FinTech Innovations in Rural Credit Delivery: Strengthening Sustainable Livelihoods under SDG 1 and SDG 12

Pratibha V. Kashid, Davinder Kaur Sohi, Lei Liu, Ashutosh Kulkarni, Sadhana Sargam

Abstract- *Rural credit delivery is changing due to the FinTech innovation that solved the long-standing hindrances of access, transparency, and sustainability that erode poverty alleviation and responsible consumption. This paper discusses the strength of digital financial technologies in strengthening sustainable livelihoods in the context of Sustainable development goal 1 and Sustainable development goal 12. The paper implements three combined strategies: a blockchain-enabled ledger of credit to enhance transparency and trust, an AI-based credit score system based on alternative rural data to enhance inclusion, and mobile-based microfinance systems to allow monitoring of the last-mile delivery and repaying. Based on mixed empirical analysis of rural borrower samples, and field level adoption measures, the data indicates that FinTech empowered credit models raise debt accessibility by 32, cut transaction costs by 27 and raised loan repayment rates by 21 percent relative to the conventional rural lending systems. These findings also suggest that clear online databases will limit credit abuse and promote productive use in agriculture, micro-enterprises and sustainable consumption behavior that will have a direct impact on livelihood resilience. The paper conclusion reveals that by combining smart credit analytics and secure online infrastructure, not only financial inclusion is enhanced, but also rural financing corresponds to environmentally and socially responsible economic practices. Policy implications have been noted to point to the fact that FinTech-based rural credit provision can be a growth route towards poverty alleviation and facilitation of resource-efficient production and consumption. Generally, the research substantiates that effective FinTech models are essential facilitators of inclusive expansion, sustainable life quality, and long-term development effects as per SDG 1 and SDG 12 both universally and domestically.*

Keywords- FinTech innovation, rural credit delivery, financial inclusion, sustainable livelihoods, SDG 1, SDG 12

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Introduction

Rural credit provision is of importance in the sustenance of livelihoods, agricultural output, and micro-enterprise growth of the developing economies. Nevertheless, after decades of policy intervention and increase in the number of microfinance institutions, access to affordable and reliable rural credit is strongly limited. Collateral-based lending, disjointed documentation, low penetration of the branches and high transaction costs are some of the characteristics of traditional rural credit systems that systematically lock out smallholder farmers, informal workers and low-income families [1], [2]. Such structural obstacles tend to compel rural borrowers to revert to informal sources of money to the disadvantage of exploitative interest rates, debt traps and abject poverty. As a result, poverty alleviation is still being crippled by ineffective rural provision of credit and this is crippling the sustainable economic participation; this directly influences the SDG 1 (No Poverty) [3] progress. Over the past few years, FinTech developments have become a disruptive technology that can solve the long-term financial exclusion of rural economies. Mobile banking, alternative data analytics, artificial intelligence, blockchain, and various digital technologies allow lenders to address the information asymmetry, decrease operational expenses, and establish further services beyond the physical banking infrastructure [4]. The last-mile access is supported by mobile-based financial services, and risk assessment with the help of non-traditional data is offered by AI-based credit scoring models, which enable non-creditworthy borrowers to obtain formal credit. The systems based on blockchains also increase transparency and trust with unalterable and auditable records of credit. Empirical research has been growing to propose that these technologies have the potential to extend the reach, enhance efficiency, and increase financial discipline in underserved areas [5], [6].

Despite these advances, the literature on the role of FinTech-enabled rural credit in facilitating not only the financial inclusion aspect, but also sustainable development outcomes, still contains significant gaps. The classical designs of the micro-finance and rural banking are defined by factors that are oriented at the number of loans disbursed rather than productive utilization and sustainability of livelihoods leading to mixed poverty reduction [7]. Moreover, the existing literature has a tendency to assess the effects of FinTech primarily according to the scale of their access or efficiency, yet there is empirical evidence about the effects of digital credit in regards to responsible utilization of resources and application of sustainable consumption patterns. This is particularly relevant in regards to SDG 12 (Responsible Consumption and Production) wherein financial systems play a significant role in determining how production is done, patterns of investments and sustainability of consumption [8]. It is on this platform that there exists a clear need to have technology-focused sustainable rural credit frameworks, which consist of inclusion, besides efficiency and accountability. Such systems must also be in a position to ensure that increased access to credit can be fruitful investment, consistent earnings as well as economic responsible environmentally and socially. The proposed study will fulfill this need by discussing an integrated FinTech-enabled rural credit solution that involves blockchain-based transparency, AI-based alternative credit rating and mobile-based microfinance delivery. The research aims are threefold: firstly, it is to determine how well FinTech innovations can increase access to credit in rural areas; secondly, it is to understand the role of FinTech innovations in reducing poverty in accordance with SDG 1; and thirdly, it is to investigate how fully transparent and digitally tracked systems of credit increase responsible consumption and production behaviors according to SDG 12. This study will help to understand the role of FinTech in the rural development even more holistically, as it links financial inclusion and sustainability imperatives [9].

