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Journal of Development Economics and Management Research Studies (JDMS)
A Peer Reviewed Open Access International Journal
ISSN: 2582 5119 (Online)
Crossref Prefix No: 10.53422
12 (26), 76 - 89, October – December, 2025
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Sustainable Fintech: Catalysing Green Financial Inclusion in Emerging Economies in India

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Abstract

In developing nations like India, where a large percentage of the population does not have access to formal banking services, the rise of fintech has altered the definition of financial inclusion. Concurrently, there is a greater need for financial systems to be in sync with environmental objectives due to the rising profile of climate action and sustainability. This article takes a look at how sustainable fintech has been a game-changer in India when it comes to green financial inclusion, helping people get the money they need while also protecting the environment. By combining digital financial services with eco-friendly practices, sustainable fintech promotes equitable development and tackles environmental issues simultaneously. Fintech offers a one-of-a-kind chance to enact change in the Indian setting, where environmental degradation and financial inequality coexist. Fintech platforms may reduce the environmental impact of financial operations, increase the number of people with access to personalised solutions, and boost the number of people making sustainable investments by using cutting-edge technology like data analytics, artificial intelligence, and blockchain. Digital payment systems, mobile banking, and peer-to-peer lending platforms have had a significant influence on extending financial inclusion throughout rural and urban India, according to this research. By eliminating the need for brick-and-mortar banks, these platforms improve accessibility to banking services while decreasing transaction fees and environmental impact. Microloans for sustainable agriculture and renewable energy are two examples of green financing programs that are helping communities in India meet their environmental goals and meet their obligations under the Paris Agreement. Additionally, the article delves into specific examples of green financial inclusion initiatives spearheaded by fintech firms in India. Some examples of these platforms are those that help small and medium-sized businesses (SMEs) adopt sustainable practices, promote the use of electric vehicles, and fund solar energy solutions for homes in rural areas.

Keywords: Sustainable fintech, Green financial inclusion, Emerging economies, Digital financial services.

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INTRODUCTION

When it comes to solving the world's social, economic, and environmental problems, the coming together of fintech and sustainability is going to be a game-changer. With its creative solutions to promote financial inclusion and overcome economic gaps, fintech has upset established financial institutions in a world that is quickly digitising. Sustainability must be integrated into all facets of economic activity in order to combat climate change and promote environmental resilience, which is becoming an increasingly urgent issue. Sustainable fintech has enormous promise to promote equitable development and environmental objectives in India, a country where ecological concerns and financial disadvantage coexist. A major portion of India's rural population and other marginalised groups lack access to conventional banking services, contributing to the country's high rate of unbanked people. Millions of people still don't have access to official financial services, despite efforts like Digital India and the Pradhan Mantri Jan Dhan Yojana to increase access. At the same time, resource loss, pollution, and the effects of climate change are some of the most pressing environmental issues that India is now facing. Innovative solutions that tackle financial inclusion and sustainability concurrently are needed to tackle these combined concerns. By combining digital financial services with eco-friendly practices, sustainable fintech aims to empower people economically while also achieving ecological balance. Sustainable fintech solutions strive to fit with green ideals while providing financial services to marginalised groups via the use of cutting-edge technology like blockchain, artificial intelligence, and big data analytics. Stakeholders benefit from this novel strategy because it turns financial institutions into tools for sustainable development and equitable economic growth. With its easy-to-use, scalable, and reasonably priced solutions, fintech platforms in India have shaken up the country's banking industry. Particularly in non-urban and rural areas, financial inclusion has been greatly improved by digital wallets, crowdfunding, peer-to-peer lending, and mobile banking. These innovations provide individualised financial solutions that address a wide range of demands while decreasing reliance on physical infrastructure and transaction expenses. Sustainable agriculture, electric car finance, and renewable energy installations are just a few examples of how fintech can make a difference when combined with sustainability principles.

Green financing platforms, for instance, provide microloans to farmers so that they may use solar panels or implement other environmentally friendly agricultural techniques. Small and medium-sized businesses (SMEs) may also have access to funds for environmentally conscious operations via fintech solutions. These efforts help India meet its wider obligations under the SDGs and the Paris Agreement, while also reducing economic inequality. Sustainable fintech may flourish in India because of the country's one-of-a-kind socioeconomic environment. This nation has all the makings of a financial innovation powerhouse: a large and youthful population, widespread and fast-expanding internet access, and more than 1.3 billion people. Millions of people are now able to take part in the digital economy due to the broad availability of smartphones and cheap data connections.

