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Exploring the role of fintech innovations in driving sustainability: A study on user adoption and ESG integration in financial services

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Abstract
As a result of the upheaval that fintech technologies are bringing about in the financial sector, sustainability has become a fundamental objective. This study aims to investigate the confluence of these two fields, focusing on how fintech skills could improve the sustainability of banking, investments, and insurance. Primary data was collected through surveys and interviews to determine the public's perspectives on implementing sustainable fintech. In addition to determining the primary factors that influence the adoption of financial technology in Kerala, this study aims to investigate the principles of fintech and their impact on sustainability. Knowledge, accessibility, and the integration of sustainability elements are among the aspects of typical fintech services. These elements include safety and security considerations and environmental, social, and governance (ESG) challenges. The study also looks at the theory that fintech consumers think sustainability is becoming increasingly integrated into creating new fintech services and technology. As fintech services grow, the banking industry quickly switches from conventional cash-based methods to safer, easier-to-use, and cashless alternatives. Online and digital platforms are the main drivers of this change since they are now essential for contemporary consumers.

Keywords: Fintech, financial services, sustainability, social responsibility

1. Introduction
There has been a transition into a new age in financial services, as sustainability and financial technology (Fintech) have emerged as vital elements of global banking. Because the world is now dealing with pressing environmental and social problems, such as climate change and wealth inequality, participants from all different sectors have realised that it is essential to establish a connection between economic growth and sustainable development goals. Kerala, well-known for its forward-thinking approach toward social justice and environmental conservation, can greatly battle the challenges encountered by deploying sustainable Fintech solutions. The economy of Kerala, which is mainly based on remittances, agriculture, and tourism, may enjoy the advantages of solutions driven by fintech that boost financial inclusion, especially in rural regions. By focusing on social equity, environmental responsibility, and long-term sustainability, advances in financial technology are producing a paradigm change in the conventional methods of conducting financial transactions. In Kerala, microfinance programs and digital payment platforms assist small-scale farmers, fishermen, and entrepreneurs in obtaining access to financial services, enhancing their livelihoods, and encouraging sustainable practices. Specifically, this discusses how technology has altered the financial industry and how the connection between Fintech and sustainability has evolved. Using innovative approaches that increase economic results and positively affect society and the environment, fintech solutions are forging new ground and bringing about positive change.

Some of these are making it easier for underserved areas to get financial services, encouraging eco-friendly tourism, and helping Kerala switch to a low-carbon economy. This paper examines how sustainable finance changes Fintech by examining new trends, industry practices, and recent developments. It focuses on how Kerala can use these opportunities to make the future more sustainable and open to everyone.

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2. Statement of The Problem

The rapid progression of financial technology (fintech) has transformed the worldwide financial services industry, presenting novel solutions that ensure efficiency, accessibility, and equality. In recent years, fintech has become a vital sustainability facilitator by incorporating Environmental, Social, and Governance (ESG) concepts into financial processes. Nonetheless, the degree to which fintech technologies have propelled sustainability in the regional environment, especially in Kerala, needs to be more adequately examined.

Kerala, recognised for its elevated literacy rate, progressive legislation, and strong financial infrastructure, offers a unique environment for fintech integration. User knowledge, trust, technical infrastructure, and legislative support may affect the adoption rate of fintech solutions and their compatibility with ESG objectives. Although fintech has opportunities for promoting sustainable practices, the obstacles to user uptake and the incorporation of ESG principles into financial services need a thorough examination. This research examines the impact of fintech innovations on promoting sustainability in Kerala. The objective is to analyse user adoption trends, identify obstacles and facilitators of ESG integration, and provide insights into the role of fintech in advancing sustainable development goals (SDGs). The results seek to guide policymakers, financial institutions, and fintech innovators in establishing a more inclusive and sustainable financial environment in Kerala.

3. Literature Review

According to (Varg, 2017) [16], the study aims to fill in some of the gaps identified in the academic literature. A conceptual analysis of the value drivers driving fintech, including business models, human-centred design, and open innovation, is provided in this article. In this work, a qualitative and conceptual approach is utilised, drawing from many theories in the field of strategic management, including the resource-based view. To highlight significant themes, several case studies of fintech are utilised. The analysis demonstrates that financial technology companies have the potential to act as catalysts for innovation within legacy financial institutions. Incorporating user-centricity, technology, and cooperation into business models for the financial technology industry is a crucial innovation accelerator. In addition, the article stresses the potential triple-bottomline implications that fintechs could have in effectively addressing urgent societal challenges. The author concludes that fintechs are beginning a new era in providing financial services. This new era is driven by digitalisation, disruptive thinking, and unique business models that cater to consumer segments that were previously underserved.