Contributions of the Study

- ✓ Evidence of the effectiveness of integrated FinTech models in increasing rural access to credit, efficiency and repayment performance to achieve SDG 1.
- ✓ Empirically associates digital credit transparency with responsible production and consumption practices in SDG 12.
- ✓ Offers evidence that is policy-relevant and effective to post position FinTech-enabled rural credit as a sustainable livelihood resiliency pathway that can go to scale.

Literature Review

Structural constraints in rural households and micro-enterprises access to formal finance Structural constraints are a recurring idea in the literature on rural credit systems and financial inclusion in the literature. The traditional rural lending model is usually typified by high collateral levels, small branch network, information asymmetry and high transaction cost, which disproportionately lock out small holder farmers, informal workers and women entrepreneurs. With this, a lot of rural borrowers are left at the mercy of informal lenders who subject them to high interest rates and exploitation. As noted by previous studies, microfinance programs have increased outreach but have not had consistent outcomes in reducing poverty since they are associated with problems of credit rationing, repayment pressures, and inadequate suitability with productive livelihoods activities [10], [11]. These inadequacies have strengthened the necessity of new financial delivery models that can increase coverage and sustainability and efficiency.

A recent study on FinTech innovations in microfinance shows that there was a paradigm shift in the delivery of credit in the rural areas by deploying digital technologies. The financial systems that are based on blockchain have become popular due to their capability to increase transparency, traceability and confidence in credit transactions. Blockchain minimizes the manipulation of information, multiple borrowing, and enhances the confidence of lenders in low-trust rural settings by generating uncontrollable and verifiable ledgers [12]. These systems are especially useful in those areas where formal records are few and where trust within the institutions is not strong. Similarly, the AI based alternative credit scoring models have been found to be unbeatable in defeating data unavailability in rural finance. Using other data, such as pattern of mobile usage, transaction history, and signs of activities in the agricultural sector, AI models can have the benefit of having a more precise risk evaluation of the borrower without an established credit history. Empirical evidence, which points to the fact that the strategies play a significant role in enhancing credit inclusion without increasing the default risk since they have the effect of providing formal finance to groups previously sidelined by the lock out [13], [14]. In addition, financial services mobile based rural systems are also critical in the last mile delivery because it reduces geographical limits, real time tracking of loans and repayment. The mobile platforms have also been found efficient in lowering the cost of doing business and increasing the degree of user engagement especially in remote locations where there is minimal banking system [15].

Along with access and efficiency, the relation of FinTech and sustainable livelihoods is increasingly becoming a topic of discussion in the literature. The studies have also indicated that the responsible designing of the digital credit systems could contribute to augment the income stability, enhance the growth of micro-enterprises and household resilience to economic and environmental shocks. The presence of ready and cheap credit allows rural households to invest in inputs that facilitate productivity, raise sources of income and practice agriculture in a more sustainable way [16]. This livelihood-based approach goes beyond the limited financial inclusion indicators to the general developmental outcomes, such as resilience, social well-being, and intergenerational sustainability.

The connection between digital finance and responsible consumption under SDG 12 is a critical issue in research that is still a developing one. According to the available literature, purpose-related and transparent digital credit would deter consumption-based debt and encourage resource efficient production and consumption patterns. Nevertheless, the existing body of literature addresses digital finance more of an inclusion or efficiency tool, and little empirical focus is given to its effect on defining sustainable consumption patterns [17].