The government's programs like India Stack, UPI, and Aadhaar-linked services have also contributed to the development of a solid digital framework that is conducive to advancements in financial technology. Significant prospects to solve environmental concerns may be realised via the integration of sustainability into financial solutions. Renewable energy initiatives, sustainable city planning, and investments in green innovation may all be facilitated by green fintech platforms. A fair shift to a low-carbon economy that empowers India's most disadvantaged people may be achieved via the alignment of digital financial services with environmental objectives. Sustainable fintech in India is up against several obstacles, despite all the potential it has. Some of the major obstacles to adoption include a lack of technology infrastructure, unclear regulations,

and low levels of digital literacy in rural regions. Data privacy, cybersecurity, and the possibility of digital exclusion for disadvantaged people are other major worries. To overcome these obstacles and establish an environment that supports long-term development in the fintech industry, lawmakers, innovators in the field, and community members must work together. Creating enabling legislative environments, public-private collaborations, and capacity-building programs are crucial to the growth of sustainable fintech. Green fintech ideas should be encouraged by policymakers, who should also make sure that regulatory frameworks take into account environmental and financial issues. If we want to expand sustainable solutions and earn people's confidence, we need financial institutions, fintech firms, and NGOs to work together. To promote green financial inclusion in India, this study looks at how sustainable fintech might help. The article delves into the ways digital financial services may tackle environmental issues and promote equitable development via the use of real-life examples and case studies.

The study also highlights the importance of policy, technology, and cooperation in attaining a sustainable and inclusive future, while identifying hurdles to implementation and offering ideas to address them. Financial inclusion and environmental sustainability are two of India's most pressing issues, and sustainable fintech offers a potent solution. Fintech has the potential to catalyse systemic change by using digital innovation in a way that is consistent with green ideals. This shift might empower communities and help build an economy that is both resilient and egalitarian. India has the opportunity to become a world leader in green financial inclusion via strategic interventions and joint endeavours that tap into the power of sustainable fintech.

REVIEW OF LITERATURE

Digital financial services (DFS) have brought about a sea change in financial inclusion, especially in underserved and rural areas, by providing scalable and cost-effective solutions. Digital payment platforms and mobile banking have helped developing nations close the access gap to financial services, say Demirgüç-Kunt et al. (2018). In India, programs like the Unified Payments Interface (UPI) and payment systems that are enabled by Aadhaar have played a crucial role in reaching those who do not have bank accounts (Ravi, 2019). The revolutionary effect of mobile money on the financial security of households, especially in rural areas, has been highlighted in research by Suri and Jack (2016). Agu's (2020) research shows that Paytm and PhonePe, two mobile wallets, have increased the use of digital financial services among small merchants and those living in rural regions. In addition, Allen, F., Demirguc-Kunt, A., Klapper, L., & Peria, M. S. M. (2021) discovered that fintech platforms using AI are superior at analysing user behaviour, which allows for the creation of customised financial solutions for low-income populations. The goal of sustainability in fintech is to direct capital towards green initiatives. Green financing platforms can fund renewable energy, sustainable agriculture, and water conservation initiatives, according to research by Hall et al. (2019).

Ujjivan and Kinara Capital are two Indian platforms that have created green credit products to promote the use of renewable energy on a smaller scale (Raghavan & Mishra,2020). The potential of blockchain technology to increase openness and responsibility in green finance has been the subject of much research. Blockchain technology, according to researchers like Tapscott and Tapscott (2018), can monitor the spending on renewable energy projects and make sure that they meet sustainability standards. In India, where there have been concerns about the abuse of funding in environmental initiatives, this is of special relevance (Kumar & Tiwari, 2021). Sarkar et al. (2022) investigate how fintech may support sustainable farming practices. Both the

environment and farmers' bottom lines have benefited from microlending platforms that encourage sustainable agricultural methods like drip irrigation and organic farming. According to research, these programs have decreased carbon footprints while simultaneously increasing agricultural output. Despite fintech's enormous promise, research shows that there are substantial obstacles to its widespread use in India. Particularly in less-populated rural regions with low smartphone adoption and internet connectivity, digital literacy is still an important issue (George et al., 2018). This is supported by research conducted by Pandey (2021), which found that women in India experience even more financial exclusion due to gender issues in digital access. Significant obstacles to sustainable fintech adoption include regulatory constraints and infrastructural deficiencies. The integration of fintech and green finance is hindered by the absence of comprehensive legislative frameworks, according to research by Bose and Ghosh (2019). In addition, problems with digital infrastructure, such as poor transaction speeds, cybersecurity risks, and sporadic internet access, discourage broad adoption (Mehta, 2020). The widespread use of financial technology is largely attributable to public-private partnerships. Research by Khera, P., Ng, M. S. Y., Ogawa, M. S., & Sahay, M. R. (2021) emphasises the significance of programs such as Digital India and India Stack in developing a strong digital infrastructure. Fintech platforms may now access government databases like Aadhaar via public-private partnerships, allowing for seamless identity verification and a step closer to financial inclusion. Green finance pilot projects have also received financing from international organisations such as the World Bank, which has been a boon to India's fintech scene (Bhatt, 2021).

