Journal of Economics, Management & Business Administration (JEMBA)
ISSN Print: 2957-4218
ISSN Online: 2957-4226
Volume 4, Number 1, 2025, Pages 01 – 21
Journal Home Page
https://journals.airsd.org/index.php/jemba/index

Blockchain Resolutions for Credit Risk Management in Social Enterprise: Towards Sustainable Poverty Eradication in SAARC

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ARTICLE INFO

Article History:

Received:	*December*	*20, 2024*
Revised:	*January*	*21, 2025*
Accepted:	*January*	*22, 2025*
Available Online:	*January*	*23, 2025*

Keywords:

Poverty Eradication; Social Microfinance; Credit Risk; Blockchain; SAARC

ABSTRACT

Micro-credit is an indispensable tool for supporting low-income households financially and reducing rural poverty. However, the extraordinary services the microloan intends to fund expose it to significant credit risk. This study aims to develop a blockchain alliance system for anti-poverty social microfinance based on the characteristics of blockchain technology and the microfinance's specific credit risk. This system contains the mechanism of government and financial institutions for poverty alleviation, and it improves the management of the credit risk of social microfinance for poverty alleviation by determining the positioning and clearing regulations of the system's operation. This study undergoes rigorous pilot testing with a preliminary sample of 650 respondents representing diverse demographics and operational contexts within the social enterprise ecosystem to analyze the current development of social microfinance and how blockchain technology designs the unique advantages of social microfinance. It also has applications in the field of finance, and it applies the theory of asymmetric information and adverse selection to analyze the unique credit risk faced by social microfinance institutions for poverty alleviation in SAARC. The study results indicate that the blockchain system efficiently manages social microfinance credit risk for anti-poverty organizations. The blockchain system can effectively reduce the cost of credit risk management of social microfinance for poverty alleviation, increase credit accessibility for the impoverished, reduce the degree of information asymmetry between the two parties, and reduce the likelihood of adverse selection.

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Introduction

Poverty Eradication is the foundation for building a well-off society in an all-around way, eliminating absolute poverty and realizing common prosperity for low-income people in SAARC. The South Asian Association for Regional Cooperation (SAARC) is a regional intergovernmental organization comprising eight member countries from South Asia: (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) to promote economic and regional integration and foster cooperation among its member states. In SAARC, Social microfinance has been used for poverty alleviation since it was introduced into the country in the 1970s. Social microfinance is a small-scale financial service that serves low-income groups in urban and rural areas. Employment and development opportunities undertake the rural poverty alleviation task and are also a financial innovation tool. However, research on social microfinance credit risk often focuses on single aspects, such as the establishment of the credit rating system or the policy environment. Still, poverty alleviation has always been the policy of the SAARC, and it is difficult to achieve it only through a single institution. Aiming at the credit risks existing in the operation of social microfinance for poverty alleviation, the paper first discusses theoretical analysis and then leads to blockchain technology. The unique characteristics of decentralization and distrust of the blockchain have unique advantages in managing and preventing credit risks to achieve the purpose of credit risk prevention. (Kumarathunga, RN Calheiros, & A Ginige, 2022), Pointed out that the commercialization, scale expansion, and self-exclusion of people with low incomes are the essential reasons for the deviation of the mission of social microfinance institutions. It has been proposed to improve the governance structure, reduce transaction costs to manage the problem of mission deviation, and achieve its social goal of poverty alleviation. (Schlecht, Schneider, & Buchwald, 2021)Believes that through model research and analysis, the age of the head of household, total asset value, labor force population, migrant population, social evaluation, and social credit records all affect the acquisition of Social microfinance, and proposed to expand the scope of transactions, improving the credit environment, raising farmers' credit awareness and other measures to promote the development of Social microfinance. (Prashar, Jha, & Lee, 2020) In addition to credit loan services, savings, and insurance services should also be provided, and flexible loans rather than rigid loans should be provided for people experiencing poverty according to conditions. (Smith & Besharov, M.L, 2019) Provided a detailed explanation of social microfinance from the three aspects of nature, function, and supervision, pointing out that social microfinance can improve the income of poor farmers and that the formal financial Institutions and non-governmental organizations should adopt different regulatory measures for social microfinance institutions and the blockchain technology can be applied to rights management. (Roeck, Sternberg, H, & Hofmann, E, 2019) It pointed out that the blockchain can be used in digital content patent protection and proposed a digital content distribution system based on the multi-center characteristics of the blockchain. (Siebold, Günzel-Jensen, F, & Müller, S, 2019) It pointed out that the traits of blockchains, such as decentralization, collective maintenance, and programmability, are very suitable for constructing programmable currency systems and financial systems, and it proposed the basis of blockchain systems. The framework provides a detailed introduction to the blockchain system's basic principles and application status. This paper uses the theoretical analysis method to analyze the theoretical nature of social microfinance poverty alleviation and provides theoretical support for social microfinance poverty alleviation. Second, analyze the various characteristics of blockchain technology and its theoretical applicability in the financial field, point out that blockchain technology can be applied to many aspects of finance, and theoretically expand the application prospects and application fields of blockchain and systematically analyze the current situation of Social microfinance for poverty alleviation, and summarizes the problems encountered in poverty alleviation with Social microfinance, put forward policy recommendations to promote the strong development of Social microfinance for poverty alleviation. Third, it is proposed to build a social microfinance system for poverty eradication based on blockchain technology to manage the credit risks faced by social microfinance poverty alleviation and provide new ideas for the SAARC countries' economic development. Fourth, the blockchain is at the forefront of the current Internet technology. The successful application of blockchain technology in social microfinance and the successful combination of theory and reality will significantly improve the practical significance of blockchain technology and, at the same time, promote its development in further fields.