Fintech companies have the potential to revolutionise traditional financial services by facilitating increased accessibility, sustainability, and good social change. As a result, they can serve as a pioneer in transforming the whole industry. (Lagna & Ravishankar, 2022) [9]. It aims to steer research efforts toward responsible digital finance platforms that equitably serve the needs of underprivileged populations. This study intends to address the research gap concerning how information systems (IS) scholarship may connect with and inform the potential of financial technology (fintech) to drive financial inclusion for populations that are economically disadvantaged and do not have bank accounts. Fintech business strategies for inclusion, digital artefacts that enable access, policy settings, social micro-foundations, and development implications are the five areas that the author focuses on when proposing study topics. Case examples illustrate the gaps in knowledge and opportunities that exist. Lastly, the author's proposed research lens clarifies areas for rigorous scholarly inquiry that evaluate optimal designs, adoption determinants, and overall welfare impacts. This contributes to achieving the discipline's purpose of enabling technology for social good (Thomas *et al*.,2020) [15].

Activities include monitoring borrowers' energy efficiency data, providing loan discounts for achieving green goals, buying carbon offsets, and releasing thorough environmental impact reports. The author concludes that some forward-thinking fintech lending companies are beginning to embrace sustainability, as demonstrated by their experimentation with sustainability KPIs, loan products that encourage borrowers to make energy-efficient investments and internal carbon reduction initiatives. (Charalampos *et al*, 2022) [5]. This study examines the financial technology industry's (FinTech) explosive growth and assesses its effects on the Greek banking industry. It seeks to comprehend shifting consumer trends and established banks' difficulties due to FinTech rivals. The study uses a quantitative questionnaire-based methodology to gather empirical data on FinTech usage, perceptions, and implications by polling bank workers and financial services consumers. According to the analysis, traditional banks are trusted more than FinTechs. However, FinTech online and mobile services use varies by age and educational attainment. One of the leading consumer concerns with FinTech adoption is security. Employee skill sets and experience with new technology also differ among banks, and it is concluded that while FinTech is expanding quickly, traditional Greek banks can still maintain their competitive advantages in terms of perceptions of security and trust. To satisfy customer aspirations for cutting-edge technologies, banks must prioritise safe mobile platforms while investing in staff training and digital literacy. (Mohammad *et al*., 2023) [11]. The effects of fintech and digital financial services on financial inclusion in India were examined in this study using regression and correlation analysis. The fact that almost 80% of Indians currently own bank accounts shows how far the country has come regarding financial inclusion. The government is encouraging the growth of fintech companies to expand financial services to the unbanked population. The results showed that fintech has significantly improved financial inclusion, particularly for the middle class.

Policymakers use the information to promote more involvement in the official financial system. (Aditee & Dr. Devyani, 2023) [1]. This study aims to gather information from secondary sources relevant to the research topic, including government publications, websites, journals, business annual reports, research papers, and research reports. Through a thorough evaluation and analysis of the literature, the current study aims to determine the role of FinTech in sustainable banking.

Secondary research served as the foundation for this investigation. It was noted that many scholars have looked at how new and emerging technologies affect the growth of the banking sector and how cooperative, public, and private banks use these technologies. To understand the state-of-the-art literature associated with Fintech, this review article aims to compile earlier research on the topic and its significance for the banking industry. This evaluation of the literature may establish a platform for additional research. (Aditee & Neeta, 2022) [2] To investigate the socioeconomic characteristics of bank employees in Pune, the significance of fintech in meeting the expectations of bank customers in Pune, and the opinions of bank customers regarding the use of financial technology in Pune, 100 responses from the city were collected. Because the non-probabilistic convenient sampling technique offers competitive advantages like speed transparency, time savings, and resource optimisation, the author decides to use it. Additionally, it provides top-notch customer support.

4. Research Gap

Insights into how Fintech may be improved via ongoing innovation and used to improve sustainability via new financial services are the primary goals of the research. Although previous studies have investigated how financial technology (Fintech) might help promote environmentally friendly practices in the banking industry, primarily via mobile banking and other digital platforms, there are still significant knowledge gaps. First, although many studies have looked at how Fintech can help with sustainability, only a few have looked at how it would affect sustainability in the long run or what other problems it may cause when integrated into financial services.