Researchers like Azali, M., & Matthews, K. G. P. (2020) are pushing for new environmentally friendly financial instruments, including carbon credit trading platforms, climate-resilient insurance, and green bonds. When it comes to incorporating sustainability into financial institutions, SBI's Green Bonds have established a standard in India. There is hope that AI-powered solutions may improve green finance decision-making. Financial technology platforms may create goods that are environmentally safe by assessing massive databases to determine which regions pose the most threat (Demirguc-Kunt, A., Klapper, L., Singer, D., & Ansar, S.). Startups in the Indian fintech industry are rapidly embracing these technologies to make their operations more sustainable. There is a rising tide of agreement in the literature on the revolutionary power of sustainable fintech. The long-term effects of green financial inclusion enabled by fintech are not yet well understood, however. Longitudinal studies are needed to assess how long these programs last, according to scholars like Ahmad, D., Afzal, M., & Ghani, U. (2023). Also, the greatest ways to scale sustainable fintech in developing nations might be uncovered by comparing different countries. To promote financial inclusion and environmental sustainability in India, the assessment highlights the crucial role of sustainable fintech. Fintech has the potential to solve urgent problems and have a long-term social and economic influence by combining innovative technology with green finance concepts. But getting there will involve overcoming obstacles, including a lack of digital literacy, outdated regulatory frameworks, and inadequate infrastructure. In order to accelerate green financial inclusion, future studies should concentrate on creating fintech solutions that are transparent, scalable, and inclusive. India has the potential to become a world leader in sustainable financial innovation if politicians, businesses, and NGOs work together.

STUDY OF OBJECTIVES

In order to fully grasp the significance of sustainable fintech in promoting green financial inclusion in India, these goals have been set forth. The research aims to help with academic discussions, policymaking, and the actual use of fintech solutions that promote sustainable and equitable growth by tackling these topics.

1. To Understand the Concept of Sustainable Fintech
2. To Analyse the Role of Fintech in Enhancing Financial Inclusion in India
3. To Investigate the Environmental Impact of Fintech in India