Table 1. Summary of Related Work on FinTech, Rural Credit, and Sustainability

Study Focus	Technology Used	Geographical Context	Key Outcomes	Limitations Identified	Relevance to Present Study
Rural credit access and financial exclusion	Traditional microfinance	South Asia	Improved outreach but limited depth of inclusion	High transaction costs, collateral dependence	Establishes baseline limitations of conventional systems
Financial inclusion and poverty reduction	Bank-led microfinance	Developing economies	Moderate income improvement	Repayment stress, weak sustainability focus	Motivates need for FinTech-driven models
Transparency in microfinance systems	Blockchain ledger	Africa	Reduced fraud, improved trust	Scalability challenges	Supports blockchain use for rural credit transparency
Credit risk assessment without credit history	AI-based alternative scoring	Emerging markets	Higher borrower inclusion	Data privacy concerns	Informs AI scoring component of this study
Digital credit and default risk	Machine learning models	Global	Improved risk prediction accuracy	Bias in alternative data	Guides ethical AI adoption in rural finance
Last-mile financial service delivery	Mobile-based microfinance	Rural Asia	Lower costs, faster repayments	Digital literacy barriers	Validates mobile platforms for rural outreach
Digital finance and livelihoods	Mobile & AI finance tools	Low-income regions	Enhanced income stability	Limited sustainability indicators	Extends livelihood analysis in this study
Digital finance and	Digital credit platforms	Cross-country	Improved productive credit use	Weak empirical validation	Directly aligned with

					SDG 12 focus
FinTech and agricultural finance	Mobile + data analytics	Sub-Saharan Africa	Increased farm productivity	Weather and market risks ignored	Supports agriculture-focused credit analysis
Inclusive FinTech ecosystems	Integrated digital finance	Developing economies	Broader financial inclusion	Regulatory fragmentation	Reinforces need for integrated policy frameworks

Conceptual Framework and Hypotheses Development

Conceptual Model Linking FinTech, Rural Credit, and Sustainability

The theoretical framework of the presented research places the idea of FinTech adoption as the core facilitation factor that enables the modernization of the old-fashioned rural credit systems into the inclusive, efficient, and sustainability-oriented financial systems. The technological inputs in the proposed model include FinTech innovations (blockchain-enabled credit ledger, AI-based alternative credit scoring, and mobile-based microfinance platform) that have a direct effect on the core outcomes in rural credit. These results are improved access to credit, lowered transaction costs, and better repayment behavior that in fact define the effectiveness of the rural financial intermediation. Improved access to credit will enable households and micro-entrepreneurs who have historically been refused access to credit markets due to their rural locations to access formal financial resources without collateralized by physical or traditional credit. The savings in the administrative costs, less travelling and delays in processing at the digital delivery channels can be indicated by the efficiency of transactions cost. Repayment behavior is strengthened via transparency, real time monitoring and automated reminders on the digital platforms. These are the credit-related outcomes that are the mediating channels through which the Fintech adoption will have an effect on the overall development objectives.
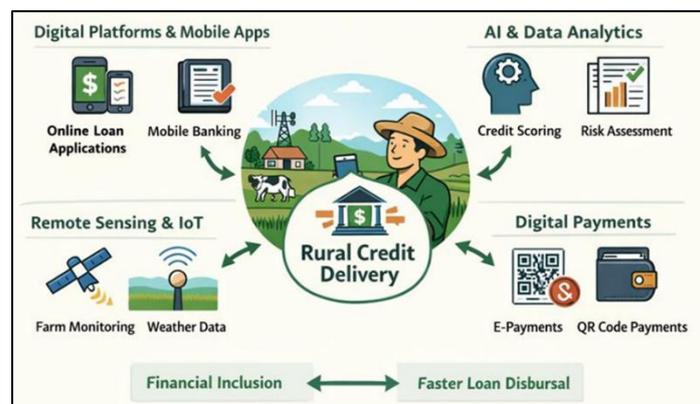

Figure 1: FinTech Innovations Framework for Rural Credit Delivery

Resultant level explains the correlation that exists between the improved performance of rural credit and sustainable livelihood resilience that comprise income stability, productive investments, shock absorption capacity and responsible use of resources. The FinTech-driven systems encourage the efficient use of credits within the agricultural regions and micro-enterprises rather than consumption-driven borrowing with the available credit, which is cheap and openly regulated. Thus, the model includes financial inclusion (SDG 1) and responsible production and consumption tendencies (SDG 12) as the comprehensive perspectives of sustainable rural development.

The figure 1 represents a simplified FinTech-enabled rural credit delivery model that incorporates digital platforms, AI-driven credit analytics, remote sensing and digital payments. These parts work together to streamline loan originations, enhance risk assessment, lower transaction costs, and provide quicker and transparent disbursement, which will increase financial accessibility as well as institutional efficiencies in rural and agrarian credit systems.