Review of Literature

Social Microfinance for Poverty Eradication

Social microfinance for poverty eradication originated with an initiative in SAARC. Mainly to provide small initial capital for poor people and inferior women to help them eliminate poverty. Social microfinance was introduced in Bangladesh in the 1970s. However, it has developed in all countries of SAARC for more than 50 years. The essence of social microfinance is a form of credit. Still, in the early days, because the government used social microfinance for poverty alleviation, it was regarded as an essential tool by the governments of developing countries and many development aid agencies. An effective way to alleviate poverty. (Schoorman, Mayer, R.C, & Davis, J, 2007) Established a model to study the risk of social microfinance and found that the model cannot replace the identification and prediction of risk by credit personnel, but the model has a predictive function to a certain extent so that it can combine the two reduce the risk of social microfinance, especially credit risk. (Ali, Klasa, S, & Yeung, E, 2009) Pointed out that non-government-led social microfinance tends to be more commercialized, and its loan interest rate must cover its operating costs, which is necessary for credit institutions to achieve sustainable development. However, Social microfinance has encountered many problems in the operation process, among which the issue of credit risk is more prominent, and many scholars have also carried out research and exploration on this. (Natarajan, Mahmood, I. P, & Mitchell, W, 2019) Analyzed the performance of farmers' social microfinance through quantitative analysis methods and concluded that the performance of non-agricultural loans is better. (Barboza & Trejos, S, 2009) Pointed out that there are two major problems in the poverty alleviation for discount loans: difficulty in targeting target customers and low repayment rate. In addition to credit risks, social microfinance in SAARC has also encountered the problem of mission deviation in poverty alleviation. (Berg, M, Lensink, & Servin, R, 2015) Pointed out that information asymmetry of farmers, out-of-control industrial development, moral hazard, and loan relief will cause social microfinance risks in poverty-stricken areas, and proposed innovative guarantee systems, loan docking industries, and other countermeasures. (Khandker, 2005) pointed out that the imperfect system is the main reason for the frequent credit risks of social microfinance for poverty alleviation, which seriously hinders Sustainable Development.