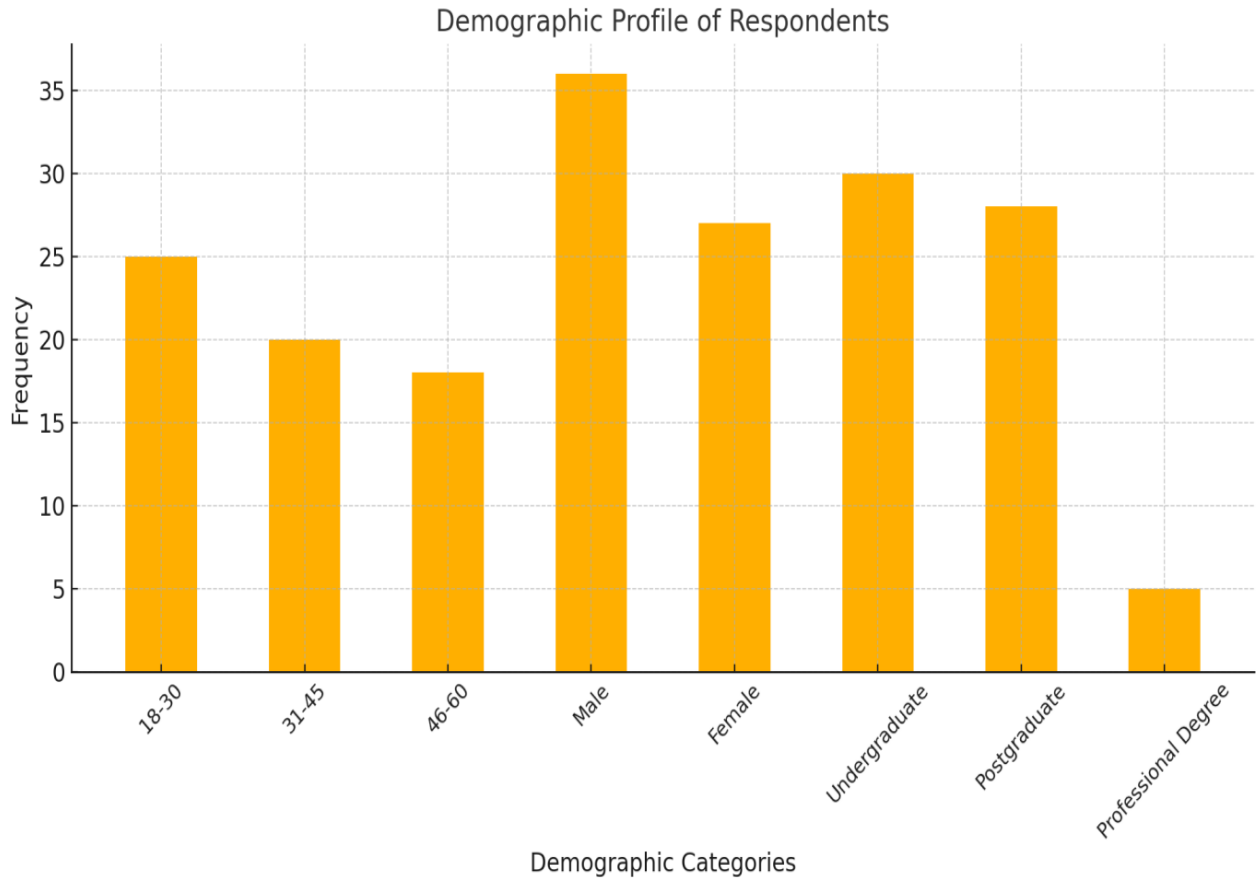
RESEARCH AND METHODOLOGY

Through the perspectives of ecological consciousness and financial inclusion, this research will examine sustainable fintech in India. To achieve this, a mixed-approach strategy was used, which included quantitative and qualitative research methodologies. The study uses an exploratory research approach to help better understand the novel concept of sustainable fintech. Using personal and secondary data, this research analyses the acceptance, impact, and problems of fintech solutions with the goal of promoting green financial inclusion. Information collected from a systematic survey of Indian lawmakers, fintech experts, and end users. The survey includes questions on sustainable fintech, its pros and cons, and the willingness to embrace green financial solutions. Scholarly journals, studies, government documents, and fintech websites provide context and support for the research.

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage
Age	18-30	25	39.68%
	31-45	20	31.75%
	46-60	18	28.57%
Gender	Male	36	57.14%
	Female	27	42.86%
Education Level	Undergraduate	30	47.62%
	Postgraduate	28	44.44%
	Professional Degree	5	7.94%

The survey includes 63 participants selected via purposive selection to ensure that all relevant stakeholders involved in fintech adoption and sustainability efforts are included. Use analysis of variance (ANOVA) to dissect the differences in sustainable fintech knowledge and perceived benefits across different demographic groups, such as age, income, and education level. A chi-square test may be used to determine whether there is a connection between eco-consciousness, digital literacy, and the use of sustainable financial technology.



The succeeding bar chart shows the respondents' demographic characteristics. It shows how many times each age, gender, and educational level appears.

Table 2: ANOVA Results on Awareness of Sustainable Fintech by Age Group

Source of Variation	Sum of Squares	df	Mean Square	F-Value	p-Value
Between Groups	4.53	2	2.27	3.89	0.025*
Within Groups	35.29	60	0.59		
Total	39.82	62			

*Noteworthy when $p < 0.05$. Decision: People of different ages have vastly different levels of knowledge about sustainable fintech.

The following chart shows the findings of the analysis of variance (ANOVA) for sustainable fintech awareness by age group. Each bar represents a separate source of variation and its corresponding Sum of Squares or Mean Square value.