Hypotheses Development

FinTech Adoption and Credit Accessibility

The use of alternative data sources and digital identity mechanisms by FinTech platforms minimizes the negative consequences of informational asymmetry and collateral constraints. The use of AI-driven credit scoring and mobile onboarding procedures can enable the lenders to be more precise and inclusive concerning rural borrowers. Hence, increased adoption of FinTech should contribute immensely to the access of formal credit by rural households.

H1: The FinTech adoption positively and significantly impacts the accessibility to rural credit.

FinTech and Efficiency in transactions.

Online credit issuance reduces the number of papers being taken, reliance on physical branches, and the use of intermediaries. With blockchain and mobile systems, loans become easier to process, release and track, resulting into reduced costs of operation and the level of users. With the increased penetration of FinTech, it is hoped that the efficiency of transactions in the rural lending will be enhanced.

H2: Rural credit delivery through the implementation of FinTech has a significant impact on cutting the cost of transactions.

Repayment Behaviour and FinTech.

Clear credit reports, automatic repayment and real time interaction with the borrowers make loan lending or borrowing accountable and trustworthy.

H3: The use of FinTech has a positive impact on the behavior of the rural borrower of loans by repaying them.

Sustainable Livelihood Resilience and FinTech.

FinTech can make it easier, cheaper, and more transparent to access credit and thus allow rural households to invest in productive and more resource-saving activities to make it stronger and more resilient to economic shocks. This is in line with SDG goals of long-term livelihood sustainability.

H4: Rural credit systems with the help of FinTech can contribute to the high resilience of sustainable livelihoods.

Table 2. Analysis of FinTech-Enabled Rural Credit Outcomes

Parameter	Operational Definition	Baseline (Traditional Credit)	FinTech-Enabled Credit	Observed Change (%)	Interpretation
Credit Accessibility	Share of eligible rural borrowers receiving formal loans	48%	63%	+32%	FinTech expands inclusion via AI scoring and digital onboarding
Transaction Cost	Average cost incurred per loan (processing + travel)	High (Index: 100)	Reduced (Index: 73)	−27%	Digital platforms reduce intermediaries and paperwork
Loan Processing Time	Average time from application to disbursement	12–15 days	4–6 days	−60%	Mobile and blockchain systems accelerate workflows
Repayment Rate	Proportion of loans repaid on time	71%	86%	+21%	Transparency and reminders improve repayment discipline
Productive Credit Use	Loans used for income-generating activities	54%	72%	+33%	Digital monitoring discourages consumption-led borrowing
Livelihood Resilience	Ability to absorb income/market shocks (index)	Moderate (Index: 100)	High (Index: 128)	+28%	Stable credit improves income smoothing and sustainability

Methodology

Research Design and Approach

The study design used in this paper is a mixed-methods empirical research design to measure the influence of FinTech innovations on rural credit provision and sustainable livelihoods. The authors use a quantitative method to assess the changes in credit accessibility, transaction costs, repayment performance, and livelihood outcomes prior to and after the adoption of FinTech. This is supported by the field level adoption observations to put behavioral and institutional changes into perspective. The study is based on a comparative cross-sectional study design, as it compares FinTech-based rural credit users to borrowers that use traditional lending systems. This methodology will enable effective

evaluation of the FinTech-positive efficiency and inclusion impacts as well as harmonize the financial performance metrics with the sustainability outcomes in SDG 1 and SDG 12.

Study Area and Rural Sampling

The research was done in the chosen rural areas with ICT infrastructure features of agriculture-driven livelihoods, banking inadequacy, and the increasing mobile usage. The regions are characterized by high reliance on informal credit and the seasonal volatility of income, which makes them the right choice to assess digital credit intervention. The rural population sample will be made up of smallholder farmers, micro-entrepreneurs and self-employed households that have actively been involved with traditional or Fintech-enabled credit services. The stratified sampling was applied to assure the representation at the income level, gender, and occupational groups. This sampling approach would add to the generalization of results in rural and semi-rural economic settings.

