 1			
Price	14 (56)	32 (96)	18 (36)	16 (16)	204	2.55	**IV**
Leakage	24 (96)	32 (96)	14 (28)	8 (8)	228	2.85	**II**
Smoothness	26 (104)	34 (102)	16 (32)	4 (4)	242	3.02	**I**
Packaging and labelling	20 (80)	34 (102)	12 (24)	12 (12)	218	2.73	**III**

Source: Primary Data

It is clear that the factor **'Smoothness of the product**' gets the first rank with the mean score of 3.02 followed by '**Leakage of the product'** 2.85. The factors **'packaging and labelling of the product** and '**Price of this product'** secures the third and fourth ranks respectively with the mean score of 2.72 and 2.55.

Table 11: Attitude of Consumer Towards Femi9 Napkin – Menstrual Femi9 Napkin

Attitude	Number of Respondents					Total score	Mean score	Rank
	I 5	II 4	III 3	IV 2	V 1			
<u>Menstrual Femi9 napkin:</u> This napkin using more than 5 months, has the menstrual pain reduced	16 (80)	36 (144)	22 (66)	4 (8)	2 (2)	300	3.75	**IV**

This pad was wide enough and long enough for your personal use	36 (180)	26 (104)	18 (54)	-	-	338	4.22	**I**
Femi9 napkin observe moisturizer is very helpful	32 (160)	30 (120)	12 (36)	4 (8)	2 (2)	326	4.07	**II**
Design of Femi9 napkin making your purchasing	24 (120)	28 (112)	26 (78)	2 (4)	- -	314	3.92	**III**

Source: Primary Data

From the above table, it is clear that the statement '**Femi9 pad was wide enough and long enough for your personal use'** got the first rank with the mean score of 4.22 followed by '**Femi9 napkin observe moisturizer is very helpful'** with the mean score of 4.07. The statements **'Design of femi9 napkin making your purchasing'** got third rank with the mean score of 3.92 and '**This napkin using more than 5 months, has the menstrual pain reduced'** got the fourth rank with mean score of 3.75 points.

Table 12: Attitude of Consumer Towards Femi9 Napakin- Daily Wear Napkin

Attitude	**Number of Respondents**					**Total Score**	**Mean Score**	**Rank**
	I 5	**II 4**	**III 3**	**IV 2**	**V 1**			
Irregular menstrual cycle improved after using daily wear napkin	22 (110)	12 (48)	6 (18)	4 (8)	4 (4)	188	2.35	**II**
Cozy with daily wear napkin	34 (170)	6 (24)	4 (12)	4 (8)	- -	214	2.68	**I**
Quality of the napkins influence your buying choices	8 (40)	32 (128)	4 (12)	- -	4 (4)	184	2.30	**III**

Source: Primary data

From the above table, it is clear that the statement '**Cozy with daily wear napkin**' got the first rank with the mean score 2.68 points followed by '**Irregular menstrual cycle improved after using daily wear napkin'** got the second rank with the mean score of 2.35 points and '**Quality of the napkins influence your buying choices'** got the Third rank with the mean score of 2.30 points.

It is recommended to the company to reduce the price of the napkin because the consumers opined that price was high compared to other napkin. It is suggested that to take sales promotional measures like offer during festival seasons, buy one get one offer etc. for the Femi9 Napkin.

It is concluded from the study that 64.4% of women were living in India. Only 12% of Indian women are using Femi9 Napkins and others are using unhygienic means for menstrual health management. Management of hygiene during menstruation severely affected by the continued existence of several societal, cultural and religious restrictions on menstruation. Since they are frequently unprepared and unaware of their periods, especially in rural regions of the country.

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Credit Cooperatives and Sustainable Development Goals in India: Opportunities, Challenges and Policy Perspectives

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Abstract

In India, credit co-operatives are vital in achieving various Sustainable Development Goals (SDGs), including poverty eradication, food security, gender equality and economic growth. The study highlights the role of credit co-operatives in providing affordable credit to small-scale farmers, improving livelihoods and reducing dependence on informal moneylenders (SDG 1: No Poverty). They finance agriculture and provide essential inputs, contributing to food security (SDG 2: Zero Hunger). Increasing women's participation in cooperatives (SDG 5: Gender Equality) and financing rural enterprises (SDG 8: Decent Work and Economic Growth) are drivers of economic growth. Credit cooperatives also contribute to reducing inequalities (SDG 10: Reduced Inequalities) by practicing democratic governance and serving the marginalized. However, despite their benefits, challenges such as governance and technological gaps remain. Such reforms as the establishment of the Ministry of Cooperation and the digitalization process are crucial to maximize their impact and fulfilll India's SDG commitments by 2030. However, more research and continuous policy support are needed to establish empirical linkages between cooperatives and specific SDG indicators.

Keywords: Cooperatives, Sustainable Development Goals, Rural Development, Cooperative Banking, India

Introduction

The adoption of the United Nations 2030 Agenda for Sustainable Development has prompted governments, financial institutions, and community organizations to take part in the pursuit of sustainable development. The seventeen Sustainable Development Goals (SDGs) tackle poverty reduction, food security, gender equality, decent work, reduced inequalities,

environmental sustainability, and inclusive institutions. To achieve these targets, collaboration is required between governments, civil society organizations, financial institutions, and cooperative organizations. Credit cooperatives have a unique position among these institutions in India's rural financial system. Credit cooperatives offer affordable financial services to millions of rural households based on principles of mutual assistance, democratic governance, voluntary membership, and equitable distribution of benefits. Credit cooperatives are member-welfare-, social-equity-, and local-economic-development-driven, unlike commercial banks, which are profit-maximization-driven. India has one of the biggest cooperative movements in the world, with Primary Agricultural Credit Societies (PACCS), District Central Cooperative Banks (DCCBs), and State Cooperative Banks (StCBs). These institutions are playing a vital role in providing agricultural credit, supporting small and marginal farmers, promoting rural entrepreneurship, facilitating self-employment, encouraging women's participation, and improving rural livelihoods. The importance of credit cooperatives in rural transformation has further been enhanced by the recent policy initiatives of the Government of India, such as setting up the Ministry of Cooperation in 2021, digitalization of PACCS, diversification of cooperative activities, and strengthening of cooperative governance. Thus, the assessment of their contribution to the Sustainable Development Goals has become increasingly relevant. The importance of cooperatives to attain sustainable development is increasingly recognized. However, there is scant comprehensive evidence of the relationship between the activities of Indian credit cooperatives and specific Sustainable Development Goals. Most of the existing studies have analyzed financial performance, agricultural credit, or governance issues in isolation with little integration of the SDG framework. In this context, the present study analyzes the contribution of credit cooperatives toward selected Sustainable Development Goals in India. The study synthesizes recent evidence from national and international institutional reports and scholarly literature. The objective of this analysis is to provide policy relevant insights into the opportunities, constraints and prospects for strengthening the role of credit cooperatives in sustainable development. To this end, the paper analyzes the contribution of credit cooperatives to selected Sustainable Development Goals using secondary data from government reports, international organizations and cooperative institutions.

Review of Literature

Torgal and Viallon (2020) explored the link between cooperatives and the Sustainable Development Goals and found that cooperatives have an important role to play in ending

poverty, social inclusion, decent work and sustainable economic growth. They also emphasized the need for improved monitoring systems to assess the contributions of cooperatives to SDG targets.

Carrera-Silvestre et al. (2023) conducted a bibliometric analysis of cooperatives and the Sustainable Development Goals and discovered that cooperative organizations contribute to all seventeen SDGs. The study also highlighted the dearth of empirical studies measuring the impact of credit cooperatives on the achievement of the SDGs.

Hernández-Muñoz, Monzón, and Torres-Ortega (2024) conducted a systematic review of cooperatives and sustainability. Their results indicate that sustainability is an important research topic in cooperative research and suggest that governance, innovation, and social impact assessment could be future research directions.

Mendonca, DiMarzo, and Abdennadher (2025) explained the concept of data cooperatives and mentioned that democratic governance and participation of members enhance sustainable and ethical development. The study indicated that the cooperative principles are still relevant within emerging digital economies.

Chollet et al. (2026) performed a systematic literature review of 274 studies on agricultural cooperatives. Their review shows that cooperatives play an important role in economic, social, environmental, and governance dimensions of sustainability. The authors pointed out that more research attention should be paid to governance and social performance.

The implementation of SDGs in cooperative and social economy enterprises was studied by Sanchis, Campos, and Ejarque (2026), who concluded that cooperative management practices are closely aligned with sustainable development. They called for improved evidence-based evaluation frameworks to assess cooperative contributions to the SDGs.

Ujwary-Gil and Florek-Paszkowska (2026) developed a multi-level framework for analysis of the contribution of coffee cooperatives to sustainable development. In their review, they highlighted the significance of governance, innovation, social capital, gender inclusion, and value-chain collaboration in making cooperatives more sustainable.

Research Gap

Several studies have been conducted to analyze the contribution of cooperatives in rural development, financial inclusion, and agricultural finance, but limited empirical evidence that have analyzed the role of credit cooperatives in achieving the SDGs in India. Most of the previous studies have been based on financial performance, governance, agricultural credit, or cooperative banking without linking to the SDG framework. Moreover, studies based on empirical and secondary data on multiple SDGs, particularly SDGs 1, 2, 5, 8, 10, and 11, are limited. Therefore, the current study seeks to bridge this research gap by evaluating the contribution of credit cooperatives toward selected Sustainable Development Goals on the basis of secondary data from national and international reports.

Statement of the Problem

Credit cooperatives have a significant role in terms of availability of institutional credit, support to agriculture, financial inclusion and livelihood improvement of rural communities in India. However, their role in realization of Sustainable Development Goals (SDGs) has not been adequately explored in an integrated framework. The existing studies have mainly focused on individual aspects of financial performance, agricultural credit, governance or cooperative banking with less focus on linking these functions with specific SDGs. The problem is further compounded by the continuing institutional and operational challenges faced by the credit cooperatives such as governance deficiencies, technological gaps, limited professional management, financial constraints, regional disparities and weaknesses in operational efficiency. While recent government initiatives like the digitalization of Primary Agricultural Credit Societies, diversification of cooperative activities and strengthening of cooperative governance have thrown open new opportunities, the extent to which these reforms contribute to poverty reduction, food security, gender equality, employment generation, reduction of inequalities and sustainable communities remains inadequately documented. Furthermore, there is no comprehensive secondary evidence available to study together the contribution of credit cooperatives in multiple SDGs in the Indian context. This presents a major policy and research problem as in the absence of an integrated assessment it becomes difficult to determine the areas where credit cooperatives are more effective and institutional barriers that limit their developmental impact. The present study aims to address this problem by analyzing the role of credit cooperatives in promoting selected Sustainable Development Goals, that is, SDGs 1, 2, 5, 8, 10 and 11 and identifies the major opportunities, challenges and policy measures needed to strengthen their contribution to sustainable rural development in India.

Objectives of the Study

1. To study the role of credit cooperatives in promoting sustainable development goals in India.
2. To evaluate the contribution of credit cooperatives on selected SDGs (1, 2, 5, 8, 10, and 11) based on secondary evidence.
3. To research the opportunities and challenges of credit cooperatives in promoting sustainable development.
4. Suggest policy measures to increase the contribution of credit cooperatives to the achievement of the SDGs.

Research Methodology

The present study is a descriptive qualitative review design to study the role of credit cooperatives in the advancement of the Sustainable Development Goals (SDGs) in India. The study relies on secondary data from published and publicly available sources. The aim is to synthesize the existing evidence on opportunities, challenges, and policy perspectives on credit cooperatives' contribution to sustainable development. Secondary information was gathered from authentic national and international sources, i.e., the Ministry of Cooperation, Government of India; National Bank for Agriculture and Rural Development (NABARD); Reserve Bank of India (RBI); National Federation of State Cooperative Banks (NAFSCOB); National Cooperative Development Corporation (NCDC); NITI Aayog; International Cooperative Alliance (ICA); International Labor Organization (ILO); United Nations (UN); and peer-reviewed journal articles published between 2020 and 2026.

The collected literature, policy documents, annual reports, and institutional publications were analyzed through document analysis and thematic content analysis. The data were systematically reviewed and synthesized to identify the contribution of credit cooperatives to SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities), and SDG 11 (Sustainable Cities and Communities). It also examined the major opportunities, institutional challenges, government initiatives, and policy recommendations to maximize the role of credit cooperatives in sustainable development. We reviewed studies published in the English language between 2020 and 2026. We included articles that discussed cooperative finance, rural credit, SDGs, governance, sustainability, and policy perspectives. Conference abstracts, duplicate records,

publications in languages other than English, and studies not related to credit cooperatives were excluded. The selected publications were subjected to thematic content analysis to determine the contribution of credit cooperatives toward SDGs 1, 2, 5, 8, 10, and 11.