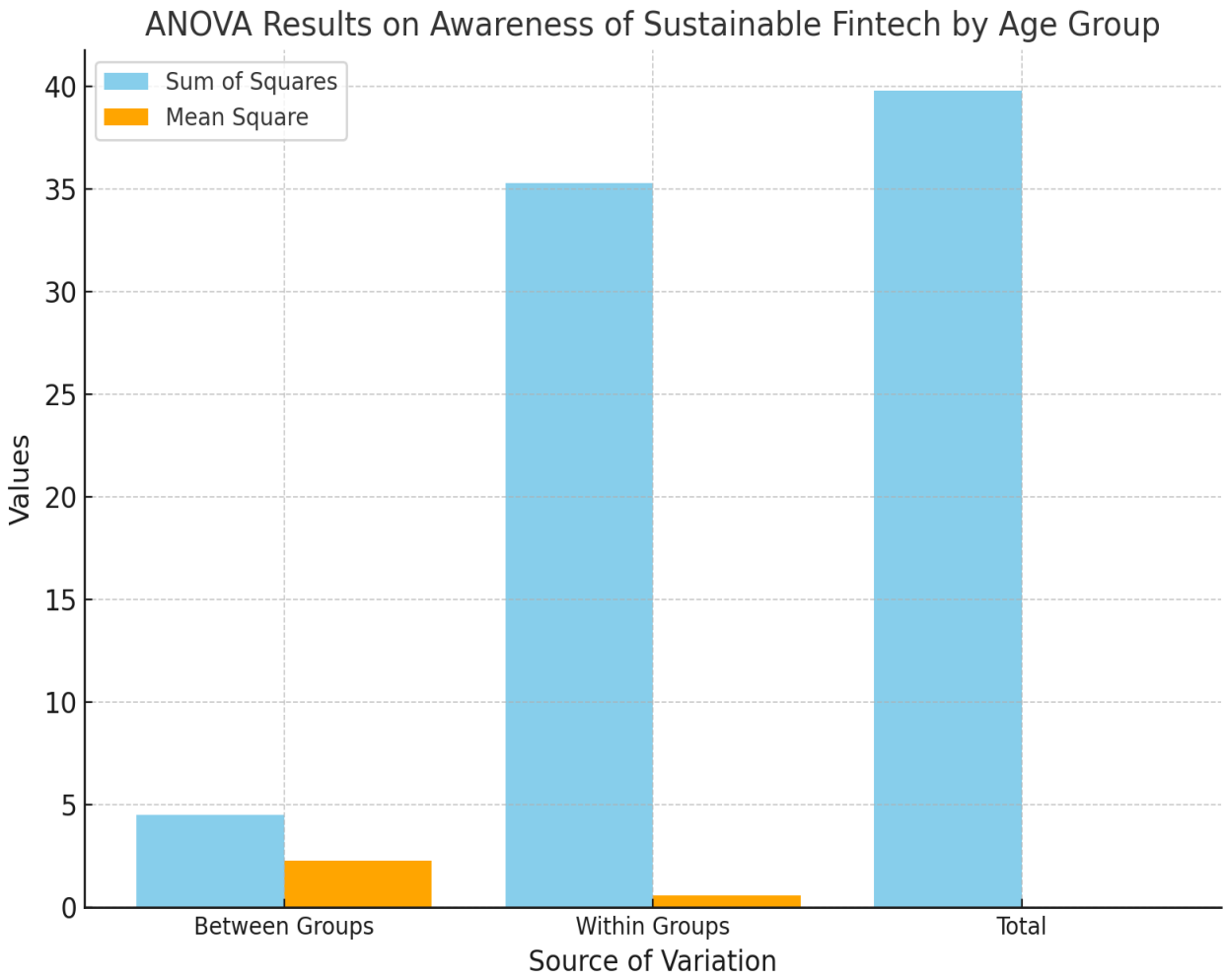