Second, some writing concerns the possible benefits of mixing Fintech with sustainability. However, more about the problems must be written when combining financial innovation with environmentally friendly practices. This group includes regulatory problems, security worries, and Fintech solutions that are unavailable in places that have yet to be looked after. Last but not least, not much is known about how Fintech solutions could be improved in the future to make banking services more sustainable. More studies are needed to determine where Fintech ideas end up and how they can be changed to meet the banking industry's changing sustainable goals. These holes make us think we need to learn more about the good and bad aspects of using Fintech in green projects and the best ways to support new ideas when these issues happen.

5. Scope of the Study

The research examines the relationship between financial technology and sustainable practices in the financial services sector. It will explore how technical developments and new banking, investing, and insurance business models help move financial services toward more ecologically and socially responsible. The research aims to clarify why sustainability has emerged as a significant concern in the financial sector and the primary drivers of this shift, such as climate change threats, ethical customer expectations, and regulatory changes. It also discusses how Fintech and sustainability might combine to change financial services systems to enhance social and environmental results.

6. Objectives of the Study

By addressing important goals, this research seeks to investigate how fintech technologies and sustainability interact. It aims to explore the connection between sustainability and the fundamental ideas of financial technology, looking at how fintech might promote socially and ecologically conscious behaviour. The research also seeks to determine the different elements—such as legislative frameworks, technical infrastructure, user knowledge, and trust—that impact the adoption of fintech solutions. By exploring these dynamics in greater detail, the study will also examine the complex relationship between fintech and sustainability, emphasising how financial technology can be used to integrate Environmental, Social, and Governance (ESG) principles into financial practices and act as a catalyst for the achievement of the Sustainable Development Goals (SDGs).

7. Research Methodology

This study uses a quantitative research technique and descriptive analysis to evaluate Fintech's role in enhancing financial services' sustainability. Participants are chosen using a probability and simple random sampling approach, ensuring that the sample represents the population. The study provides a reliable analytic dataset based on a sample size of one hundred fifty responses each.

Information was supplied through structured questionnaires and in-person interviews with Internet banking users. Secondary data, such as articles, journals, and websites, will also be collected online.

8. Hypotheses of the Study

This research examines how fintech innovations drive sustainability in financial services, focusing on user uptake and ESG integration. Fintech, which uses mobile apps, blockchain, and AI, has transformed the financial industry by making services more efficient, accessible, and safe. This research examines how fintech innovations promote sustainable financial practices and how consumers' use of fintech services affects sustainability initiatives. Two theories underpin the study:

(H0): Fintech does not significantly affect the sustainable development of financial services.

(H1): Fintech significantly impacts financial service sustainability.

The research surveys and interviews fintech users to assess their understanding of sustainability in fintech and the degree to which ESG concepts are being applied to their services. The investigation should reveal if fintech innovations are boosting the financial services sector's sustainability.

Understanding fintech's role in promoting sustainability is critical as global financial markets prioritise it. This study will highlight fintech's sustainability advantages and the obstacles to adopting ESG principles. The report compares user adoption patterns with ESG adoption in fintech services to provide suggestions to boost the sector's sustainable economic development. These findings will add to the debate on fintech's ability to create a more sustainable and socially responsible financial system.

Factors Identified for the Study

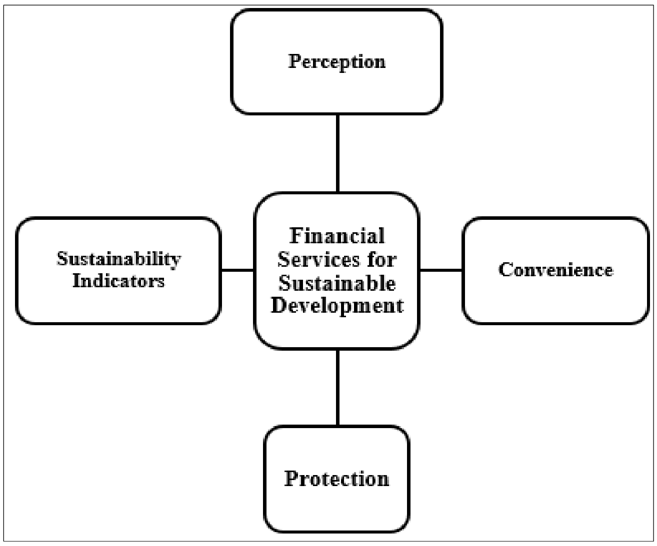
9. Data Analysis and Interpretation

Fintech encourages sustainable growth by offering modern financial services.

Statistical tool – chi-square test

H0: Fintech does not significantly affect the sustainable development of financial services.

H1: Fintech significantly impacts financial service sustainability.