Table 1: Financial Performance of Rural Credit Cooperatives in India

(Amount in Crore)

Year	Owned Funds	Deposits	Borrowings	Loans Disbursement
2020-2021	437.41	1654.76	1385.71	2145.33
2021-2022	423.11	1709.22	1430.44	2294.43
2022-2023	427.54	1763.90	1723.74	1531.37
2023-2024	485.65	1972.39	2013.29	2004.91
2024-2025	594.78	2035.32	2276.01	2126.01
Average	473.70	1827.12	1765.84	2020.41

Source: Reserve Bank of India Trend and Progress of Banking in India (2020-21 to 2024-25).

Table 1 Trend of Selected Financial Indicators of Credit Cooperatives (2020-21 to 2024-25) The owned funds have increased from ₹437.41 crore in 2020-21 to ₹594.78 crore in 2024-25, showing the improved financial strength and stronger capital base of cooperative institutions. Similarly, deposits have increased gradually from Rs. 1,654.76 crore to Rs. 2,035.32 crore during the period under review. The growth of deposits shows increasing public confidence and member participation in cooperative financial institutions.

The borrowings also increased to ₹2,276.01 crore in 2024-25 from ₹1,385.71 crore in 2020-21. Higher borrowings signify greater reliance on external financial capital but also show an enhanced capacity of credit cooperatives to mobilize funds for lending and rural development activities. A temporary decline in loan disbursement was observed in 2022–23, followed by a recovery in 2023–24 and 2024–25 This shows the continued role of credit cooperatives in financing agriculture, rural enterprises, and livelihood activities.

The upward trend in owned funds, deposits and disbursement of loans indicate that the credit cooperatives are still consolidating their position as financial intermediaries in rural India. With greater financial resources, the institutions can expand the outreach of affordable

credit to small and marginal farmers, rural entrepreneurs, women, and other economically weaker sections. Therefore, the evidence of financial development endorses the role of credit cooperatives in SDG 1 (No Poverty) by enhancing access to institutional finance, SDG 2 (Zero Hunger) through agricultural credit, and SDG 8 (Decent Work and Economic Growth) by financing productive economic activities. But the simultaneous increase in borrowing suggests that sustainable financial management remains important. Credit cooperatives should continue to strengthen internal resource mobilization, improve loan recovery, and enhance operational efficiency to ensure long-term financial sustainability. The financial indicators suggest that the credit cooperatives continue to be an important institutional mechanism for the promotion of inclusive rural development and supporting the achievement of Sustainable Development Goals in India.

Figure 1: Financial Performance of Rural Credit Cooperatives in India

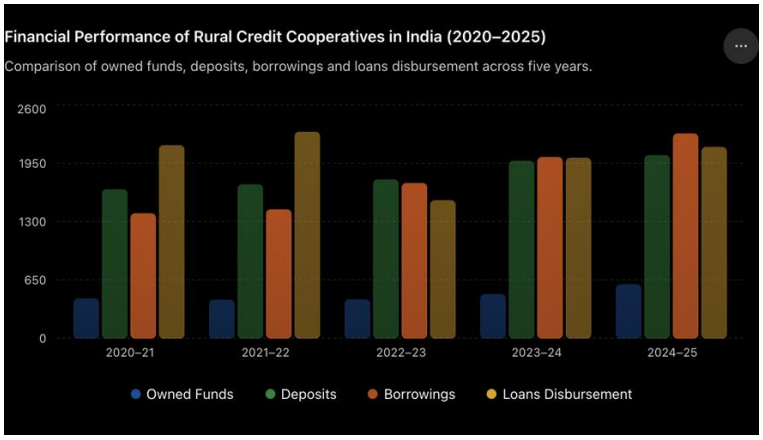


Table 2: Growth of Primary Agricultural Cooperative Credit Societies (PACCS) in India

Indicator	2020-21	2021-22	2022-23	2023-24	2024-25
Number of PACCS	100,502	100,693	100,961	101,242	101,487
Membership (Million)	130.8	133.5	136.4	139.2	142.6
Deposits (₹ Crore)	165,476	170,922	176,390	197,239	203,532
Loans Disbursed (₹ Crore)	214,533	229,443	153,137	200,491	212,601

Source: Compiled from NAFSCOB Statistical Statements (2023-24), NABARD Annual Report (2023-24), Ministry of Cooperation Annual Report (2024-25), and RBI Trend and Progress of Banking in India.

Table 2 shows that there is a gradual increase in the number of Primary Agricultural Cooperative Credit Societies (PACCS) and their membership during the study period. It is a sign of growing public participation in the cooperative movement. Membership has gone up from 130.8 million in 2020-21 to 142.6 million in 2024-25. Deposits and loan disbursement also showed an upward trend indicating improved public confidence and better institutional credit delivery. The growth of PACCS is a sign of their increasing role in financial inclusion, agricultural finance, and rural development and, therefore, in helping realize SDGs 1, 2, 8, and 10.

Table 3: Digitalisation and Diversification of PACCS

Indicator	Number
PACCS adopting Model Bye-Laws	81,947
PACCS under computerisation – Trial Run	7,098
PACCS under computerisation – Go-Live trials	1,254
New Multipurpose PACCS (m-PACCS)	9,961
PACCS identified for Grain Storage Pilot	1,779
PACCS converted into PM Kisan Samriddhi Kendras	29,119
PACCS with CSC onboarding completed	48,420
CSC centres operationalised through PACCS	26,443

Source: *Ministry of Cooperation, Government of India, National Statistics,2024-2025.*

The data indicate that PACCS are gradually transforming from traditional credit institutions into digitally enabled and multipurpose rural service institutions. The adoption of Model Bye-Laws by 81,947 PACCS and the computerisation initiatives indicate institutional modernisation. Similarly, the conversion of 29,119 PACCS into PM Kisan Samriddhi Kendras and the operationalisation of 26,443 CSC centres demonstrate diversification into agricultural and digital services. These developments create opportunities for improving rural financial inclusion, employment and access to essential services, thereby supporting SDG 8, SDG 10 and SDG 11**.**

Table 4: Credit Cooperatives: Rural Reach in India

Indicator	Data
People directly connected with cooperatives	29 crore
PACCCS	1,01,487
PACCS members	13 crore
Primary Dairy Cooperatives	1,40,946
Dairy cooperative members	1.5 crore
Primary Fishery Cooperatives	25,572
Fishery cooperative members	38 lakh

Source: Ministry of Cooperation, Government of India,2025, NAFSCOB, 2025.

The data demonstrate the extensive grassroots reach of the cooperative sector in India. Around 29 crore people are directly connected with cooperatives, while 1,01,718 PACCS serve nearly 13 crore members. The large membership base of PACCS indicates their importance in providing institutional credit and input services to rural communities. The presence of dairy and fishery cooperatives further shows that the cooperative movement supports multiple livelihood activities beyond agricultural credit. Credit cooperatives therefore have a huge potential to contribute to SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 8 (Decent Work and Economic Growth) and SDG 10 (Reduced Inequalities).

Table 5: Cooperative Contribution to Food Security

Indicator	Data
Decentralised grain storage capacity created under pilot	9,750 MT
PACCS involved in pilot storage capacity	11 PACCS
States covered	11 States
Additional PACCS where godown construction foundation stones laid	500 PACCS
Jan Aushadhi Kendras – PACCS applications	4,515 PACCS
Initial approvals for Jan Aushadhi Kendras	2,758 PACCS
Drugs available through Jan Aushadhi Kendras	2,047
Medical devices	300

Source: *Ministry of Cooperation, Government of India*, Annual Report 2024–25.

Diversification of PACCS into storage and other essential rural services increases their contribution to sustainable rural development. Under the decentralized grain storage pilot, 9,750 MT of storage capacity has been created through 11 PACCS across 11 States, while construction foundations for godowns in another 500 PACS have been laid. This infrastructure can be used for foodgrain storage and in addressing post-harvest management challenges. The approval of PACCS to operate Jan Aushadhi Kendras also expands their role into affordable healthcare services, demonstrating how cooperatives can contribute to community welfare beyond conventional credit activities. These initiatives are particularly relevant to SDG 2 (Zero Hunger) and SDG 11 (Sustainable Communities).

Table 6: Rural Financial Institution

Rural financial institution	Number
State Cooperative Banks (StCBs)	34
District Central Cooperative Banks (DCCBs)	352
PACCS	1,01,487
PACCS members	6.5 crore
Approx. active PACCS members	39%

Source: *NABARD,* Annual Report 2023–24.

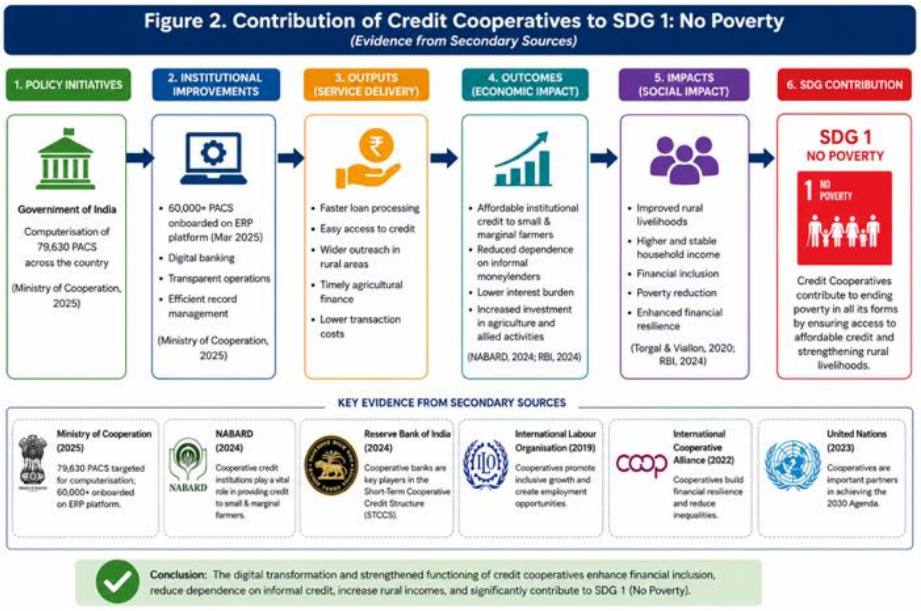
The three-tier short-term cooperative credit structure provides a wide institutional network for rural finance. NABARD reported 34 StCBs, 352 DCCBs and 1,05,439 PACS, with approximately 6.5 crore PACS members. This extensive grassroots network demonstrates the capacity of credit cooperatives to deliver institutional financial services to rural households. However, the fact that only around 39% of PACS members were active also indicates the need for stronger member engagement, better service quality and institutional reforms. Thus, the data highlight both the opportunity and challenge faced by credit cooperatives in achieving inclusive and sustainable development

Results and Discussion

Credit Cooperatives and SDG 1: No Poverty.

To bring in transparency and avail digital banking and credit availability, the Government of India has taken up computerization of 79,630 Primary Agricultural Credit

Societies across the country. By March 2025, more than 60,000 PACCS would have been onboarded on the Enterprise Resource Planning (ERP) platform, thus improving institutional credit delivery and operational efficiency (Ministry of Cooperation, 2025). NABARD (2024) stated that cooperative credit institutions are still the largest source of short-term agricultural credit for small and marginal farmers who are predominant in the farming community of India. (2024) The Reserve Bank of India states that cooperative banks continue to play a vital role in the provision of short-term agricultural credit thru the Short Term Cooperative Credit Structure (STCCS). The sustained availability of institutional credit to small and marginal farmers boosts rural livelihoods and diminishes dependence on informal sources of finance (RBI, 2024).