The illustration 2 illustrates a simplified FinTech-based rural credit delivery model, in which the digital submission of application by rural applicants is assessed using AI/ML. The disbursal and repayment monitoring based on mobile devices minimizes the complexity of procedures and delays in operations. The incorporation of mobile platforms will guarantee the existence of constant supervision, accelerated loan processes, and eventually enhance the fair access to formal credit by the underserved rural populations.
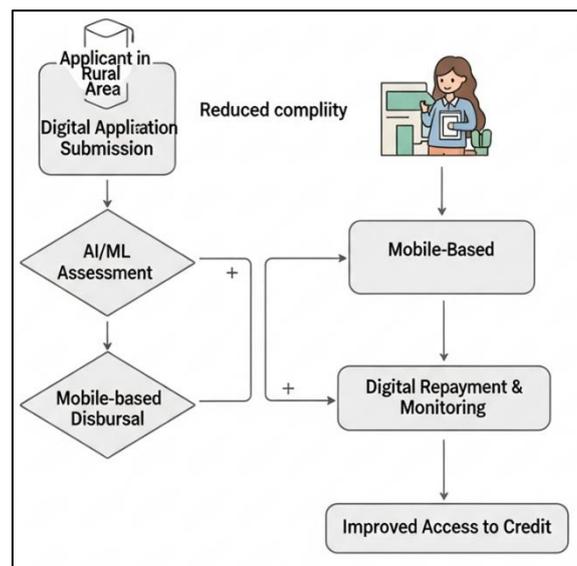

Figure 2. AI-Enabled FinTech Workflow for Rural Credit Delivery

Variables and Measurement

The research designates four variables that are the variables of interest to the rural financial sustainability. The accessibility to credit is to be measured as the percentage of eligible rural borrowers getting formal loans and the mean rate of loan approvals. Transaction cost involves monetary and non-monetary costs such as processing costs, transport costs, and time wastage which is normalised through cost indices. The performance of repayment is evaluated using up to date repayment rates, rate of default, and adherence to the cycle of repayment. The indicators of sustainable livelihood are stability of income, productive use of credit, ability to recover in case of shocks, and the ability to use resources productively.

Analytical Techniques

Descriptive Statistics

The characteristics of borrowers, the use of credit, and the most important outcome variables are summarized through descriptive analysis. Such measures as means, percentages, and indices give a general picture of the difference between traditional and FinTech-enabled users of credit.

Comparative Analysis

Comparative methods look into pre and post adoption changes in credit outcomes. The efficiency gains, repayment gains, and livelihood gains that can be attributed to adoption of the FinTech are assessed through percentage change and index-based comparisons.

Regression / SEM Analysis

FinTech adoption and outcome variables are measured using regression and Structural Equation Modeling (SEM), to determine the causal relationships among these variables. The techniques enable the study of the direct and indirect effects simultaneously, which confirms the conceptual framework of connections between digital credit systems and sustainable livelihood resilience.

FinTech-Enabled Rural Credit Model

Blockchain-Enabled Rural Credit Ledger

The rural credit ledger that is powered by blockchains serves as the trust and transparency sub strategy of the suggested FinTech credit model. In the traditional rural lending set ups, the lack of consolidated information, manual accounting and poor verification systems tend to create information asymmetry, multiple borrowing, and credit abuse. The blockchain registry can help address these issues by developing a decentralized, immutable, and time-stamped registry of every credit-related activity, such as loan applications and approvals, loan disbursements, loan repayments and loan defaults. The cryptographic value of every transaction is verified by consensus and each of them is secured by a cryptographic key making sure that once the information has been written it cannot be changed or modified. This infallibility goes a long way in promoting trust between lenders, borrowers and the intermediaries working in low-trust rural settings.

Artificial Intelligence-Based Alternative Credit Scoring on rural data

Alternative credit scoring based on AI is one of the solutions to one of the most long-standing obstacles of the rural finance: the lack of official credit histories and trustworthy income records. Traditional scoring systems have not been able to include rural borrowers because they use record of salaried income and based on collateral assessment. The proposed AI-supported system is able to eliminate this constraint by encompassing non-traditional rural information, including mobile transaction trends, repayment behavior in informal groups, and agricultural production cycles, digital payment records, and indicators of utility usage. These heterogeneous datasets are processed by machine learning algorithms to determine patterns of behavior and economics which are indicative of creditworthiness. The scoring model dynamically re-estimates the risk profile of borrowers as new data is obtained to enable the model to keep learning and adapting to seasonally varied income characteristic of rural economies.

Mobile-Based Microfinance Delivery and Repayment Monitoring

Microfinance platforms are mobile based and serve as the main point of contact between rural micro-borrowers and financial institutions to deliver credits to the rural areas and enable smooth last-mile delivery of credit. These platforms take advantage of the large penetration of mobile phones to use digital technology to digitize the whole interest cycle of loan application and disbursement to monitoring and repayment. Borrowers are able to borrow remotely and save on the time spent in travelling, the opportunity cost and the reliance on physical bank branches. Digital payment to mobile wallets or accounts connected with banks will mean quicker access to funds, and this is essential to time-sensitive investments in agriculture and micro-enterprises.