(Source: Author's input)

Table 1: Finance technology encourages sustainable growth.

SL No:	Finance technology encourages sustainable growth.	Responses	Percentage
1	Strongly Agree	40	26.66
2	Agree	92	61.33
3	Neutral	15	10
4	Disagree	3	2
5	Strongly Disagree	0	0

(*Source*: Primary Data)

Table 2: Illustrates the Chi-Square Test of Respondents' Opinions on Fintech's Substantial Influence on The Sustainable Growth of Financial Services.

Parameters	O	E	(O-E)	(O-E) ^2	(O-E) ^2]/E
1	40	30	10	100	3.33
2	92	30	62	3844	128.13
3	15	30	-15	225	7.50
4	3	30	-27	729	23.70
5	0	30	-30	900	30.00
Total	150	150	-	5798	193.27

(*Source*: Primary Data)
Observed frequency (O) = 40+92+15+3+0=150
Expected frequency (E) = 30+30+30+30+30+150
Degree of freedom (df) = 5-1 = 4
Chi-square Statistic (χ2\chi^2χ2): 193.27

10. Interpretation
The null hypothesis (H0) says, "Fintech does not significantly affect the sustainable development of financial services." We reject it because the p-value is much less than the standard significance threshold of α=0.05\alpha = 0.05α=0.05. The data supports the alternative hypothesis since the p-value shows that the observed frequencies of the categories are substantially different from the predicted frequencies. Consequently, the null hypothesis is rejected. So, we agree with (H1) that "Fintech significantly impacts the sustainability of financial services." The findings of the Chi-square test strongly suggest that Fintech substantially impacts the long-term growth of financial services.

11. Findings of the Study
1. Effects of Financial Technology on Industry: Fintech substantially affects the long-term viability of the financial services industry, according to the Chi-square test. With the null hypothesis disproven, it is clear that Fintech is vital to the long-term viability of the financial services industry.
2. Fintech Knowledge: Over half of those who took the survey are up-to-date regarding their knowledge of Fintech and its uses in the banking and insurance industries.
3. Online Payment Options: The poll found that 55.9% of respondents use online payment services regularly.
4. Financial Services Utilization of Mobile Apps: There has been an uptick in mobile-based financial transactions, with 56.40% of respondents using apps to access various financial services.
5. Safety and Security: Around 41.80% of respondents said payments made via Fintech platforms are secure.
6. ESG Impact: As a sector, Fintech plays an essential role in encouraging responsible and sustainable practices, and 64.20 % of respondents believe that ESG implications are incorporated into Fintech solutions.

12. Conclusion
This study investigated the progressive incorporation of sustainability factors inside prominent fintech services. By conducting surveys of fintech customers and interviews with industry professionals, it evaluated the premise that fintech has progressively integrated sustainability concepts into its new technology and offers. This research focuses on people whose replies will facilitate accurate conclusions about their opinions on fintech and its implications on sustainable growth in financial services.
Fintech services have emerged as a prevailing trend. The strategic incorporation of sustainability concepts within the fintech sector is still at an early, experimental stage; however, it has significant disruptive potential. Realising a next-generation financial system integrating equality and environmental stewardship requires a unified vision and collaborative efforts from many stakeholders in technology, politics, finance, and other sectors. Through unified leadership and social dedication, this innovative period for sustainable fintech may steer a more equitable and restorative economy. These developments may pave the way for more ethical banking in an age where fintech and sustainability are more interdependent. According to the user perspective, this future happens through values-first design and purpose-driven technology. Access to financial services and social justice. These patterns have the potential to support ecological regeneration, among other things. This continuous green fintech revolution may be better understood by conducting in-depth research on user preferences, business offers, and market implications.

13. Potential for Additional Research
This study examines the gradual incorporation of sustainability considerations into fintech services and identifies many areas that need further research. Future studies may examine the long-term effect of sustainability integration in fintech, namely how these practices change and affect the financial services industry over time. Furthermore, more thorough research might be done to learn more about user preferences and how they utilise sustainable fintech services, looking at how consumer behaviour affects the expansion and prosperity of green fintech solutions. Research may also examine fintech businesses' difficulties in achieving sustainability objectives, such as technical, regulatory, and market obstacles. A comparative analysis of

different geographical areas or financial ecosystems may better understand various markets' sustainability adoption rates. Examining the role of collaboration among stakeholders is also necessary as the sector develops to realise the goal of a sustainable financial system. Ultimately, this research would further knowledge of how fintech may promote social justice, economic equity, and ecological regeneration, resulting in a more ethical and sustainable financial future.

14. Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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