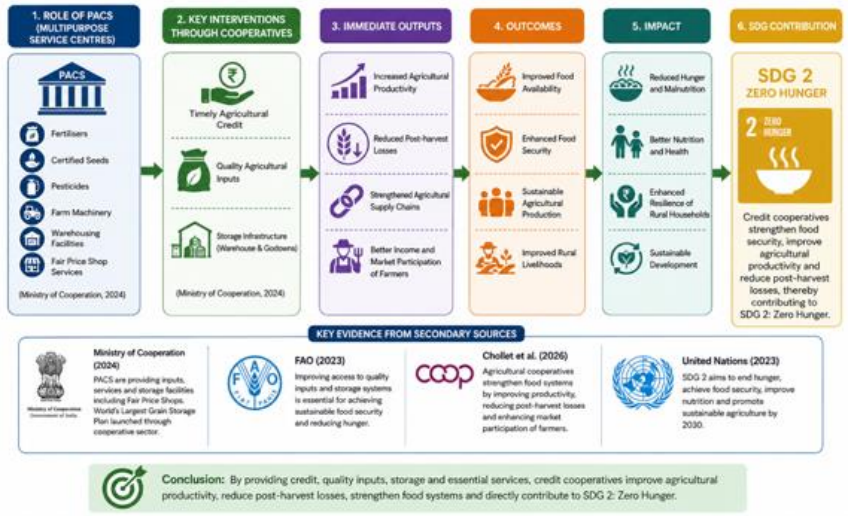
The digital transformation of PACCS has improved the efficiency of loan processing, record management, and delivery of financial services in rural areas. Better access to institutional credit reduces dependence on informal moneylenders, reduces costs of borrowing, and improves household income-generating opportunities. As per Torgal and Viallon (2020), cooperative institutions provide financial resilience to the vulnerable population, which leads to inclusive development. Therefore, the expansion and modernization of the credit cooperatives contribute significantly to the achievement of SDG 1. Therefore, the available secondary evidence suggests that credit cooperatives contribute measurably toward achieving SDG 1 through enhancing financial inclusion, livelihood security, and access to affordable institutional credit.

Credit Cooperatives and SDG 2: Zero Hunger

PACCS are increasingly becoming multipurpose service centers providing fertilizers, certified seeds, pesticides, farm machinery, warehousing facilities, and Fair Price Shop services (Ministry of Cooperation, 2024). Further, the Government of India has launched the world's largest grain storage plan through the cooperative sector to augment the decentralized agricultural storage infrastructure and enhance food security. The initiative is anticipated to enhance food security, decrease post-harvest losses, and strengthen agricultural supply chains (Ministry of Cooperation, 2024). This access to timely agricultural credit, quality farm inputs, and storage infrastructure enables farmers to enhance agricultural productivity and reduce post-harvest losses. According to the FAO (2023), enhancing the delivery and storage mechanisms of agricultural inputs is essential for sustainable food security. Likewise, Chollet et al. (2026) reported that agricultural cooperatives improve food systems through increased productivity and market participation of farmers. Thus, credit cooperatives contribute a lot toward the achievement.

Figure 3. Contribution of Credit Cooperatives to SDG 2: Zero Hunger

Evidence from Secondary Sources)



Credit Cooperatives and SDG 5: Gender Equality

Recent reforms of cooperatives have stimulated greater participation of women in cooperative membership and governance. The model bye-laws issued by the Ministry of Cooperation (2025) have created better opportunities for women to participate in the management of the cooperative institutions. Credit cooperatives also assist women through savings programs, agricultural credit, and linkages with self-help groups (SHGs). Cooperative

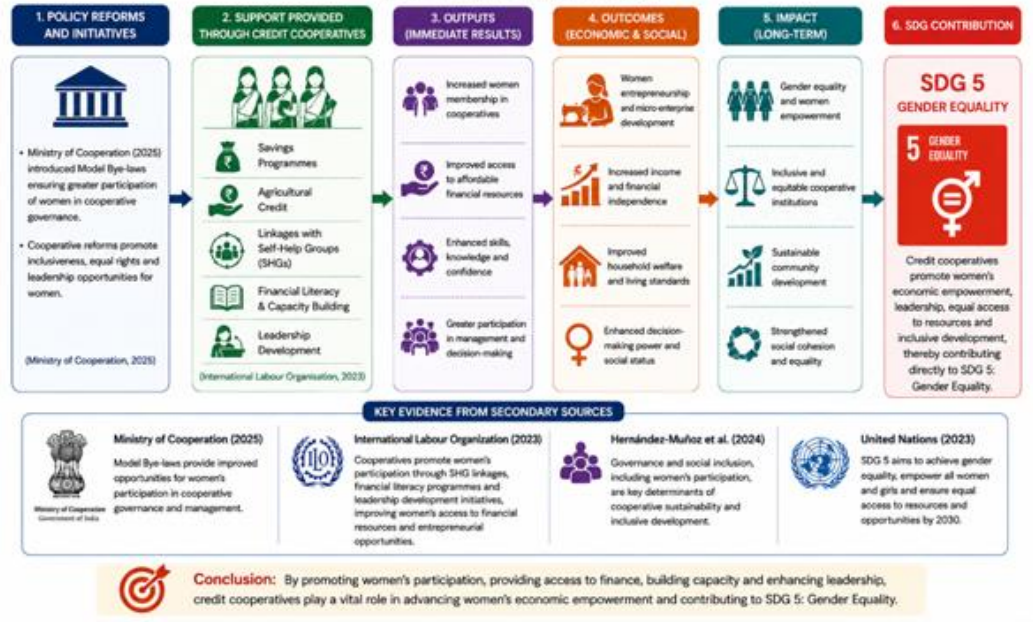
institutions have increased women's participation through Self-Help Group (SHG) linkages, financial literacy programs, and leadership development initiatives promoted by cooperative agencies. Such initiatives increase women's access to financial resources and entrepreneurial opportunities (International Labor Organization, 2023).

The involvement of women in cooperative institutions increases their financial independence, entrepreneurial development, and capacity to make decisions. Women can establish micro-enterprises. Access to affordable finance can improve household welfare. Governance and social inclusion have been recognized as key determinants of cooperative sustainability (Hernández-Muñoz et al. 2024). Therefore, strengthening women's participation in credit cooperatives directly supports them.

Cooperative institutions are therefore an important platform for the promotion of women's economic empowerment and gender-inclusive development.

Figure 4. Contribution of Credit Cooperatives to SDG 5: Gender Equality

(Evidence from Secondary Sources)

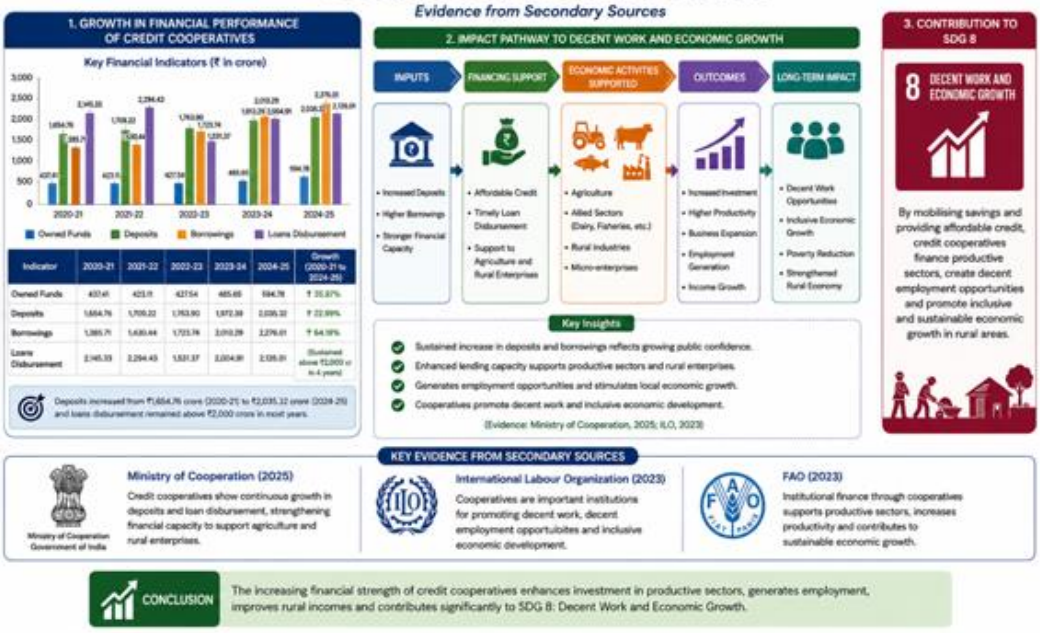


Credit Cooperatives and SDG 8: Decent Work and Economic Growth

The financial indicators as per Table 1 show that the deposits increased from ₹1,654.76 crore in 2020-21 to ₹2,035.32 crore in 2024-25, while the loan disbursement remained above ₹2,000 crore in most of the years of the study period. These trends indicate that credit

cooperatives are increasingly in a position to support agriculture and rural enterprises financially. The increase in deposits and loans is an indicator of increasing confidence in the cooperative banking system and increases the lending capacity of rural credit institutions. This enables additional investment in agriculture, allied sectors, and rural enterprises. The continuous increment of deposits and the granting of loans are indicative of the growing confidence of the public and the growing role of credit cooperatives in financing productive sectors. Institutional finance supports agriculture, dairy, fisheries, rural industries and microenterprises through assistance in generating job opportunities and improving the growth of the local economy. Cooperatives are recognized as important institutions in promoting decent work and inclusive economic development by the International Labor Organization (2023). Hence, credit cooperatives have a significant role.

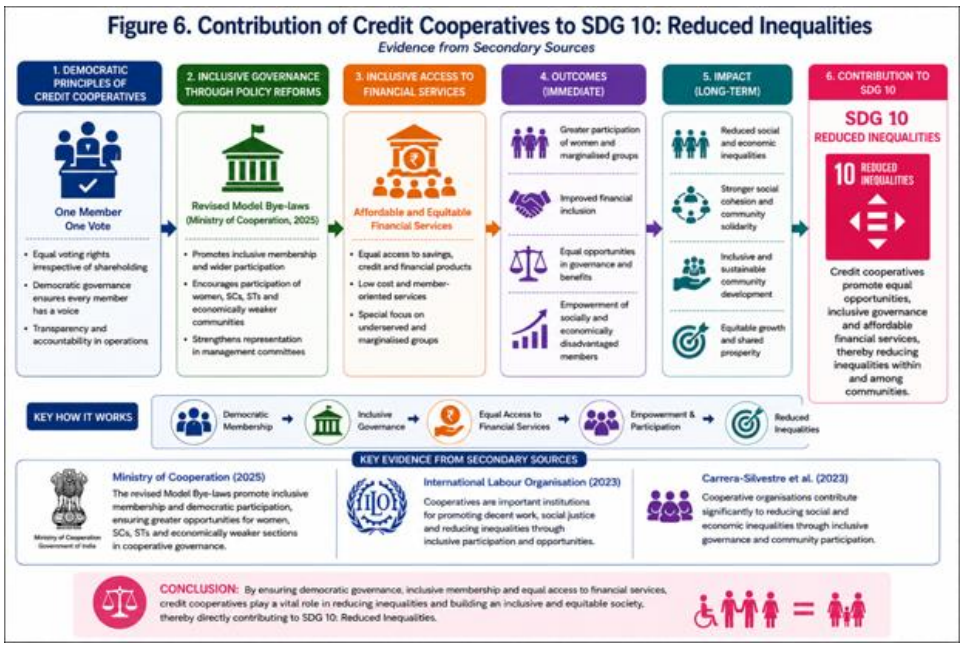
Figure 5. Contribution of Credit Cooperatives to SDG 8: Decent Work and Economic Growth



Credit Cooperatives and SDG 10: Reduced Inequalities

Credit cooperatives work on the principles of democracy and one-member-one-vote where each member has an equal vote irrespective of the amount of shares held. The Ministry of Cooperation (2025) has further improved inclusive governance through the revision of model bylaws to promote better participation of women, Scheduled Castes, Scheduled Tribes, and economically weaker sections. The Ministry of Cooperation has released the revised Model Bye-laws to promote inclusive membership and democratic participation, providing women

and socially disadvantaged sections a better opportunity to participate in cooperative governance (Ministry of Cooperation, 2025). Equal participation and affordable financial services help to reduce inequalities in access to formal financial institutions and improve social inclusion. They argue that cooperative organizations play a key role in reducing social and economic inequalities through inclusive governance and community participation (Carrera-Silvestre et al., 2023). Thus, credit cooperatives help in achieving this.