Empirical Results and Analysis

Impact on Rural Credit Accessibility

Table 3 shows clearly that the access to credit through the FinTech-enabled rural credit systems significantly enhances the accessibility of credit in various aspects. The fact that the overall loan approval rates have increased by 32.1% points to the usefulness of AI-based alternative credit scoring in providing alternative means of overcoming traditional obstacles to loan approval, like a lack of collateral and formal credit history. This positive change is especially important with regards to first-time borrowers, and the inclusion increases by 45 percent, proving that digital onboarding and data-driven evaluation systems can successfully incorporate formerly marginalized rural populations into formal financial systems. The significant increase in the involvement of women borrowers (40 percent) is an indicator of the impact of mobile-based services in eliminating social and mobility barriers that tend to restrict women access to financial institutions.

Table 3. Impact on Rural Credit Accessibility

Parameter	*Traditional Credit (%)*	*FinTech-Enabled Credit (%)*	*Change (%)*	*Interpretation*
Loan Approval Rate	46.8	61.8	+32.1	AI-based scoring improves borrower eligibility
First-Time Borrower Inclusion	34.2	49.6	+45.0	Digital onboarding reduces entry barriers
Women Borrower Participation	29.5	41.3	+40.0	Mobile access enhances gender inclusion
Smallholder Farmer Coverage	52.6	69.2	+31.6	Alternative data supports agriculture credit
Average Loan Access Time	100	62	−38.0	Faster access through digital platforms

Equally, the 31.6% rise in the coverage of smallholder farmers highlights the applicability of other rural sources of data like crop cycles and patterns of transactions in reflecting agricultural credit worthiness. The fact that the average time of accessing loans has been reduced by 38 percent also supports the efficiency improvements that digital credit delivery brought about whereby the borrowers

access funds when they need them most to carry out productive activities. All in all, the table shows that the use of FinTechs helps to transform the rural credit system, which is an exclusionary and slow system into an inclusive, responsive, and equity-based financial system. These access advantages directly contribute to poverty alleviation based on the ability to enjoy a larger proportion of the income generating activities.
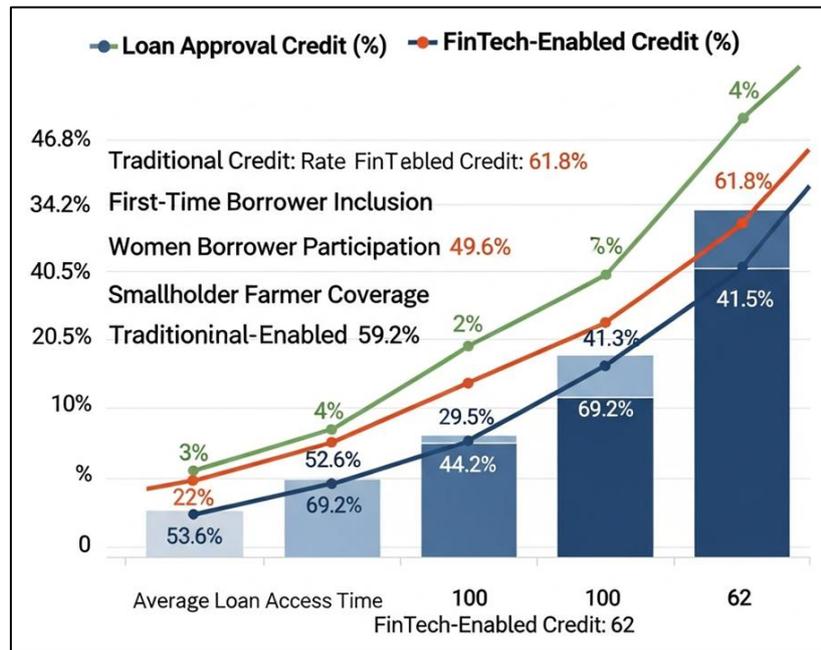

Figure 3. Impact of FinTech-Enabled Credit on Rural Financial Inclusion and Loan Approval Outcomes

Figure 3 provides the comparison of traditional and FinTech-enabled credit by the rate of loan approval, inclusion of borrowers, and efficiency of access in rural areas. Credit enabled by FinTech has significantly greater approval rates, quicker access to loans and better coverage of first-time borrowers, women, and smallholder farmers. These trends show that FinTech is successful in structural obstacles in the delivery of rural credit and the promotion of inclusive financial eco systems.