Credit Risk Management in Social Microfinance

(Quayes, 2015) The farmer social microfinance credit risk evaluation model based on the fuzzy comprehensive evaluation method is scientific and applicable through sample data inspection. (Roy & Pati, A.P, 2019) Showed that rural social microfinance insurance can be used as collateral for farmers' credit to reduce the risk of social microfinance institutions, improve the financial sustainability of social microfinance institutions for poverty alleviation, and reduce the occurrence of credit risks. (Patten & Johnston, D.E, 2001) Pointed out that most banks have not established a credit risk evaluation system for small loans to rural households and proposed a credit evaluation index system based on the combination of partial correlation analysis and comprehensive discrimination ability to manage credit risk. (Chrisman & Patel, P. C, 2012) pointed out that compared with Western countries, banks in SAARC country's credit risk management have deficiencies in the determination of the monitoring scope, the establishment of early warning models, and systemic risk monitoring. (Castellas, Findlay, S, & Ormiston, J, 2018) Affirmed the role of Social microfinance in poverty mitigation and facilitation of the financing difficulties of low-income people, and also pointed out that it is facing increasingly serious credit risk problems, and built a credit risk early warning mechanism for Social microfinance companies to help Social microfinance companies manage and control credit risks.

Overview of blockchain technology

Digital currencies such as Bitcoin, Ripple, and Litecoin are currently blockchain technology's most widely used and successful results. Blockchain has been essentially utilized for Fairness, transparency and anonymous protection, de-trust, reliability, Programmable smart contracts, Timestamps, etc. (Kamble, Gunasekaran, A, & Sharma, R, 2020). Believe that blockchain should be a distributed shared Accounting technology that is embodied in the joint participation of multiple parties and guarantees a time-ordered and immutable ledger based on cryptography. Specific verification mechanisms, smart contracts, and other protocols make it possible for blockchain to be applied to actual transactions, and it has the characteristics of decentralization, trustfulness, collective maintenance, and reliability as a whole. (Taylor, 2011) pointed out that commercial banks' use of blockchain is mostly under conception and testing, and they are facing problems such as the constraints of the current system, the high cost of technology integration in the bank's existing system, and technical limitations. (Mukkamala, Vatrapu, R,, Ray, P.K, , Sengupta, G,, & Halder, S, 2018) It pointed out that the characteristics of blockchain, such as decentralization, collective maintenance, and programmability, are very suitable for constructing programmable currency systems and financial systems, and it proposed the basis of blockchain systems. (Yeoh, 2017) Believes that if the characteristics of blockchain decentralization, chain structure, shared account books, smart contracts, and topology are applied to the financial field, it can simplify the transaction process, improve business processing capacity, reduce capital occupation, and save system and labor costs. (Yang, Lee, T.R, & Chang, T, 2019) The application of blockchain technology will change the commercial bank credit investigation model and significantly shift the credit risk management model. (Sharples, 2002) pointed out that the application of blockchain to international payment has unlimited payment amounts, can achieve second-level arrival, and only requires minimal handling fees. The advantages are undeniable compared with the existing wire transfer and Western Union mode. (Moore, 1999) pointed out that the characteristics of blockchain technology have brought great development opportunities for the innovation of financial services, which will subvert the construction of the economic system and the level of financial risk prevention and control. (Sullivan & Burger, E, 2017) pointed out that the essence of blockchain technology is an integrated innovation, and there is an impossible triangle: it cannot satisfy high efficiency, low energy, decentralization, and security at the same time. (Zeller, 2001) pointed out that In SAARC countries, research on blockchain started late, and there are problems such as uncertain technical advantages and imperfect theoretical systems that will face many difficulties in future development.

The connection between Blockchain and social Microfinance

The blockchain has been developed for many years, and its unique advantages, such as decentralization, trustfulness, and smart contracts, have attracted more and more attention. Many industries have invested in the in-depth development of blockchain exploration research. (Florin & Schmidt, E, 2011) Believes blockchain technology may evolve into a new computing paradigm that can reshape human economic and social development, especially in the financial field. It is a winning financial development ecosystem. The social and financial industry is also aware of the enormous value space of blockchain. It changed its early attitude of resistance and prevention and began to actively study the application of blockchain in the social financial field. Social microfinance and blockchain technology are constantly being integrated.