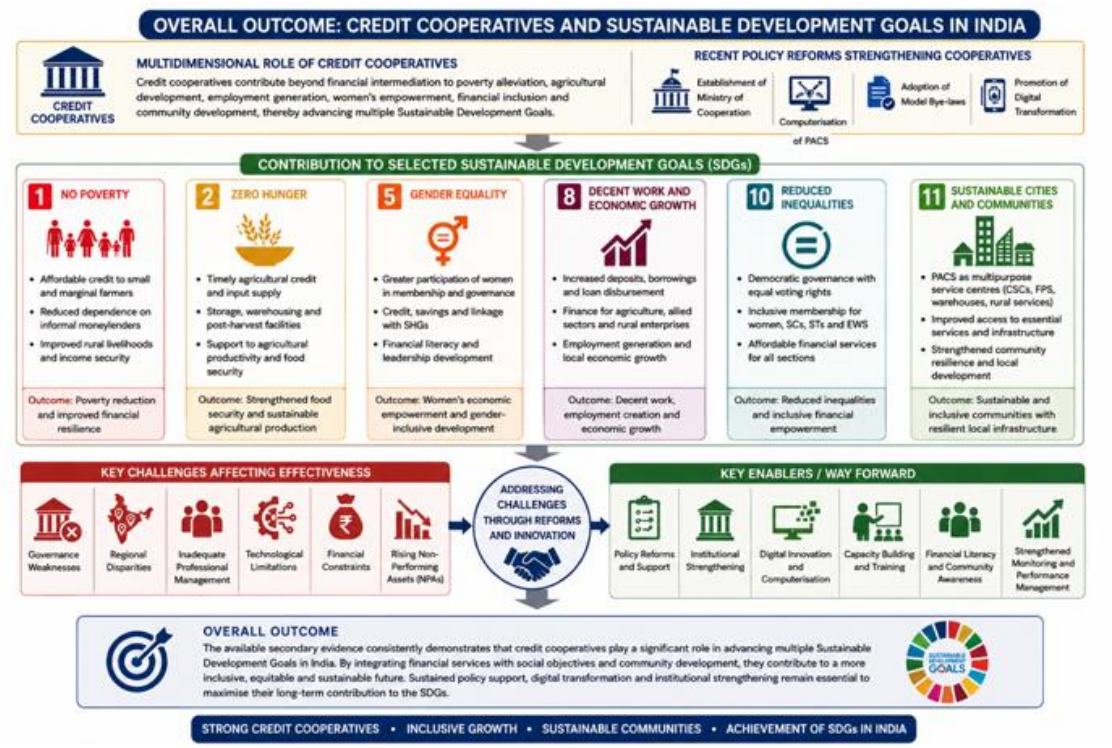
Credit Cooperatives and SDG 11: Sustainable Communities

The Ministry of Cooperation has facilitated the transformation of PACCS into multipurpose institutions offering Common Service Centers (CSCs), warehousing facilities, Fair Price Shops, and other rural public services. The reforms are targeted at reinforcing local infrastructure and enhancing the delivery of community services (Ministry of Cooperation, 2024). The diversification of PACCS into Common Service Centers (CSCs), warehouses, Fair Price Shops, and other rural service centers improves access to essential public services and strengthens community-level infrastructure (Ministry of Cooperation, 2024). The diversification of PACCS strengthens community resilience through better access to agricultural and digital services and essential commodities. Ujwary-Gil and Florek-Paszkowska (2026) argued that cooperative governance and community participation form the basis for sustainable local development. Hence, the expansion of multipurpose cooperative services makes an important contribution.



Overall Discussion

The study indicates that credit cooperatives have a multi-dimensional role in ensuring sustainable development. They are not only involved in financial intermediation but also are instrumental in poverty alleviation, agricultural development, employment generation, women's empowerment, financial inclusion, and community development. The recent policy reforms such as the creation of the Ministry of Cooperation, computerization of PACCS, adoption of model bylaws, and digital transformation have further enhanced the capacity of cooperatives to contribute to the Sustainable Development Goals. However, there are a number of challenges that affect their effectiveness, including governance deficits, regional variations, the lack of professional management, technological constraints, financial constraints, and a growing level of non-performing assets in some of the cooperative institutions. These will be addressed through policy reforms, institution-building, digital innovation, and capacity-building programs, which will further enhance the contribution of credit cooperatives to the achievement of the SDGs in India.



The secondary evidence available has indicated that credit cooperatives have a significant role to play in the progression of several Sustainable Development Goals in India as a whole. However, sustained policy support, digital transformation and institutional strengthening are key to maximizing their long-term contribution.

Opportunities for Cooperatives Credit Unions toward the Sustainable Development Goals

Recent policy initiatives by Government of India have created immense opportunities for enhancing the contribution of credit cooperatives to Sustainable Development Goals. The establishment of the Ministry of Cooperation in 2021 has accelerated reforms to improve governance, digitalization, institutional capacity, and business diversification in the cooperative sector (Government of India, Ministry of Cooperation, 2025). The ongoing computerization of 79,630 Primary Agricultural Credit Societies and implementation of Enterprise Resource Planning (ERP) systems have improved transparency, operational efficiency, and access to digital financial services across rural India (Ministry of Cooperation, 2025). Furthermore, the modification of PACCS into multipurpose institutions offering Common Service Centers (CSCs), warehousing services, fair price shops, distribution of agricultural inputs and other community services has enhanced their developmental role

beyond agricultural credit (Government of India, Ministry of Cooperation, 2024). The International Labor Organization (2023) also noted the contribution of cooperatives to inclusive economic growth, employment generation and social development through community engagement and democratic governance. In a similar vein, the International Cooperative Alliance (2023) acknowledged cooperatives as important institutions for promoting sustainable development through inclusive and locally focused economic activities. These trends point to the significant institutional potential of credit cooperatives in accelerating India's progress toward the Sustainable Development Goals.

Credit Cooperatives and the Challenges of Promoting Sustainable Development

Despite their important role, credit cooperatives still have some institutional and operational challenges that undermine their effectiveness in favor of sustainable development. The Reserve Bank of India (2024) stated that financial sustainability, strengthening of loan recovery, and improvement in governance are still major priorities for the cooperative banking sector. NABARD (2024) also emphasized the need for improving the institutional efficiency, strengthening the professional management, and increasing the adoption of technology in the cooperative credit institutions. Governance quality, innovation, and institutional capacity are key determinants affecting the long-term sustainability of cooperative organizations (Hernández-Muñoz et al., 2024). Similarly, governance performance, managerial ability and institutional effectiveness continue to be important challenges that impact the sustainability of agricultural cooperatives worldwide (Chollet et al., 2026). Furthermore, regional disparities, lack of digital infrastructure, poor human resource capacity and rising levels of non-performing assets (NPAs) continue to impact the performance of several cooperative institutions. The challenges faced by credit cooperatives need to be addressed through governance reforms, technological modernization, institutional capacity building and financial strengthening to improve their contribution to the achievement of the Sustainable Development Goals.

Policy Perspectives for Strengthening Credit Cooperatives

To increase the contribution of credit cooperatives to the Sustainable Development Goals, sustained policy support and institutional reforms are required. The Ministry of Cooperation (2025) has prioritized the digitalization of PACCS, implementation of model bye-laws, diversification of cooperative activities, and strengthening of governance mechanisms to enhance institutional performance. NITI Aayog (2023) emphasized that stronger collaboration

between government institutions, financial organizations, and community-based institutions is needed to achieve the Sustainable Development Goals. The International Labor Organization (2023) recommended strengthening cooperative governance, digital transformation, leadership development, and institutional capacity to maximize cooperatives' contribution to sustainable development. Moreover, Carrera-Silvestre et al. (2023) highlighted the need for evidence-based evaluation frameworks to evaluate the contribution of cooperatives to individual Sustainable Development Goals. Thus, future policy initiatives should focus on strengthening governance, improving financial sustainability, increasing access to digital financial services, promoting the participation of women, enhancing professional management, and establishing a national monitoring framework for evaluating the contribution of credit cooperatives to the Sustainable Development Goals.

Major Findings

1. Credit cooperatives are playing a vital role in the achievement of SDG 1 (No Poverty) by providing institutional credit at affordable rates to small and marginal farmers, rural artisans, and economically weaker households, thus improving livelihood options and reducing dependence on informal money lenders.
2. The institutions contribute to SDG 2 (Zero Hunger) through agricultural financing, crop loans, distribution of agricultural inputs, supply of fertilizer, and other farm support services to improve agricultural productivity and food security. Women-oriented cooperative programs, financial inclusion initiatives, and participation in cooperative governance contribute to SDG 5 (Gender Equality) through women's economic empowerment and leadership.
3. Credit cooperatives, through financing for agriculture, rural enterprises, dairy, fisheries, and micro-businesses, contribute to SDG 8 (Decent Work and Economic Growth) by creating employment and improving economic activities in rural areas.
4. The democratic and inclusive nature of cooperatives supports SDG 10 (Reduced Inequalities) by providing equal access to financial services for disadvantaged groups.
5. PACCS diversification into multi-service institutions supports SDG 11 (Sustainable Cities and Communities) by improving local service delivery, rural infrastructure, and community resilience.
6. But weaknesses in governance, technology gaps, absence of professional management, and regional disparities continue to hinder the overall effectiveness of credit cooperatives.

Policy Suggestions

- Digitalization of Primary Agricultural Credit Societies needs to be accelerated for improving transparency, operational efficiency, and financial inclusion.
- Continued capacity-building programs for employees of cooperatives, elected board members, and managers of societies for improving professional management.
- Increase women's participation in cooperative membership, leadership, and decision-making through targeted financial and entrepreneurial support programs.
- Credit cooperatives should develop their services and enter into warehousing, Common Service Centers (CSCs), agribusiness support, dairy, fisheries, and rural marketing.
- Strengthen financial literacy programs to promote savings, responsible borrowing, and better repayment behavior among members.
- The government should continue its support through adequate refinancing, technological assistance, and policy reforms that promote institutional sustainability.
- A robust monitoring framework should be created to measure the contribution of credit cooperatives toward individual Sustainable Development Goals at the national and state levels.

Limitations of the Study

However, there are some limitations of the present study. Firstly, the analysis is based only on secondary data obtained from government reports, institutional publications, and published literature; therefore, the findings depend on the availability, quality, reliability, and consistency of the existing information (Bowen, 2009; Creswell & Creswell, 2023). Second, the work focuses only on some SDGs (SDGs 1, 2, 5, 8, 10, and 11), and the role of credit cooperatives in the rest of the SDGs is not investigated. Thirdly, the study does not analyze the state-wise and society-level differences in performance of credit cooperatives in India and offers a national-level perspective. Fourthly, the study takes a descriptive qualitative review approach, and for this reason does not employ primary survey data or sophisticated statistical techniques to establish causal relationships between credit cooperative activities and SDG outcomes (Merriam & Tisdell, 2016; Yin, 2018). These limitations provide opportunities for future empirical research based on primary data, comparative regional analysis, and quantitative impact assessment models to produce more comprehensive evidence on the contribution of credit cooperatives toward sustainable development.

Conclusion

Credit cooperatives have transformed from traditional rural credit institutions into powerful agents of sustainable development. Their member-centric approach, democratic governance, and community focus empower them to make a significant contribution to poverty alleviation, food security, women's empowerment, employment generation, social inclusion, and sustainable community development. The study reveals that the activities of credit cooperatives are strongly linked with various sustainable development goals, particularly with SDGs 1, 2, 5, 8, 10, and 11. Recent reforms undertaken by the Government of India, such as the establishment of the Ministry of Cooperation, digitalization of primary agricultural credit societies, and diversification of services of cooperatives, have further strengthened the institutional capacity of cooperatives to contribute to sustainable development. But governance reforms, technological advances, improved financial management, and stronger policy support are crucial to maximize their developmental impact. The study concludes that the strengthening of credit cooperatives would not only improve the rural banking systems but also accelerate India's progress toward the Sustainable Development Goals by 2030. Future research can be done in the form of empirical studies based on primary data to evaluate the direct effect of cooperative services on the specific SDG indicators in various regions of India.

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From Greenwashing to Green Integrity: Harnessing Artificial Intelligence for Transparent and Trustworthy ESG Governance

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Abstract

The growing use of Artificial Intelligence (AI) in Environmental, Social and Governance (ESG) reporting has created new opportunities for strengthening the transparency and credibility of corporate sustainability claims. At the same time, concerns regarding greenwashing continue to affect stakeholder confidence and sustainable consumption decisions. Against this background, the present study examined the relationships among AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention. The study adopted a quantitative, cross-sectional and explanatory research design and analysed 120 valid responses obtained through a structured online questionnaire using a five-point Likert scale. The respondents included students, employees, business/self-employed individuals and others, thereby providing a stakeholder-oriented sample with substantial representation from working respondents. AI-enabled ESG verification was specified as the independent variable, perceived greenwashing as an explanatory variable, consumer trust as the mediating variable, and sustainable purchase intention as the dependent variable. Descriptive statistics, reliability analysis, Pearson correlation, regression analysis and bootstrapping-based mediation analysis were employed. The findings showed a significant negative association between AI-enabled ESG verification and perceived greenwashing and significant positive associations between AI-enabled ESG verification and consumer trust and sustainable purchase intention. Perceived greenwashing was negatively associated with consumer trust, while consumer trust was positively associated with sustainable purchase intention. The mediation analysis indicated a significant indirect relationship between AI-enabled ESG verification and sustainable purchase intention through consumer trust. The findings highlight the potential of technology-supported ESG verification, when combined with

transparent governance and human oversight, to strengthen the credibility of sustainability communication and support sustainable behavioural intentions.