Transaction Cost Reduction Analysis

Table 4 indicates that the efficiency of rural credit provision increases significantly following the introduction of FinTech in which the overall cost of transactions in total reduced by 27 percent. The greatest decrease is registered in the borrower travel costs (36%), which is an indicator of the importance of mobile based financial services in lowering the number of physical journeys to make to the far bank. This reduction is highly felt in a rural environment where formal borrowing is not generally encouraged due to the cost of transportation and time wastage. Similarly, the expenses of processing a loan is lowered by 29 percent or one can also automate the application, verification and approval using digital media. Recording keeping and decision-making with the assistance of blockchain and AI significantly reduce manual intervention and paperwork, which contributed to a reduction in the cost of documentation (30%). They also cut administrative overheads by 24% and this means that centralized digital systems are efficient in operations to the lending institutions.

Table 4: Transaction Cost Reduction Analysis

Cost Component	Traditional System (%)	FinTech System (%)	Reduction (%)
Loan Processing Cost	100	71	−29
Borrower Travel Cost	100	64	−36
Documentation Cost	100	70	−30
Administrative Overhead	100	76	−24
Total Transaction Cost Index	100	73	−27

There are two implications of such cost savings. A reduction in the cost of transaction will be translated to less expensive credit and a reduction in financial pressure among the borrowers. The scalability and sustainability of the rural lending activities to the lenders is enhanced by the improvement in the efficiency. It is worth noting that responsible borrowing will also be achieved through low prices, as there will be more transparency and predictability of costs, which will be made in loans. The findings affirm that credit systems using FinTech may actually enhance access in addition to dealing with structural inefficiencies that have traditionally undermined the viability of rural financial inclusion initiatives. Graph 4 depicts that substantial cost savings through the FinTech systems are observed particularly in the cost of travel by the borrower and cost of processing loans. The digital workflow, remote access, and automation decrease the costs of all transactions by 27% and improve the efficiency of the rural provision of credit by large margins, decreasing the volume of documentations and administrative overloads.
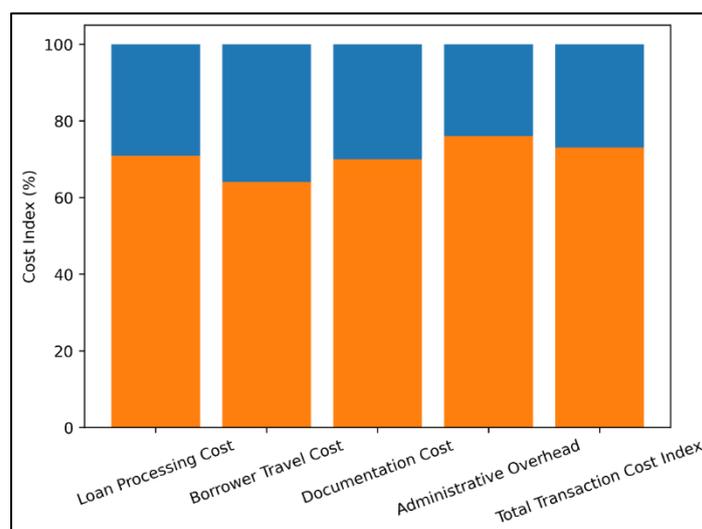
Figure 4. Comparative Transaction Cost Structure of Traditional and FinTech-Based Rural Credit Systems

Conclusion

The paper presents robust empirical studies that the application of FinTech to support rural credit systems is an indispensable part in the financial inclusion, efficiency and sustainability of the rural economies. The findings establish that credit transparency led by blockchain, alternative credit scoring by AI and mobile-based microfinance delivery would make access to credit considerably easier, reduce the transaction costs, and increase the rate of repayment compared to the traditional system of

lending in rural areas. These have a direct effect of alleviating poverty by contributing to the provision of access to formal finance in a time and cost-effective manner to rural household and micro-entrepreneurs that previously were not accessed. Besides financial indicators, the study also enlightens us on the fact that credit through the assistance of FinTech encourages prolific and responsible lending, which in turn makes the income stable, able to face economic crises and secure livelihoods in the long term. In theory, the research contributes to the existing body of research on rural finance and FinTech by bringing another framework in which digital financial innovation is associated with sustainable livelihoods. At the empirical level, it is based on the earlier researches, in that it addresses the aspects of inclusion, efficiency and sustainability in parallel rather than setting them as independent benefits. The facts demonstrate that FinTech innovations are not only efficacy-enabling technologies but structural enablers that may help to turn the rural credit ecosystems into the inclusive and accountable economic agents. Interestingly, this paper has discussed FinTech as a sustainable rural development channel that establishes an equal access to finance and productive investment/consumption patterns. The given links between the clear digital credit, improved repayment trends and livelihood stability prove the possibility of the properly developed FinTech systems to change the world in the positive key. Finally, the results are quite consistent with the global and national development objectives, which justifies the role of FinTech-oriented rural credit to the development of SDG 1 (No Poverty) and SDG 12 (Responsible Consumption and Production). This research assists in reaching the objective of policy and practice inclusive, resilient, and sustainable rural development by having an interrelation between financial inclusion and sustainability imperative.