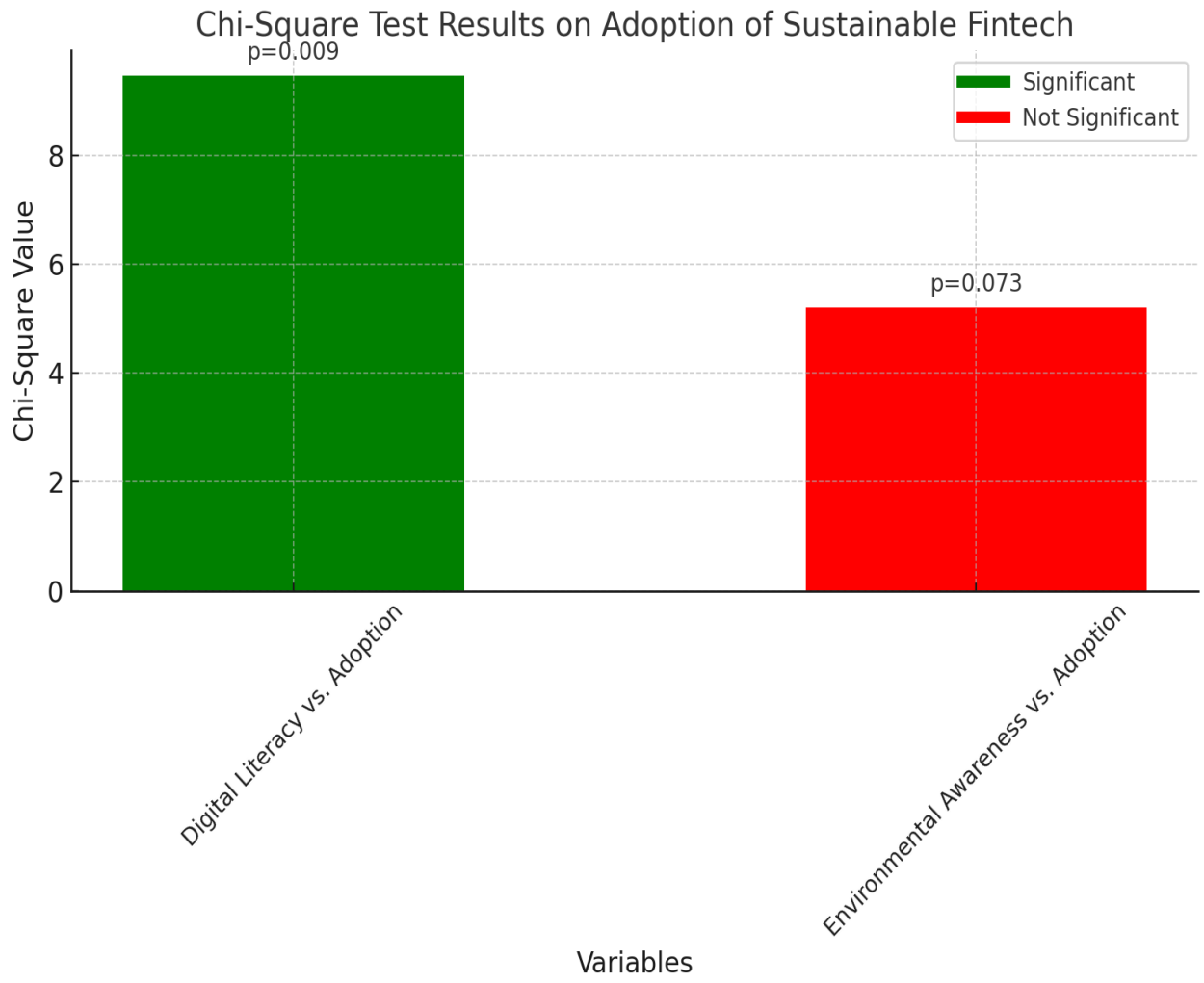