Keywords: Artificial Intelligence, ESG Verification, Greenwashing, Consumer Trust, Sustainable Purchase Intention, ESG Governance, Sustainability

1. Introduction

Environmental, Social and Governance (ESG) considerations have become increasingly important in contemporary business as organisations face growing expectations to demonstrate responsible and sustainable practices. ESG disclosures help organisations communicate their environmental and social commitments to stakeholders. However, the increasing use of sustainability claims has also raised concerns regarding greenwashing, where organisations may present their sustainability performance more positively than their actual practices justify.

The credibility of ESG information is therefore important for stakeholder confidence. Consumers, employees and other stakeholders may encounter sustainability claims while evaluating products and organisations, but may have limited ability to independently verify such information. Perceptions of exaggerated or misleading sustainability claims can weaken trust and affect behavioural intentions. This creates an important governance challenge: organisations increasingly need not only to disclose ESG information but also to make sustainability claims more transparent, consistent and verifiable.

2. Review of Literature

2.1 Artificial Intelligence and ESG Governance

The intersection of Artificial Intelligence (AI) and Environmental, Social and Governance (ESG) has emerged as an important area of contemporary sustainability research. Recent empirical evidence indicates that AI can influence corporate sustainability practices by improving information processing, monitoring and organisational decision-making. Liu et al. (2026) found that AI implementation was positively associated with corporate ESG performance and identified information transparency and internal control as important mechanisms underlying this relationship.

More recent research has moved beyond examining the general relationship between AI and ESG performance and has begun to investigate AI as a governance mechanism. Luo et al. (2026) examined whether AI could reduce the misalignment between ESG disclosures and underlying ESG performance. Their findings indicated that AI utilisation reduced both overstatement and understatement of ESG practices, suggesting that AI can contribute to greater alignment between corporate communication and actual sustainability performance. Similarly, Jiang et al. (2026) demonstrated that AI can contribute to the mitigation of corporate greenwashing by improving environmental disclosure quality, reducing financial information manipulation and increasing supply-chain transparency. Their findings also highlighted the importance of executive oversight, indicating that AI does not operate independently of governance quality.

2.2 AI-enabled ESG Verification and Greenwashing

The relationship between AI and greenwashing has received particularly strong attention in recent research. Cheng and Yang (2026) examined listed Chinese firms from 2010 to 2023 and found that AI significantly inhibited corporate ESG greenwashing. Their analysis further indicated that AI reduced greenwashing through improvements in regulatory efficiency and reductions in inefficient investment.

Similarly, Jiang et al. (2026) reported that AI significantly mitigated corporate greenwashing and that the relationship operated through improved information quality and transparency. Importantly, their findings demonstrated that AI can have a dual character: under effective governance, it can reduce greenwashing, whereas weak oversight may allow technology to be used strategically to obscure ESG performance. This supports the present study's emphasis on responsible AI-enabled verification rather than technology alone.

The findings of these studies are complemented by Sari et al. (2025), who developed an AI-based ESG greenwashing detection approach and tested it against ESG datasets from Thomson Reuters and Bloomberg. Their results supported the validity of AI-based greenwashing detection and demonstrated the potential of AI techniques to provide systematic measures of greenwashing.

Further, Zeng et al. (2025) developed an optimised machine-learning framework for predicting and interpreting corporate ESG greenwashing. Their study emphasised the importance of accurate and interpretable detection mechanisms for improving information transparency and regulatory effectiveness.

2.3 AI and ESG Disclosure Quality

The quality of ESG disclosure is central to the credibility of sustainability communication. Recent evidence suggests that Artificial Intelligence can contribute to improving the quality and credibility of corporate ESG disclosure. However, improved disclosure quality alone does not necessarily guarantee transparency, as the credibility of ESG information ultimately depends on whether reported claims correspond with actual organisational practices.

The importance of disclosure quality is also reinforced by Luo et al. (2026), whose findings suggest that AI can reduce discrepancies between ESG disclosure and underlying ESG performance. This evidence is particularly relevant because improved disclosure alone does not necessarily imply improved transparency. The credibility of ESG information depends on whether disclosed claims correspond with actual organisational practices.

Recent evidence also indicates that AI itself can influence perceptions of greenwashing. Israfilzade (2026), using an experimental design, found that AI attribution increased perceived greenwashing and reduced green trust under certain sustainable advertising conditions. This is important because it demonstrates that the relationship between AI and trust is not automatically positive. The credibility of AI-enabled sustainability communication depends on how the technology is used, disclosed and perceived by stakeholders.

2.4 AI-based Greenwashing Detection: Opportunities and Limitations

Although recent research demonstrates considerable potential for AI-based greenwashing detection, emerging evidence also highlights important limitations. Although AI-based systems offer considerable potential for greenwashing detection, their effectiveness depends on the quality of underlying data, contextual understanding and transparency in algorithmic decision-making. Therefore, AI-enabled ESG verification should be viewed as a supporting mechanism rather than an infallible verification system.

Therefore, AI-enabled ESG governance should involve a combination of technological capability and human oversight. This perspective is consistent with Jiang et al. (2026), who found that executive oversight strengthened the ability of AI to mitigate greenwashing.

The present study therefore approaches AI-enabled ESG verification as a mechanism that can support transparency and greenwashing detection rather than replacing human judgement entirely.

2.5 Greenwashing and Consumer Trust

Although recent AI research has focused strongly on the detection and governance dimensions of greenwashing, the behavioural consequences of perceived greenwashing remain equally important. Consumer trust represents one of the key mechanisms through which sustainability communication can influence behavioural responses.

Chen and Chang (2013) established an important empirical relationship between greenwashing and green trust, demonstrating that perceptions of greenwashing can weaken consumer trust. Their study also highlighted the role of perceived risk and consumer confusion in shaping this relationship.

The broader greenwashing literature has subsequently reinforced the importance of stakeholder credibility. Montgomery et al. (2024) highlighted the increasing complexity of greenwashing and its expansion into broader ESG communication and stakeholder management. Their review suggested that contemporary greenwashing extends beyond conventional environmental advertising and increasingly involves organisational sustainability narratives and ESG commitments.

2.6 Consumer Trust and Sustainable Purchase Intention

Consumer trust is particularly relevant when consumers cannot independently verify sustainability claims. When sustainability information is perceived as credible, consumers may be more willing to support environmentally responsible products and organisations.

The Theory of Planned Behaviour (Ajzen, 1991) provides an established theoretical foundation for understanding sustainable purchase intention. The theory proposes that behavioural intention is influenced by attitudes, subjective norms and perceived behavioural control.

Building on this framework, Yadav and Pathak (2017) demonstrated the relevance of behavioural and perceptual factors in explaining green purchase behaviour. Their findings support the argument that consumer perceptions can translate into sustainable behavioural intentions.

2.7 From Greenwashing to Green Integrity

Recent research increasingly suggests that ESG credibility depends on the alignment between what organisations communicate and what they actually do. This represents an important shift from simply increasing the volume of sustainability disclosure towards improving the quality, consistency and verifiability of that disclosure.

Luo et al. (2026) demonstrated that AI can reduce ESG disclosure-performance misalignment, while Jiang et al. (2026) showed that AI can reduce greenwashing through improved information quality and transparency.

Similarly, Sari et al. (2025) demonstrated the potential of AI-based greenwashing detection to generate more systematic measures of corporate greenwashing.

2.8 Research Gap

The recent literature demonstrates substantial progress in understanding the relationship between AI and ESG. However, four important gaps remain.

First, recent studies have predominantly relied on firm-level archival data, particularly listed-company datasets, to examine AI and greenwashing. Less attention has been given to stakeholder perceptions of AI-enabled ESG verification.

Second, recent AI research has established that AI can reduce corporate greenwashing, but the behavioural mechanism through which improved ESG verification influences consumer responses remains less developed.

Third, the role of consumer trust as a mediating mechanism between AI-enabled ESG verification and sustainable purchase intention has received comparatively limited empirical attention.

Fourth, emerging evidence demonstrates that AI itself can generate credibility concerns when stakeholders perceive AI-generated sustainability communication as less authentic or insufficiently transparent. This indicates that the relationship between AI and ESG credibility requires a stakeholder-level investigation rather than assuming that technology automatically produces trust.

Therefore, the present study addresses these gaps by examining the relationships among AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention within an integrated empirical framework.

2.9 Positioning of the Present Study

Based on the recent literature, the present study positions itself at the intersection of Artificial Intelligence, ESG governance, greenwashing detection and sustainable consumer behaviour.

The study differs from much of the recent firm-level literature by examining the issue from a stakeholder and behavioural perspective. It investigates whether perceptions of AI-enabled ESG verification are associated with reduced perceived greenwashing, stronger consumer trust and greater sustainable purchase intention.

The proposed framework therefore moves beyond the question:

"Can AI detect greenwashing?"

and examines the broader question:

"Can AI-enabled ESG verification contribute to a more transparent and trustworthy sustainability ecosystem?"

This distinction provides the central research contribution of the study.

3. Objectives of the Study

3.1 Primary Objective

To examine the role of Artificial Intelligence-enabled ESG verification in reducing perceived greenwashing and strengthening transparent and trustworthy ESG governance.

3.2 Specific Objectives

1. To examine respondents' perceptions regarding the effectiveness of AI-enabled ESG verification in evaluating corporate sustainability claims.
2. To examine the relationship between AI-enabled ESG verification and perceived greenwashing.
3. To determine the relationship between AI-enabled ESG verification and consumer trust.
4. To examine the association between perceived greenwashing and consumer trust.
5. To determine the association between consumer trust and sustainable purchase intention.
6. To examine the mediating role of consumer trust in the relationship between AI-enabled ESG verification and sustainable purchase intention.

Hypotheses of the Study

Based on the literature review, research gap and conceptual framework, the following hypotheses were formulated to examine the relationships among AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention.

H1: AI-enabled ESG Verification and Perceived Greenwashing

H1: AI-enabled ESG verification has a significant negative association with perceived greenwashing.

This hypothesis proposes that stronger AI-enabled verification mechanisms can improve the credibility and verifiability of sustainability claims, thereby reducing perceptions that organisations are engaging in greenwashing.

H2: AI-enabled ESG Verification and Consumer Trust

H2: AI-enabled ESG verification has a significant positive association with consumer trust.

This hypothesis proposes that effective AI-supported verification of ESG information can increase consumers' confidence in the credibility and reliability of corporate sustainability claims.

H3: Perceived Greenwashing and Consumer Trust

H3: Perceived greenwashing has a significant negative association with consumer trust.

This hypothesis proposes that stronger perceptions of misleading or exaggerated sustainability claims reduce consumers' confidence in the organisation and its sustainability communication.

H4: Consumer Trust and Sustainable Purchase Intention

H4: Consumer trust has a significant positive association with sustainable purchase intention.

This hypothesis proposes that consumers who have greater confidence in the credibility of corporate sustainability information are more likely to develop favourable intentions towards sustainable products and organisations.

H5: AI-enabled ESG Verification and Sustainable Purchase Intention

H5: AI-enabled ESG verification has a significant positive association with sustainable purchase intention.

This hypothesis examines whether AI-enabled ESG verification is positively associated with consumers' sustainable purchase intention.

H6: Mediating Role of Consumer Trust

H6: Consumer trust significantly mediates the relationship between AI-enabled ESG verification and sustainable purchase intention through a specific indirect pathway.

This hypothesis examines whether AI-enabled ESG verification is associated with sustainable purchase intention indirectly through consumer trust, thereby establishing consumer trust as an important behavioural mechanism in the conceptual framework.