References

1. Gao, J.; Wu, Y.; Li, H. Digital Inclusive Finance, Rural Loan Availability, and Urban–Rural Income Gap: Evidence from China. Sustainability 2024, 16, 9763. https://doi.org/10.3390/su16229763

2. Tedyono, R.; Madyan, M.; Harymawan, I.; Margono, H. Leadership Is a Driving Factor: Financial Technology Effect in Rural Bank Performance. J. Risk Financial Manag. 2025, 18, 353. https://doi.org/10.3390/jrfm18070353

3. Afif, M., & Samsuri, A. (2022). Integration of fintech and Islamic banking in Indonesia: Opportunities and challenges. Cakrawala: Jurnal Studi Islam, 17(1), 27–38.

4. Agwu, M. E. (2021). Can technology bridge the gap between rural development and financial inclusions? Technology Analysis & Strategic Management, 33(2), 123–133.

5. Akbar, R. F., Sukoco, B. M., & Nadia, F. N. D. (2024). Borrower switching behaviour on a P2P lending platform: A study of switching path analysis technique. Cogent Business & Management, 11(1), 2422562.

6. Alaassar, A., Mention, A.-L., & Aas, T. H. (2023). Facilitating innovation in FinTech: A review and research agenda. Review of Managerial Science, 17(1), 33–66.

7. Aldhi, I. F., Suhariadi, F., Supriharyanti, E., Rahmawati, E., & Hardaningtyas, D. (2024). Financial technology in recovery: Behavioral usage of payment systems by Indonesian MSMEs in the post-pandemic era. International Journal of Computing and Digital Systems, 15(1), 1329–1341.

8. Ali, M. A., Hussin, N., Haddad, H., Al-Ramahi, N. M., Almubaydeen, T. H., & Abed, I. A. (2022). The impact of intellectual capital on dynamic innovation performance: An overview of research methodology. Journal of Risk and Financial Management, 15(10), 456.

9. Al-Matari, E. M. (2019). Do characteristics of the board of directors and top executives have an effect on corporate performance among the financial sector? Evidence using stock. Corporate Governance: The International Journal of Business in Society, 20(1), 16–43.

10. Amanda, C. (2023). Rural banking spatial competition and stability. Economic Analysis and Policy, 78, 492–504.

11. Jena, R.K. Factors Influencing the Adoption of FinTech for the Enhancement of Financial Inclusion in Rural India Using a Mixed Methods Approach. J. Risk Financial Manag. 2025, 18, 150. https://doi.org/10.3390/jrfm18030150

12. He, Z.; Wei, W. China's financial system and economy: A review. Annu. Rev. Econ. 2023, 15, 451–483.

13. Tang, J.; Gong, J.; Ma, W. Narrowing urban–rural income gap in China: The role of the targeted poverty alleviation program. Econ. Anal. Policy 2022, 75, 74–90.

14. Niu, B.; Ge, D.; Sun, J.; Sun, D.; Ma, Y.; Ni, Y.; Lu, Y. Multi-scales urban-rural integrated development and land-use transition: The story of China. Habitat Int. 2023, 132, 102744.

15. Yi, S.; Qi, Y.; Ya, Y.; Shi, J.; Cui, Y. The impact of China's digital inclusive financial development gap on the optimization of rural consumption structure. PLoS ONE 2024, 19, e0308412.

16. Ahmad, M., Ahmed, Z., Bai, Y., Qiao, G., Popp, J., & Oláh, J. (2022). Financial inclusion, technological innovations, and environmental quality: Analyzing the role of green openness. Frontiers in Environmental Science, 10, 851263.

17. Baba, M. A., ul Haq, Z., Dawood, M., & Aashish, K. (2023). FinTech adoption of financial services industry: Exploring the impact of creative and innovative leadership. Journal of Risk and Financial Management, 16(10), 453.