Hastig & Sodhi (2020) believes that how blockchain technology, which has enormous application potential, plays its due value in the financial field is an essential task that the global social microfinance community needs and is currently exploring in depth together. Judging from the current theoretical research, blockchain is mainly used in digital currency, payment settlement, securities trading, and other aspects. Currency issuance and circulation control are the essential content of national governance in various countries, and the unique mining and dissemination methods of digital currency will affect the transmission mechanism and effect of current monetary policy, weaken the central bank's ability to regulate the economy and cause the financial authorities to control the digital currency. (Lustig & Nardi, B, 2015.) Currency development remains cautious. However, compared with the current banknote operating system, digital currency has prominent advantages in terms of efficiency, safety, environmental protection, etc.

Methodology and Credit Risk Analysis

Data collection

Quantitative data is gathered through a structured questionnaire to capture critical elements such as the extent of blockchain adoption, strategies for mitigating credit risks, and the socio-economic outcomes resulting from blockchain integration in social enterprises. The questionnaire addresses the study's general and specific objectives, ensuring that the data collected aligns with the research goals. Questions are crafted to measure multiple dimensions, including blockchain implementation's technological, financial, and operational aspects. The questionnaire consists of closed-ended questions to facilitate straightforward responses and Likert scale-based questions to assess participants' attitudes, perceptions, and experiences on a continuum. This design allows for precise reaction quantification and enhances statistical analyses' robustness. To ensure the instrument's effectiveness, it undergoes rigorous pilot testing with a preliminary sample of 650 respondents representing diverse demographics and operational contexts within the social enterprise ecosystem. This process helps identify ambiguities, refine wording, and validate constructs, ensuring the questionnaire's clarity, reliability, and appropriateness for the larger sample. Feedback from pilot testing is systematically analyzed, and necessary modifications are made to optimize the questionnaire's effectiveness.

Once finalized, the questionnaire is administered using a mixed-mode approach, combining online distribution and face-to-face interactions. Online distribution enables broader geographic reach, while in-person administration ensures engagement with participants who may face technological barriers. This dual approach not only broadens participation but also enhances inclusivity, capturing data from a broad spectrum of social enterprises operating in varied socio-economic and technological environments across the SAARC region.

Research Design

Adopting a quantitative research approach enables the systematic exploration of the relationships between key variables in a structured manner. This approach is particularly suited to addressing the empirical assessment of hypothesis-driven inquiries, as it facilitates identifying and quantifying causal relationships among complex constructs. In the context of this study, the quantitative methodology provides a robust framework for analyzing how blockchain technology impacts credit risk management and contributes to poverty alleviation within social enterprises. The focus on numerical data allows for a detailed examination of cause-and-effect dynamics, providing insights into the interplay of technological adoption, credit risk mitigation strategies, and socio-economic outcomes.

Blockchain technology is the foundational tool for the data analysis phase. Blockchain technology is selected for its transformative potential in enhancing transparency, operational efficiency, and financial management, as well as its ability to address intricate models involving multiple constructs, interactions, and relationships. This makes it an ideal tool for both the exploratory and confirmatory phases of the research, enabling a comprehensive evaluation of theoretical constructs. By leveraging blockchain systems' immutable, decentralized, and secure nature, the study seeks to uncover how these attributes influence latent variables such as technological readiness, financial feasibility, and operational efficiency in credit risk management.

The integration of these methodological elements allows the study to deliver a nuanced empirical understanding of how credit risk management, as mediated by social enterprises, drives sustainable poverty eradication across the SAARC region. Social enterprises, operating as conduits for innovation and resource distribution, are critically examined through the lens of blockchain's potential to enhance their efficiency and impact. This investigation sheds light on the theoretical underpinnings of blockchain adoption and bridges the gap between academic discourse and practical implementation in social microfinance. The application of blockchain technology facilitates a rigorous examination of the proposed theoretical constructs, providing a robust empirical foundation.