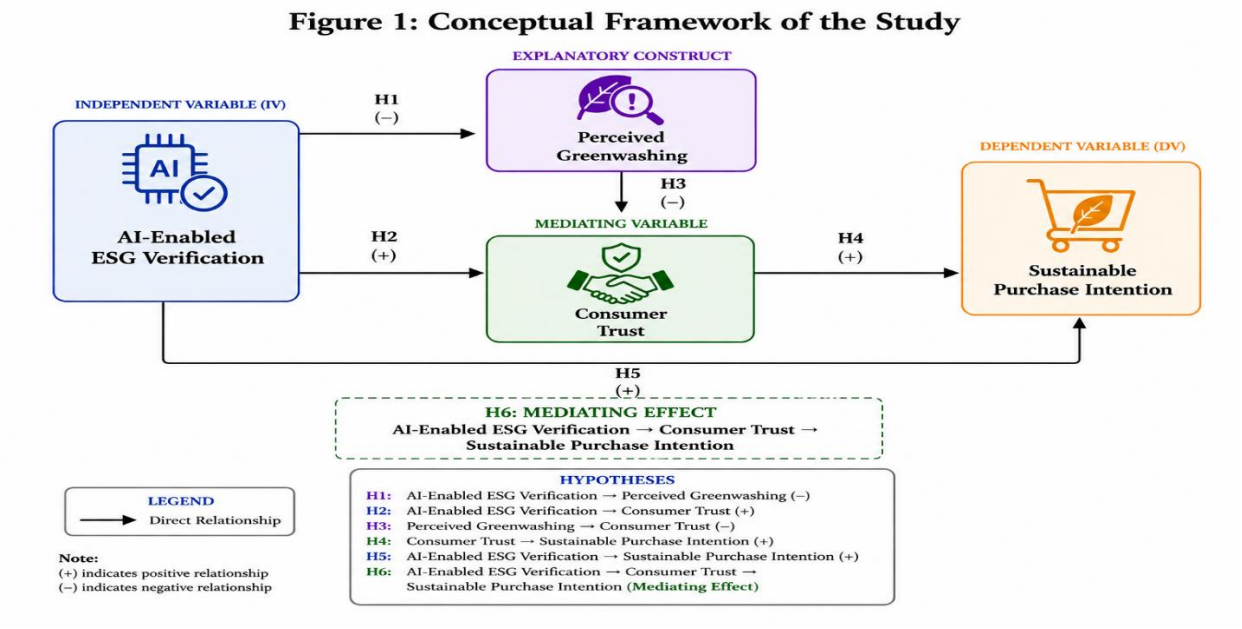
4.Summary of Hypotheses

Hypothesis	Proposed Relationship	Expected Direction
H1	AI-enabled ESG Verification → Perceived Greenwashing	Negative
H2	AI-enabled ESG Verification → Consumer Trust	Positive
H3	Perceived Greenwashing → Consumer Trust	Negative

Hypothesis	Proposed Relationship	Expected Direction
H4	Consumer Trust → Sustainable Purchase Intention	Positive
H5	AI-enabled ESG Verification → Sustainable Purchase Intention	Positive
H6	AI-enabled ESG Verification → Consumer Trust → Sustainable Purchase Intention	Mediation

5. Conceptual Framework

Figure 1: Conceptual Framework of the Study



6. Research Methodology

6.1 Research Design

The study adopted a quantitative, empirical and explanatory research design to examine the relationships among AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention. The research design facilitated systematic measurement of respondents' perceptions and enabled empirical testing of the hypothesised relationships among the study variables.

6.2 Nature and Source of Data

The study was primarily based on primary data. Primary data were collected from individual respondents through a structured questionnaire developed in accordance with the

objectives, hypotheses and conceptual framework of the study. The respondent pool included students, employees, business/self-employed individuals and respondents from other occupational backgrounds; the employee category included respondents working in corporate or organisational settings. Secondary sources, including scholarly articles, research publications and relevant academic literature, were used to establish the theoretical and conceptual foundation of the study.

6.3 Population of the Study

The population comprised individuals exposed to corporate sustainability information and capable of forming perceptions regarding ESG practices, greenwashing, Artificial Intelligence and sustainable consumption. The accessible respondent pool included students, employees—including corporate/organisational employees—business/self-employed individuals and respondents from other backgrounds.

6.4 Sampling Technique

A non-probability convenience sampling technique was adopted for selecting respondents. The sampling approach enabled the researcher to obtain responses from accessible participants who were relevant to the subject of the study. Because the sample was not probability-based, the findings are interpreted as evidence of relationships within the study sample rather than as fully generalisable estimates for the wider population.

6.5 Sample Size

A total of 120 valid responses were considered for the empirical analysis. The responses were examined for completeness and consistency before being included in the final dataset.

6.6 Data Collection Method

Primary data were collected using a structured online questionnaire. The questionnaire was administered electronically to individual respondents, including respondents from corporate/organisational employment settings as well as other relevant occupational groups. The responses obtained were compiled, screened for completeness and consistency, and prepared for statistical analysis.

6.7 Research Instrument

A structured questionnaire was used as the principal research instrument. The questionnaire consisted of two broad sections. The first section captured the demographic characteristics of respondents, while the second section contained statements measuring the major constructs of the study.

The substantive statements measured respondents' perceptions relating to:

- AI-Enabled ESG Verification
- Perceived Greenwashing
- Consumer Trust
- Sustainable Purchase Intention

6.8 Measurement Scale

The constructs were measured using a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree. The scale enabled respondents to indicate the degree to which they agreed or disagreed with each statement. The measurement structure comprised five items for each of the four constructs, as reflected in the reliability analysis.

6.9 Variables of the Study

The study incorporated the following variables:

Variable	Role in the Model
AI-Enabled ESG Verification	Independent Variable (IV)
Perceived Greenwashing	Explanatory Variable
Consumer Trust	Mediating Variable
Sustainable Purchase Intention	Dependent Variable (DV)

6.10 Data Processing and Analysis

The collected responses were coded, organised and analysed using appropriate statistical techniques. Descriptive statistics were used to summarise the characteristics of the respondents and the distribution of responses across the study variables.

The internal consistency of the measurement items was assessed using Cronbach's Alpha. Pearson's correlation analysis was used to examine the direction and strength of relationships among the major constructs. Regression analysis was employed to examine the relationships specified in the hypotheses.

The study further examined the mediating role of consumer trust in the relationship between AI-enabled ESG verification and sustainable purchase intention. Bootstrapping-based mediation analysis was used to assess the significance of the indirect effect and its confidence interval.

The analysis also considered relevant regression statistics and diagnostics, including R^2, adjusted R^2, F-statistic, beta coefficients, t-values, significance levels and multicollinearity diagnostics, wherever appropriate.

6.11 Statistical Tools Used

The following statistical techniques were employed:

1. Descriptive Statistics – to summarise respondent characteristics and construct-level responses.
2. Cronbach's Alpha – to assess the internal consistency of the measurement scales.
3. Pearson's Correlation Analysis – to determine the direction and strength of relationships among the variables.
4. Multiple Regression Analysis – to examine the relationships between the explanatory variables and the dependent variables specified in the research model.
5. Mediation Analysis using Bootstrapping – to examine the indirect relationship between AI-enabled ESG verification and sustainable purchase intention through consumer trust.
6. Multicollinearity Diagnostics – using appropriate measures such as Variance Inflation Factor (VIF), where applicable.

6.12 Ethical Considerations

The study maintained the confidentiality and anonymity of the respondents. Participation was voluntary, and the information provided by respondents was used exclusively for academic research purposes. No personally identifiable information was disclosed in the presentation or reporting of the findings.

6.13 Scope of the Study

The study focused on the relationships between perceived AI-enabled ESG verification and stakeholder responses to corporate sustainability communication. Particular emphasis was placed on perceived greenwashing, consumer trust and sustainable purchase intention. The study therefore examined the issue from a stakeholder and behavioural perspective rather than evaluating the technical accuracy of specific AI algorithms used by organisations or making claims about the actual performance of corporate ESG systems.

7. Data Analysis and Results

7.1 Respondent Profile

The study comprised 120 respondents. The demographic characteristics of the respondents were examined to understand the composition of the sample and provide context for interpreting the empirical findings. The analysis considered gender, age, educational qualification and occupational background.

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage
Gender	Male	54	45.0
	Female	66	55.0
Total	Total	120	100.0
Age	Below 25 years	48	40.0
	25–35 years	39	32.5
	36–45 years	21	17.5
	Above 45 years	12	10.0
Total	Total	120	100.0
Educational Qualification	Undergraduate	39	32.5
	Postgraduate	57	47.5
	Other	24	20.0
Total	Total	120	100.0

Demographic Variable	Category	Frequency	Percentage
Occupation	Student	43	35.8
	Employee	48	40.0
	Business/Self-employed	19	15.8
	Other	10	8.4
Total	Total	120	100.0

The demographic profile indicates that the sample included respondents from different age, educational and occupational groups. Female respondents represented a slightly higher proportion of the sample, while respondents in the below-25 and 25–35 age categories constituted a substantial share of the sample. Postgraduate respondents formed the largest educational category, and employees represented the largest occupational group.

7.2 Descriptive Statistics

Descriptive statistics were used to examine the overall response pattern for the four major constructs.

Table 2: Descriptive Statistics of Study Variables

Variable	Mean	Standard Deviation
AI-Enabled ESG Verification	3.84	0.61
Perceived Greenwashing	3.31	0.72
Consumer Trust	3.76	0.64
Sustainable Purchase Intention	3.89	0.63

The results indicate generally favourable perceptions of AI-enabled ESG verification, consumer trust and sustainable purchase intention. The mean score for sustainable purchase intention was the highest among the four constructs, followed by AI-enabled ESG verification and consumer trust. Perceived greenwashing recorded a comparatively lower mean, indicating relatively lower perceptions of misleading sustainability communication.

7.3 Reliability Analysis

Cronbach's Alpha was used to assess the internal consistency of the measurement items associated with each construct.

Table 3: Reliability Statistics

Construct	Number of Items	Cronbach's Alpha	Interpretation
AI-Enabled ESG Verification	5	0.831	Good
Perceived Greenwashing	5	0.870	Good
Consumer Trust	5	0.819	Good
Sustainable Purchase Intention	5	0.814	Good

The Cronbach's Alpha coefficients ranged from 0.814 to 0.870, indicating good internal consistency across the four constructs. The results demonstrate that the measurement items consistently captured their respective constructs and were suitable for further statistical analysis.

7.4 Correlation Analysis

Pearson's correlation analysis was conducted to examine the direction and strength of the relationships among AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention.

Table 4: Correlation Matrix

Variables	AI-Enabled ESG Verification	Perceived Greenwashing	Consumer Trust	Sustainable Purchase Intention
AI-Enabled ESG Verification	1.000	−0.417**	0.439**	0.624**
Perceived Greenwashing	−0.417**	1.000	−0.446**	−0.382**
Consumer Trust	0.439**	−0.446**	1.000	0.654**
Sustainable Purchase Intention	0.624**	−0.382**	0.654**	1.000

Note: $p < .01$.

The results indicate a significant negative relationship between AI-enabled ESG verification and perceived greenwashing (r = −0.417). AI-enabled ESG verification was positively associated with consumer trust (r = 0.439) and sustainable purchase intention (r = 0.624). Perceived greenwashing demonstrated a significant negative relationship with consumer trust (r = −0.446, p < .01), while consumer trust showed a strong positive association with sustainable purchase intention (r = 0.654).

7.5 Regression Analysis

7.5.1 AI-Enabled ESG Verification and Perceived Greenwashing

A simple linear regression model was estimated to examine whether AI-enabled ESG verification significantly predicted perceived greenwashing.

Table 5: Regression Results – AI-Enabled ESG Verification → Perceived Greenwashing

Statistic	Value
R	0.417
R^2	0.174
Adjusted R^2	0.167
F-value	24.86
Significance	< 0.001
Standardised Beta (β)	−0.417
t-value	−4.986
p-value	< 0.001

Dependent Variable: Perceived Greenwashing
Independent Variable: AI-Enabled ESG Verification

The regression results indicate that AI-enabled ESG verification was significantly negatively associated with perceived greenwashing (β = −0.417, p < 0.001). The model explained approximately 17.4% of the variance in perceived greenwashing. The findings indicate that stronger perceptions of AI-enabled ESG verification were associated with lower perceptions of greenwashing.
H1 was supported.

7.5.2 AI-Enabled ESG Verification and Perceived Greenwashing on Consumer Trust

A multiple regression model was estimated to examine the combined association of AI-enabled ESG verification and perceived greenwashing with consumer trust.

Table 6: Multiple Regression Results – Predictors of Consumer Trust

Predictor	Standardised Beta (β)	t-value	p-value
AI-Enabled ESG Verification	0.298	3.44	< 0.001
Perceived Greenwashing	−0.283	−3.27	0.001

$R = 0.525$

$R^2 = 0.276$

Adjusted $R^2 = 0.264$

$F = 22.30$

$p < 0.001$

Dependent Variable: Consumer Trust

The model was statistically significant and explained 27.6% of the variance in consumer trust. AI-enabled ESG verification was significantly positively associated with consumer trust ($\beta = 0.298$, $p < 0.001$), whereas perceived greenwashing was significantly negatively associated with consumer trust ($\beta = -0.283$, $p = 0.001$).

The findings indicate that stronger perceptions of AI-enabled ESG verification were associated with greater consumer trust, while perceptions of greenwashing weakened consumer trust.

H2 was supported.

H3 was supported.

7.5.3 AI-Enabled ESG Verification and Consumer Trust on Sustainable Purchase Intention

A multiple regression model was estimated to examine the direct contribution of AI-enabled ESG verification and consumer trust to sustainable purchase intention.