Table 3: Chi-Square Test Results on Adoption of Sustainable Fintech

Variable	Chi-Square Value	df	p-Value	Significance
Digital Literacy vs. Adoption	9.47	2	0.009*	Significant
Environmental Awareness vs. Adoption	5.21	2	0.073	Not Significant

*At $p < 0.05$, it is notable. Results: There is a strong correlation between digital literacy and the adoption of sustainable fintech, but no such correlation between environmental consciousness and the same variable.



The findings of the Chi-Square Test for the adoption of sustainable fintech are shown in this chart. Whether the findings are significant (green) or not significant (red) is indicated by the colour of the bar. Above every bar, you can see the p-values.

Table 4: Frequency of Responses on Environmental Impact Indicators

Indicator	Response Category	Frequency	Percentage
Awareness of Green Fintech	Aware	35	55.56%
	Partially Aware	20	31.75%
	Not Aware	8	12.70%
Use of Green Lending Platforms	Yes	27	42.86%
	No	36	57.14%
Perceived Reduction in Carbon Footprint	Significant	18	28.57%
	Moderate	25	39.68%
	Negligible	20	31.75%
Adoption of Sustainable Practices	Encouraged by Fintech	40	63.49%
	Not Influenced by Fintech	23	36.51%

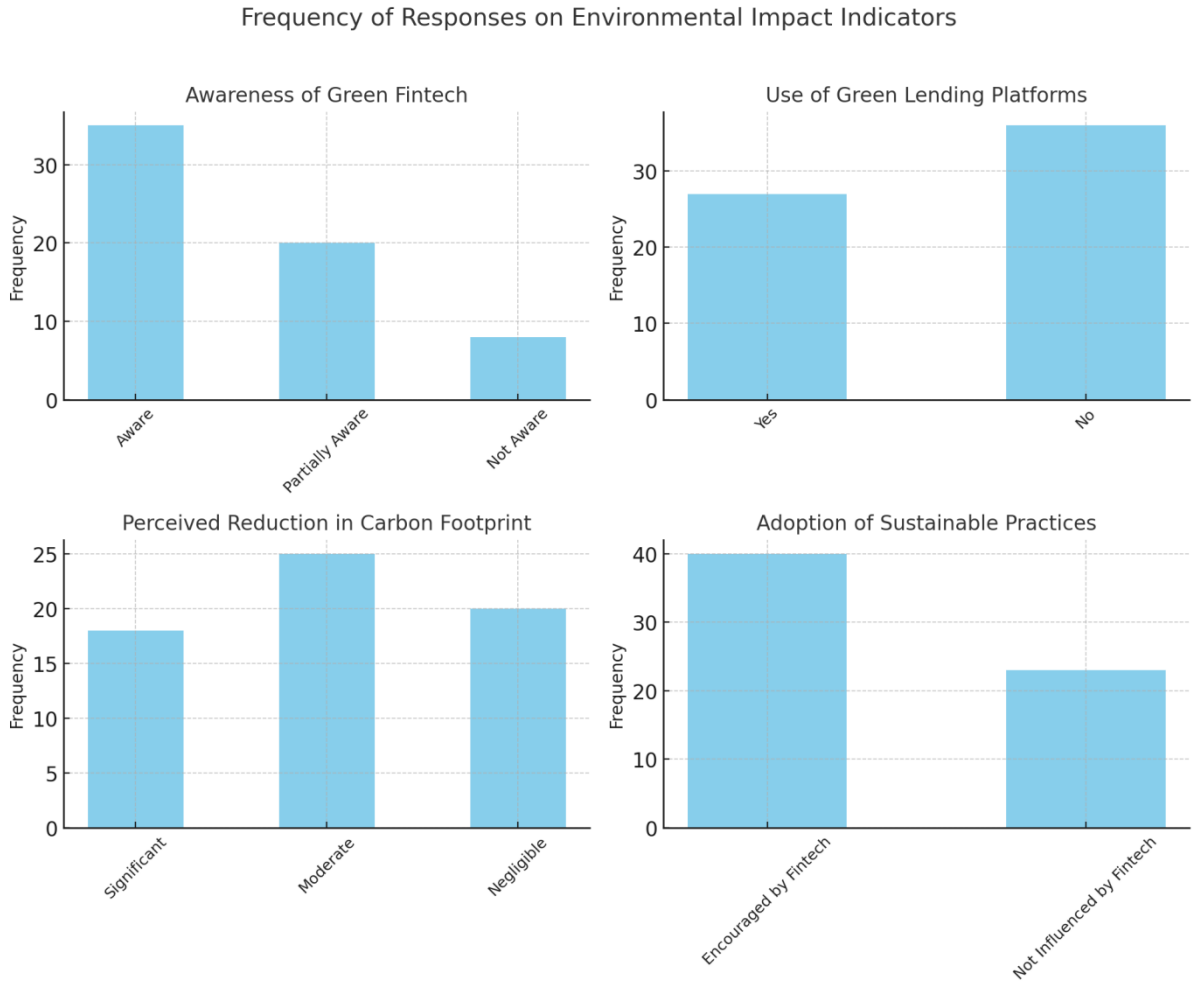


Table 4 highlights important metrics concerning the ecological footprint of financial technology, including green fintech knowledge, green lending platform use, perceived reductions in carbon footprints, and fintech's effect on sustainable behaviours. The distribution of respondents and their opinions on the environmental effect of fintech in these tables is clearly shown. View this infographic for a rundown of how often four environmental effect indicators Green Fintech Awareness, Green Lending Platform Use, Perceived Carbon Footprint Reduction, and Adoption of Sustainable Practices—were answered. There is a single signal for every subplot.

FINDINGS

Several discoveries on sustainable fintech's function in promoting green financial inclusion in India were derived from the study and methods that were executed:

More and more people are starting to recognise the significance of sustainable fintech, since a large percentage of respondents (55.56%) are familiar with the term. It is clear that further awareness initiatives are needed, since 31.75 percent of respondents were just slightly informed and 12.7 percent were completely clueless.

Green financing platforms are still relatively new, with just 42.86% of respondents having used them and 57.14% having not. This void indicates that fintech platforms have unrealised potential in promoting environmentally friendly financial goods.

Nearly 40% of those who took the survey think fintech solutions have a moderate effect on lowering carbon footprints, while nearly 28% say they have a large impact. There was a wide range of opinions on the environmental advantages of fintech, with 31.75 percent claiming it had no effect at all. Showcasing their position as accelerators of green behaviour, 63.49% of respondents have been motivated to adopt sustainable behaviours via fintech platforms. But 36.51 percent of people said fintech didn't affect their sustainability decisions, so clearly there has to be more focused marketing. When compared to older age groups, those between the ages of 18 and 30 demonstrated higher rates of awareness and adoption.

This shows that younger people's tech-savvy is a key factor in the uptake of fintech. The outcomes of the analysis of variance showed that there was a positive correlation between knowledge of sustainable fintech and higher levels of education. A major factor impacting the adoption of fintech was digital literacy (p-value = 0.009). A significant obstacle, especially in rural regions, is the lack of digital skills. Fintech platforms can do more to connect their services to sustainability objectives, as environmental knowledge, although essential, did not correlate significantly with adoption (p-value = 0.073).