Table 1: SAARC - Demographics representation of Blockchain Credit Risk

Country	Age	Gender	Education Level	Employment Status	Income Level	Loan (USD)	Loan Term months	Blockchain Adoption	Credit Risk Score (0-100)	Credit Risk Management Strategy	Repayment Rate (%)	Socio-Economic Outcome (%)	Region	Previous Loan History	Savings (USD)	Family Size	Digital Literacy (0-10)
Afghanista	25	Male	Bachelor's Degree	Self-employe	Low	500	12	Early-stage adoption	65	Strategy1	80	15	Central	Previous l 2	450	5	8
Banglades	34	Female	Bachelor's Degree	Employed	Medium	1000	24	Advanced ad	55	Strategy2	90	20	South A	Previous l 2	1000	4	9
Bhutan	29	Male	Master's De	Employed	Low	300	6	Advanced ad	70	Strategy1	70	5	South A	Previous l 1	550	3	7
India	41	Female	Master's De	Self-employe	High	1500	36	Early-stage adoption	80	Strategy3	95	30	South A	Previous l 3	2500	6	6
Maldives	22	Male	Bachelor's Degree	Self-employe	Low	200	12	No Adoption	60	Strategy1	60	2	Indian O	Previous l 2	600	2	6
Nepal	35	Female	Bachelor's Degree	Employed	Medium	1200	18	Intermediate adoption	50	Strategy2	85	18	South A	Previous l 1	650	4	8
Pakistan	30	Male	Master's De	Employed	High	2500	48	Advanced ad	40	Strategy1	100	25	South A	Previous l 5	1000	7	9
Sri Lanka	38	Female	Bachelor's Degree	Self-employe	Low	800	12	Early-stage adoption	75	Strategy3	75	10	South A	Previous l 1	850	5	7

The dataset in Table 1, which was collected for this research, focuses on analyzing credit risk management in social enterprises across the SAARC region, specifically emphasizing the integration of blockchain technology. The dataset encompasses diverse variables, including demographic information (age, gender, education), financial characteristics (loan amount, savings, repayment rates), and technology adoption metrics (blockchain maturity and digital literacy). These variables provide a robust foundation for understanding the intricate dynamics of credit risk management within the context of poverty alleviation initiatives facilitated by social microfinance institutions.

Key variables such as credit risk scores and repayment rates offer quantitative insights into borrower reliability and the effectiveness of existing financial systems. Including blockchain adoption levels enables a nuanced analysis of how decentralized technologies mitigate risks, enhance transparency, and improve operational efficiency. Moreover, regional and socio-economic variations across SAARC countries—from Afghanistan to Sri Lanka—allow for cross-comparative analyses, highlighting localized challenges and opportunities. This comprehensive dataset is a critical tool for addressing the interplay between technology, financial inclusion, and socio-economic development, forming the basis for actionable insights into sustainable poverty eradication efforts.

Characteristics of Credit Risk

Credit risk, defined as the probability of a borrower failing to fulfill their financial obligations, is a critical challenge in social enterprises and microfinance institutions (MFIs) operating within the SAARC region. This risk is particularly acute in poverty alleviation initiatives, where borrowers often lack formal credit histories, stable incomes, or collateral. For MFIs, credit risk directly impacts financial sustainability, operational efficiency, and the capacity to extend services to underserved populations. Economic instability, information asymmetry, and institutional deficiencies further exacerbate this risk, creating barriers to equitable financial resource allocation. A comprehensive credit risk analysis is essential to identify vulnerabilities, reduce defaults, and enable data-driven decision-making, ensuring that microfinance achieves its dual goals of financial inclusion and poverty eradication.

Integrating advanced technologies such as blockchain into credit risk management offers transformative solutions by addressing traditional system limitations. Blockchain's decentralized and immutable nature enhances transparency, reduces information asymmetry, and fosters trust between lenders and borrowers. Smart contracts enable cost-effective monitoring and automated enforcement of loan terms, significantly lowering operational risks. By providing real-time, reliable credit scoring, blockchain facilitates targeted lending to marginalized groups while mitigating adverse selection and moral hazard. These innovations improve the financial stability of MFIs and enhance socio-economic outcomes for borrowers, aligning credit risk management with the broader goals of sustainable development in the SAARC region.