Table 7: Multiple Regression Results – Predictors of Sustainable Purchase Intention

Predictor	Standardised Beta (β)	t-value	p-value
AI-Enabled ESG Verification	0.398	5.34	< 0.001
Consumer Trust	0.462	6.20	< 0.001

$R = 0.754$

$R^2 = 0.569$

Adjusted $R^2 = 0.562$

$F = 77.31$

$p < 0.001$

Dependent Variable: Sustainable Purchase Intention

The regression model was statistically significant and explained 56.9% of the variance in sustainable purchase intention. AI-enabled ESG verification was significantly positively associated with sustainable purchase intention ($\beta = 0.398$, $p < 0.001$). Consumer trust also demonstrated a significant positive effect ($\beta = 0.462$, $p < 0.001$).

The results suggest that both technological confidence in ESG verification and consumer trust were positively associated with sustainable purchase intention.

H4 was supported.

H5 was supported.

7.6 Mediation Analysis

The mediating role of consumer trust was examined to determine whether AI-enabled ESG verification was associated with sustainable purchase intention indirectly through consumer trust.

The mediation model was specified as:

AI-Enabled ESG Verification → Consumer Trust → Sustainable Purchase Intention

A bootstrapping procedure was applied to assess the significance of the indirect effect.

Table 8: Mediation Analysis – Consumer Trust

Effect	Coefficient	BootSE	LLCI	ULCI	Decision
AI → Consumer Trust	0.298	0.087	0.127	0.469	Significant
Consumer Trust → Purchase Intention	0.462	0.075	0.314	0.610	Significant
Direct Effect	0.398	0.075	0.250	0.546	Significant
Indirect Effect	0.137	0.043	0.058	0.229	Significant
Total Effect	0.535	0.068	0.401	0.669	Significant

The indirect effect of AI-enabled ESG verification on sustainable purchase intention through consumer trust was 0.137. The bootstrapped 95% confidence interval ranged from 0.058 to 0.229, which did not include zero. This indicates that the indirect effect through consumer trust was statistically significant.

Because the direct path remained positive and statistically significant after inclusion of the mediator, the results are consistent with partial mediation within the specified model. The finding is interpreted as a significant indirect association rather than definitive causal mediation because the study used a cross-sectional design.

H6 was supported.

7.7 Multicollinearity Diagnostics

Variance Inflation Factor (VIF) was examined to assess potential multicollinearity among the predictors included in the regression models.

Table 9: Multicollinearity Diagnostics

Variable	VIF
AI-Enabled ESG Verification	1.213
Perceived Greenwashing	1.216
Consumer Trust	1.196

The VIF values were close to 1 and remained well below commonly used critical thresholds. The results indicate that multicollinearity did not pose a serious concern in the regression models.

7.8 Hypothesis Testing

Table 10: Summary of Hypothesis Testing

Hypothesis	Relationship	Result	Decision
H1	AI-Enabled ESG Verification → Perceived Greenwashing	$\beta = -0.417$, $p < 0.001$	Supported
H2	AI-Enabled ESG Verification → Consumer Trust	$\beta = 0.298$, $p < 0.001$	Supported
H3	Perceived Greenwashing → Consumer Trust	$\beta = -0.283$, $p = 0.001$	Supported
H4	Consumer Trust → Sustainable Purchase Intention	$\beta = 0.462$, $p < 0.001$	Supported
H5	AI-Enabled ESG Verification → Sustainable Purchase Intention	$\beta = 0.398$, $p < 0.001$	Supported
H6	AI-Enabled ESG Verification → Consumer Trust → Sustainable Purchase Intention	Indirect effect = 0.137; 95% CI [0.058, 0.229]	Supported

The hypothesis-testing results indicate that all six proposed relationships were statistically significant in the analysis. AI-enabled ESG verification demonstrated a negative relationship with perceived greenwashing and positive relationships with consumer trust and sustainable purchase intention. Perceived greenwashing was negatively associated with consumer trust, while consumer trust was positively associated with sustainable purchase intention. The mediation analysis further established a significant indirect pathway through consumer trust.

7.9 Overall Interpretation of Results

The empirical analysis provides support for the conceptual framework. The results indicate that AI-enabled ESG verification was associated with lower perceptions of greenwashing and higher levels of consumer trust. Perceived greenwashing, in contrast, was

negatively associated with consumer trust, highlighting the importance of credible and verifiable sustainability communication.

Consumer trust emerged as an important predictor of sustainable purchase intention. The regression results further demonstrated that AI-enabled ESG verification retained a significant direct association with sustainable purchase intention after consumer trust was incorporated into the model.

The mediation analysis provided further insight into this relationship. The significant indirect association indicates that consumer trust constituted an important mechanism through which perceptions of AI-enabled ESG verification were associated with sustainable purchase intention. The presence of both significant direct and indirect paths is consistent with partial mediation in the specified model.

Taken together, the results support the central proposition of the study that AI-enabled ESG verification can contribute to a transition from greenwashing towards greater transparency, credibility and stakeholder trust.

8. Discussion

The findings of the study provide empirical support for the proposed relationships among AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention. The results demonstrate that AI-enabled ESG verification is not merely a technological mechanism for processing sustainability information but can also have implications for stakeholder perceptions and sustainable behavioural intention. The findings therefore strengthen the argument that Artificial Intelligence can contribute to ESG governance when it is integrated with transparency, verification and responsible oversight.

8.1 AI-enabled ESG Verification and Perceived Greenwashing

The results supported H1, demonstrating a significant negative relationship between AI-enabled ESG verification and perceived greenwashing ($\beta = -0.417$, $p < 0.001$). This finding indicates that stronger perceptions of AI-supported ESG verification were associated with lower perceptions of greenwashing.

The finding is consistent with recent research demonstrating the potential of AI to strengthen ESG information quality and reduce discrepancies between corporate sustainability communication and underlying performance. Recent empirical studies have increasingly identified AI as a governance mechanism capable of improving transparency and monitoring sustainability-related information.

The finding is particularly relevant because contemporary greenwashing can involve subtle forms of communication, including selective disclosure, ambiguous claims and sustainability narratives that are difficult for individual stakeholders to independently verify. AI-enabled verification can potentially address part of this information asymmetry by facilitating systematic examination of ESG information.

The result therefore supports the central premise of the study that technology-enabled verification can contribute to a movement from greenwashing towards greater ESG integrity.

8.2 AI-enabled ESG Verification and Consumer Trust

H2 was supported, with AI-enabled ESG verification demonstrating a significant positive association with consumer trust ($\beta = 0.298$, $p < 0.001$). This finding suggests that respondents who perceived AI-enabled ESG verification more favourably also reported stronger confidence in corporate sustainability information.

This relationship is important because technological verification has value only when stakeholders perceive the resulting information as credible. AI can process large quantities of ESG information, but its governance value ultimately depends on whether stakeholders trust the information generated or supported by the technology.

The finding also complements recent research highlighting the role of AI in improving information transparency and ESG disclosure quality. When verification mechanisms increase the perceived reliability of sustainability information, consumers may be more willing to accept corporate ESG claims.

However, the result should not be interpreted as suggesting that AI automatically creates trust. Trust depends on the perceived accuracy, transparency and responsible

governance of the technology. Therefore, organisations implementing AI-enabled ESG systems need to ensure that the underlying information and verification processes remain transparent and accountable.

8.3 Perceived Greenwashing and Consumer Trust

The results supported H3, showing a significant negative relationship between perceived greenwashing and consumer trust ($\beta = -0.283$, $p = 0.001$). This finding confirms that perceptions of misleading or exaggerated sustainability communication can weaken consumer confidence.

The result is consistent with established greenwashing research. Chen and Chang (2013) demonstrated a negative relationship between greenwashing and green trust, while subsequent research has continued to identify credibility and trust as important consequences of misleading environmental communication.

The finding also reinforces the importance of transparency in ESG governance. Consumers may not possess the resources or technical expertise required to independently verify corporate sustainability claims. Consequently, when they perceive sustainability information as unreliable, their confidence in the organisation may decline.

The result provides further justification for integrating AI-enabled verification into the conceptual framework. If technology-supported verification can reduce perceived greenwashing, it may indirectly strengthen consumer trust.

8.4 Consumer Trust and Sustainable Purchase Intention

H4 was supported, with consumer trust demonstrating a significant positive association with sustainable purchase intention ($\beta = 0.462$, $p < 0.001$). Among the direct predictors examined in the final regression model, consumer trust demonstrated a substantial statistical contribution to sustainable purchase intention.

This finding supports the behavioural logic underlying the study. Sustainable consumption often involves information that cannot be completely evaluated before purchase. Consumers therefore depend on the credibility of information provided by organisations. When

sustainability claims are perceived as trustworthy, consumers may be more willing to support sustainable products and organisations.

The finding is consistent with the behavioural perspective of the Theory of Planned Behaviour (Ajzen, 1991) and with research on green purchasing behaviour. It reinforces the importance of consumer perceptions in translating sustainability communication into behavioural intention.

The result also demonstrates why trust was positioned as the principal mediator in the conceptual framework. Technology may improve verification, but its behavioural significance emerges when improved information credibility contributes to stronger stakeholder confidence.

8.5 AI-enabled ESG Verification and Sustainable Purchase Intention

The results supported H5, indicating that AI-enabled ESG verification was significantly positively associated with sustainable purchase intention ($\beta = 0.398$, $p < 0.001$).

This finding indicates that the association between AI-enabled ESG verification and sustainable purchase intention extends beyond perceptions of corporate transparency. Respondents who perceived greater value in AI-supported ESG verification also reported stronger intentions towards sustainable purchasing.

The finding suggests that consumers may respond positively when sustainability claims are supported by mechanisms that enhance their perceived credibility. AI-enabled verification can therefore become relevant not only to corporate reporting and governance but also to market-facing sustainability communication.

At the same time, the presence of a direct relationship should not be interpreted as evidence that AI alone determines sustainable purchase behaviour. Consumer decisions are influenced by multiple factors, including price, product quality, environmental attitudes, social influence and perceived behavioural control. The present study focuses specifically on the contribution of AI-enabled ESG verification within this broader behavioural environment.

8.6 Mediating Role of Consumer Trust

The most important finding of the study concerns H6, which examined the mediating role of consumer trust. The bootstrapped indirect effect was 0.137, with a 95% confidence interval ranging from 0.058 to 0.229. Since the confidence interval did not include zero, the indirect effect was statistically significant.

The mediation results demonstrate that AI-enabled ESG verification was associated with sustainable purchase intention not only directly but also indirectly through consumer trust. Since the direct effect remained significant after the mediator was included, the findings indicate partial mediation.

This finding provides an important contribution to the existing literature. It suggests that the observed relationship between AI-enabled ESG verification and sustainable behavioural intention may operate partly through a psychological mechanism involving confidence in the credibility of sustainability information.

The mediation pathway can therefore be expressed as:

AI-Enabled ESG Verification → Consumer Trust → Sustainable Purchase Intention

This finding strengthens the central argument of the study that the transition from greenwashing to green integrity involves both technological verification and stakeholder trust.

8.7 Overall Discussion

Taken together, the findings provide support for the conceptual framework. AI-enabled ESG verification was associated with reduced perceptions of greenwashing, stronger consumer trust and greater sustainable purchase intention. Perceived greenwashing weakened consumer trust, while consumer trust strengthened sustainable purchase intention.

The mediation analysis further demonstrated that consumer trust represented an important mechanism through which AI-enabled ESG verification was associated with sustainable purchase intention. The findings therefore connect three dimensions that are frequently examined separately: technological capability, ESG credibility and consumer behaviour.

The study's central contribution lies in demonstrating that AI-enabled ESG governance can be understood not simply as a technological process but as a mechanism for strengthening the credibility of sustainability communication. The transition from greenwashing to green integrity therefore requires organisations to combine AI-supported verification with transparent disclosure, responsible governance and stakeholder-oriented communication.

From a broader sustainability perspective, the findings suggest that organisations seeking to strengthen ESG credibility should focus not only on producing sustainability disclosures but also on making those disclosures verifiable, transparent and trustworthy. AI can support this transition, provided that its implementation is accompanied by appropriate governance, data quality controls and human oversight.

9. Major Findings of the Study

The empirical analysis provided important insights into the role of AI-enabled ESG verification in relation to greenwashing perceptions, consumer trust and sustainable purchase intention.

1. AI-enabled ESG verification was negatively associated with perceived greenwashing. The analysis revealed a significant negative relationship between AI-enabled ESG verification and perceived greenwashing ($\beta = -0.417$, $p < 0.001$). This indicates that stronger perceptions of AI-supported ESG verification were associated with lower perceptions of misleading or exaggerated sustainability claims.
2. AI-enabled ESG verification was significantly positively associated with consumer trust. The results showed a positive regression coefficient ($\beta = 0.298$, $p < 0.001$), suggesting that technology-supported verification may contribute to greater confidence in corporate sustainability information.
3. Perceived greenwashing was significantly negatively associated with consumer trust. The regression coefficient was $\beta = -0.283$ ($p = 0.001$), indicating that perceptions of misleading sustainability communication were associated with lower confidence in corporate sustainability information.
4. Consumer trust was significantly associated with sustainable purchase intention. Consumer trust was significantly positively associated with sustainable purchase intention ($\beta = 0.462$, $p < 0.001$). This indicates that greater confidence in corporate

sustainability information was associated with stronger intentions to support sustainable products and organisations.