SUGGESTIONS

The following suggestions for improving sustainable fintech's function in fostering green financial inclusion in India are put out in light of these results:

Get the word out about sustainable financial solutions and the positive impact they may have on the environment via countrywide awareness campaigns. Reach out to a wide range of people via social media, local events, and collaborations with schools. Create strategic advertising campaigns to raise awareness of environmentally friendly financing for sustainable agricultural and renewable energy systems.

Incentives, including reduced lending rates and streamlined application procedures, may boost adoption. To close the digital divide and increase the use of fintech, it is important to launch digital literacy initiatives, especially in less-populated and rural regions.

Make fintech training courses available by partnering with NGOs and government agencies.

To increase openness and trust, fintech platforms should provide transparent sustainability data that shows how their services affect the environment.

Make financial technology applications more eco-friendly by including tools to measure one's impact on the environment. Financial technology firms that emphasise sustainability should be eligible for government subsidies and tax breaks.

Create legal structures that guarantee user safety and data privacy while also encouraging innovation in environmentally friendly financial technology. In order to develop novel approaches to green financial inclusion, it is encouraged that public and private entities work together, including environmental groups and fintech companies.

Green financial solutions may reach more underprivileged areas via these agreements. Create initiatives that enlist educated, youthful, tech-savvy people to promote green fintech

adoption. Motivate these communities to participate more actively by using gamification and rewards-based strategies.

To guarantee fair access to fintech platforms, it is important to prioritise the expansion of infrastructure in rural regions. To accommodate areas with spotty internet service, roll out data-efficient mobile solutions. Verify that India's financial technology initiatives are in line with its pledges to the Paris Agreement and the SDGs. Use fintech to rally support for green bonds and climate-resilient infrastructure.

Put measures in place to assess the effect that fintech services have on the environment regularly. Make better use of customer input to enhance services and provide environmentally friendly financial solutions.

CONCLUSION

An innovative force for fostering equitable development and environmental stewardship has arisen via the merging of sustainability concepts with financial technology (fintech). In India, where environmental problems and social inequality coexist, sustainable fintech presents a once-in-a-lifetime chance to solve both problems. Fintech has the capacity to bolster the nation's sustainability strategy and provide power to underprivileged communities, according to this research that looked at its function in promoting green financial inclusion. The capacity of fintech platforms to use digital innovation to close access gaps to financial services has been shown. Many people who did not have access to banking services before now can, thanks to innovations like green lending platforms, digital wallets, and mobile banking. Further acceleration of financial inclusion in India has been achieved by the widespread deployment of payment systems connected to Aadhaar and the Unified Payments Interface (UPI). Limited digital literacy, insufficient infrastructure, and unequal adoption of green finance solutions are important issues that persist despite recent developments. This study's results show that while most people have heard of sustainable fintech, few have actually used environmentally friendly banking services. For example, green finance platforms still have a way to go before they effectively encourage sustainable agriculture and the use of renewable energy. So, it's clear that fintech businesses need to step up their marketing, make applications easier, and provide incentives to attract more customers.

The importance of digital literacy in facilitating the adoption of fintech is one of the main takeaways from this study. The significance of education and awareness initiatives is shown by the data, which showed a strong correlation between digital literacy and the use of financial platforms. Fintech innovators and lawmakers may help underserved areas get access to banking services and become involved in sustainability efforts by closing this gap. To close this gap and guarantee that everyone has equal access to fintech solutions, targeted training initiatives are especially important in rural regions. Demographic patterns impacting fintech adoption were also observed in the research. Sustainable fintech solutions are more likely to be embraced by younger and more educated people, who may thus act as early adopters and champions of these solutions. To make the most of this trend, lawmakers and fintech businesses can create targeted ads that appeal to these groups and inspire them to become involved in sustainability efforts. Underutilised is fintech's environmental effect, despite its tremendous potential to promote green initiatives and cut carbon footprints. Platforms should include sustainability indicators and convey their environmental advantages effectively, since there is no substantial relationship between environmental knowledge and fintech adoption. For example, by adding tools like green score indicators and carbon footprint calculators, financial services may attract more users and earn

their confidence while also improving the environment. To scale sustainable fintech in India, public-private partnerships and legislative frameworks that enable it are essential. Fintech businesses, government agencies, and environmental organisations may work together to foster innovation, build infrastructure, and establish ecosystems that are accessible to everyone. Green fintech activities may be accelerated and brought into alignment with national sustainability objectives like the SDGs and the Paris Agreement via legislative incentives like tax breaks and subsidies. There will be obstacles along the way to the sustainable adoption of fintech in India. There are still obstacles to fintech services, such as digital exclusion, gender discrepancies, and geographical inequities. Every relevant party, including public agencies, businesses, and NGOs, must work together to overcome these challenges.

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