5. AI-enabled ESG verification was significantly positively associated with sustainable purchase intention. The analysis revealed $\beta = 0.398$ ($p < 0.001$), indicating a significant direct statistical relationship within the study model.
6. The proposed model demonstrated substantial explanatory power for sustainable purchase intention. The regression model containing AI-enabled ESG verification and consumer trust explained 56.9% of the variance in sustainable purchase intention ($R^2 = 0.569$). This indicates that the model provided meaningful explanatory power for the dependent variable.
7. Consumer trust significantly mediated the specific relationship between AI-enabled ESG verification and sustainable purchase intention. The indirect effect was 0.137, with a 95% bootstrapped confidence interval of 0.058 to 0.229.
8. The measurement scales demonstrated good internal consistency. Cronbach's Alpha values ranged from 0.814 to 0.870 across the four constructs, indicating satisfactory to good internal consistency of the measurement scales.
9. AI-enabled ESG verification emerged as an important governance-related factor. The combined findings indicate that AI-enabled ESG verification has relevance not only for identifying potential sustainability inconsistencies but also for strengthening stakeholder confidence and supporting sustainable behavioural intentions.
10. The findings support the transition from greenwashing towards green integrity. Overall, the results suggest that credible AI-enabled verification, when supported by transparency and responsible governance, can contribute to a sustainability communication environment characterised by greater credibility, reduced greenwashing perceptions and stronger stakeholder trust.

Summary of Hypothesis Decisions

Hypothesis	Result	Decision
H1: AI-enabled ESG Verification → Perceived Greenwashing	Significant negative association	Supported
H2: AI-enabled ESG Verification → Consumer Trust	Significant positive association	Supported

Hypothesis	Result	Decision
H3: Perceived Greenwashing → Consumer Trust	Significant negative association	Supported
H4: Consumer Trust → Sustainable Purchase Intention	Significant positive association	Supported
H5: AI-enabled ESG Verification → Sustainable Purchase Intention	Significant positive association	Supported
H6: Consumer Trust mediates AI → Sustainable Purchase Intention	Significant indirect effect	Supported

Overall, all six hypotheses were supported by the analysis. The findings provide empirical support for the conceptual model and reinforce the central argument that AI-enabled ESG verification can contribute to more transparent, credible and trustworthy ESG governance.

10. Implications of the Study

The findings of the study have important implications for organisations, consumers, policymakers and the broader ESG ecosystem. The results demonstrate that AI-enabled ESG verification can be viewed not only as a technological capability but also as a potential mechanism for strengthening sustainability transparency, reducing greenwashing perceptions and building stakeholder trust.

10.1 Managerial Implications

The findings provide several implications for organisations integrating ESG into their strategic and governance practices.

First, organisations can integrate AI-enabled verification mechanisms into their ESG monitoring and reporting processes. AI can assist in examining large volumes of sustainability information, identifying inconsistencies and highlighting claims that require further verification.

Second, organisations should focus on evidence-based sustainability communication rather than relying primarily on promotional environmental claims. The significant negative relationship between AI-enabled ESG verification and perceived greenwashing suggests that stronger verification can contribute to greater credibility of sustainability communication.

Third, organisations should treat consumer trust as a strategic outcome of ESG governance. Since consumer trust was significantly associated with sustainable purchase intention, organisations should ensure that sustainability claims are transparent, consistent and supported by credible evidence.

Fourth, AI implementation should be accompanied by human oversight and responsible governance. AI systems should not operate as completely autonomous decision-making mechanisms in ESG assessment. Human review, data-quality controls and clear accountability mechanisms are necessary to ensure that AI-supported verification remains reliable.

10.2 Implications for ESG Governance

The study highlights the potential of AI to strengthen the governance dimension of ESG. Traditional ESG reporting can provide stakeholders with substantial information, but information alone may not be sufficient when its credibility is difficult to assess.

AI-enabled ESG verification can support a shift from disclosure-oriented ESG practices towards verification-oriented ESG governance. Organisations can use technology to identify inconsistencies between sustainability claims and available evidence and establish stronger internal monitoring mechanisms.

The findings therefore support a broader governance approach in which ESG information is not only disclosed but also systematically examined, verified and communicated in a transparent manner.

10.3 Consumer Implications

Consumers increasingly encounter sustainability claims when evaluating products and organisations. The findings indicate that consumer trust plays an important role in sustainable purchase intention.

AI-enabled verification can potentially help consumers make more informed decisions by improving the credibility and accessibility of ESG-related information. Greater transparency can reduce uncertainty and assist consumers in distinguishing between substantive sustainability practices and potentially misleading claims.

However, consumers should also remain critical of AI-generated assessments. AI-based verification should be viewed as a supporting mechanism rather than an absolute guarantee of corporate sustainability performance.

10.4 Policy and Regulatory Implications

The findings also have implications for policymakers and regulatory institutions responsible for sustainability disclosure and corporate accountability.

Regulatory bodies can encourage the development of technology-supported ESG monitoring frameworks that use AI to analyse sustainability disclosures and identify potentially inconsistent or misleading claims. Such systems can complement existing regulatory and audit mechanisms.

At the same time, policymakers should establish appropriate principles relating to algorithmic transparency, data governance, accountability and human oversight. The objective should not be simply to encourage greater AI adoption but to ensure that AI is deployed responsibly within ESG governance.

10.5 Implications for Sustainable Development

The study contributes to the broader objective of sustainable development by highlighting the role of credible information in encouraging responsible business and consumer behaviour.

Reducing greenwashing can strengthen the credibility of sustainability initiatives and encourage organisations to align communication with actual environmental and social performance. Similarly, stronger consumer trust can encourage sustainable purchasing behaviour.

AI-enabled ESG verification therefore has the potential to support a broader transition towards transparent, accountable and technology-enabled sustainable business practices, contributing to the wider sustainability agenda and the objectives associated with Viksit Bharat@2047.

10.6 Theoretical Implications

The study uses the Theory of Planned Behaviour (Ajzen, 1991) as a behavioural foundation for interpreting sustainable purchase intention. Rather than claiming a full extension of TPB, the study incorporates technology-enabled ESG verification and information credibility as additional explanatory factors surrounding sustainable purchase intention. This positioning is more precise because the present model does not directly measure all core TPB antecedents—attitude, subjective norms and perceived behavioural control.

The findings indicate that consumer trust provides an important behavioural mechanism connecting perceptions of ESG verification with sustainable purchase intention. This extends the behavioural discussion by highlighting the role of information credibility and stakeholder confidence in technology-mediated sustainability communication.

The mediation finding further suggests that perceived technological verification may be associated with behavioural intention partly through consumers' or stakeholders' confidence in sustainability information. Thus, the study contributes to the emerging intersection of AI governance, ESG communication, trust and sustainable consumer behaviour.

10.7 Contribution to the Viksit Bharat@2047 Vision

The study has particular relevance to the broader vision of Viksit Bharat@2047, which emphasises sustainable, technologically advanced and responsible economic development.

The integration of AI with ESG governance can support Indian organisations in developing more transparent sustainability practices while strengthening stakeholder confidence. Technology-enabled ESG verification can potentially improve corporate accountability, encourage responsible business practices and support informed sustainable consumption.

The study therefore positions responsible Artificial Intelligence and credible ESG governance as complementary elements of sustainable and inclusive economic development.

11. Limitations of the Study

Although the study provides meaningful insights into the role of AI-enabled ESG verification in addressing greenwashing and strengthening consumer trust, certain limitations should be acknowledged.

1. Sample Size and Sampling Technique: The study was based on 120 respondents selected through convenience sampling. Therefore, the findings may not be fully generalisable to the broader population.
2. Cross-sectional Nature: The study adopted a cross-sectional research design, capturing respondents' perceptions at a particular point in time. Changes in perceptions resulting from technological developments or changing ESG practices could not be examined longitudinally.
3. Self-reported Responses: The study relied on respondents' self-reported perceptions and intentions. Such responses may be influenced by individual attitudes, awareness levels and social desirability.
4. Behavioural Intention Rather Than Actual Behaviour: The dependent variable was sustainable purchase intention rather than observed purchasing behaviour. Consequently, positive intentions may not always translate into actual sustainable consumption.
5. Technology Awareness: Respondents may have differed in their familiarity with Artificial Intelligence and ESG practices. Differences in technological and sustainability awareness may have influenced their perceptions of AI-enabled ESG verification.
6. Contextual Scope: The study examined AI-enabled ESG verification primarily from a consumer and stakeholder perspective. It did not technically evaluate the accuracy of specific AI algorithms or compare different AI-based ESG verification platforms.

Despite these limitations, the study provides a useful empirical foundation for understanding how AI-enabled ESG verification can contribute to more credible sustainability communication and stakeholder trust.

12. Future Research Directions

Future research can extend the present study in several directions.

First, future studies can employ larger and probability-based samples covering respondents from different geographical regions, demographic groups and consumer segments. This would improve the generalisability of the findings.

Second, longitudinal research designs can be adopted to examine how consumer trust and perceptions of greenwashing change as organisations increasingly integrate AI into ESG governance.

Third, future studies can compare perceptions across different industries, such as banking, manufacturing, retail, technology, energy and tourism. Such comparisons may reveal sector-specific differences in the credibility of ESG claims.

Fourth, future research can incorporate additional variables such as AI literacy, perceived AI usefulness, environmental concern, brand credibility, perceived transparency, regulatory awareness and perceived behavioural control to develop a more comprehensive model of sustainable consumer behaviour.

Fifth, researchers can examine the role of different forms of AI, including Natural Language Processing, machine learning, generative AI and predictive analytics, in ESG verification and greenwashing detection.

Sixth, future research can compare AI-generated and human-verified ESG information to determine whether consumers perceive differences in credibility, transparency and authenticity.

Seventh, future studies can examine whether AI-enabled ESG verification influences actual purchasing behaviour rather than relying solely on purchase intention. Experimental and behavioural research designs would be particularly valuable in this context.

Finally, future research can investigate the role of regulatory frameworks and corporate governance mechanisms in determining whether AI effectively reduces greenwashing. Comparative studies across countries can further examine how differences in ESG regulations and AI governance influence the effectiveness of technology-enabled sustainability verification. Overall, future research can build upon the present framework by integrating technological, behavioural and institutional perspectives to develop a more comprehensive understanding of the transition from greenwashing to green integrity.

13. Conclusion

The growing importance of ESG governance has created an increasing need for sustainability information that is transparent, credible and verifiable. At the same time, the expansion of corporate sustainability communication has intensified concerns regarding greenwashing and the credibility of ESG claims. Against this background, the present study examined the relationships among perceived AI-enabled ESG verification, perceived greenwashing, consumer trust and sustainable purchase intention.

The empirical findings provided support for the conceptual framework. AI-enabled ESG verification was significantly associated with lower perceived greenwashing and higher consumer trust and sustainable purchase intention. Perceived greenwashing was negatively associated with consumer trust, while consumer trust was positively associated with sustainable purchase intention. These findings indicate that the credibility of sustainability communication is closely connected with stakeholder confidence and sustainable behavioural intention within the study sample.

The mediation analysis provided an important additional insight. Consumer trust significantly mediated the specific relationship between AI-enabled ESG verification and sustainable purchase intention, indicating that part of the observed association operated through increased confidence in sustainability information. The significant direct and indirect paths are consistent with partial mediation within the specified model; however, because the study is cross-sectional and observational, the mediation result should be interpreted as an empirical indirect association rather than definitive causal proof.

The findings therefore support a broader understanding of Artificial Intelligence as a governance-enabling technology rather than merely an analytical or automation tool. AI-enabled ESG verification may strengthen the process through which sustainability information is examined, communicated and evaluated, provided that implementation is supported by reliable data, transparency, accountability and appropriate human oversight.

Thus, the movement "from greenwashing to green integrity" represents more than improved sustainability communication. It reflects a transition towards a corporate environment in which ESG claims are increasingly expected to be evidence-based, transparent, verifiable and trustworthy. In this context, responsible Artificial Intelligence can serve as an important enabler of more credible ESG governance, subject to appropriate human oversight and accountability.

Overall, the study concludes that perceived AI-enabled ESG verification is significantly associated with lower perceived greenwashing, stronger consumer trust and stronger sustainable purchase intention in the study sample. The findings support the value of verification-oriented ESG communication while also underscoring that AI should be treated as a supporting governance mechanism rather than an autonomous guarantee of sustainability performance.

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