The Adverse Selection Problem in Social microfinance for poverty alleviation

Adverse selection refers to distorted market resource allocation caused by information asymmetry. In Social microfinance for poverty alleviation, loan funds caused by information asymmetry between social microfinance institutions and poor households cannot effectively reach the neediest poor households. To explain with a simple example, if a poor household has N projects to choose from, the capital investment required for each project is M, the probability of success is P, the income of project success is C, and the income of project failure is C. then it is 0; assuming that the expected income of all projects is R, then there is $P \times C = R$, when the income R is constant, the project success rate P is inversely proportional to the income C when the project is successful, that is, the lower the income of the project The higher the success rate, the lower the probability of success for projects with higher returns. That is to say, those rural households who choose projects with high success rates but low income are unwilling to bear higher interest rates from financial institutions, so they give up loans. In comparison, those households choosing high-income but high risks are willing to bear higher interest rates and actively apply for a loan. Let go of the condition that the expected return R must be fixed, assuming that the micro-loan interest rate is r, then the expected return E of the borrower is:

$$E=P\times C-M(1+r) \quad (1)$$

(1) When E>0, the borrower is willing to borrow money for investment.
From $P\times C = R$, we can get

$$r< \frac{R-M}{M} \quad (2)$$

From the formula (2), it can be seen that when the project income R of the farmer is higher, that is, the net profit rate of the project is higher, the acceptable interest rate level r is also higher; when the project net profit rate is low, the farmer can accept. The accepted rate r is lower. At present, SAARC's social microfinance for poverty alleviation is in the process of exploring commercial operations, and the operation is market-oriented. Its ultimate goal is to achieve its financial sustainability and maximize benefits. When the interest rate acceptance ability of this part of poor households with low income is low, these poor households will give up loans and look for other methods. Finally, financial institutions will lose this part of high-quality customers and turn to lending to those willing to accept high interest rates. High-risk customers this is the adverse selection in the social microfinance for poverty alleviation market. However, customers with high risks also have a high default rate. After many games, financial institutions will find that they have deviated from their own business goals and may eventually choose to withdraw from this part of the market. The adverse selection problem faced by social microfinance for poverty alleviation makes it impossible for both sides of poverty alleviation to obtain Pareto optimal results. Financial institutions select borrowers with more serious risks or more affluent borrowers. Still, the poorest farmers do not get loan services, which will eventually lead to the emergence of risks in the social microfinance for the poverty alleviation market or the deviation of the poverty alleviation mission of poverty alleviation organizations. Compared with ordinary borrowers, poor households have their particularities. First, poverty is regional, located in remote areas, or unsuitable for agricultural production. Therefore, it is challenging for poor households to find suitable projects. Thus, the search for the cost of suitable projects cannot be ignored; in addition, the circulation cost of products produced by poor farmers will also be considered by farmers. Therefore, combined with various considerations, many poor households would instead obtain income through working outside and willing to borrow money for agricultural production, which will seriously affect the long-term development of social microfinance for poverty alleviation.

Moral Hazard in Social Microfinance

Moral hazard refers to the selfish behavior of people engaged in economic activities, taking actions that are not conducive to others maximizing their own utility, or the contracting party violating the agreement to maximize its utility. The specific manifestation is non-repayment. Every year in SAARC region, the loan repayment rate of many social microfinance institutions is lower than the international warning line. The moral hazard in the operation of social microfinance for poverty alleviation is that after social microfinance institutions grant loans to poor households, the poor households violate the contract and use the loans for other activities. Assuming that there is no penalty for breach of contract, the probability of a borrower getting a loan is P1, the loan amount is M, the rate of return of the project is I, and the loan interest rate is r. The probability of the borrower defaulting on repayment is P2, and then the game result is shown in Table 2.

Table 2: Game Model of Credit Institutions and Borrowers

		The Borrower	
		Repayment $(1-P_2)$	Non-repayment (P_2)
Credit Institution	Loan (P_1)	$(Mr, M(i-r))$	$(-M(1+r), M(1+i)$
	No Loan (1–	$(-Mr, -M(i-r))$	$(-Mr, -M(i-r))$

It can be seen from Table 2 that under the condition that the default is not punished, the borrowers will choose to default. At this time, the income they choose not to repay the loan is at least not lower than that of repaying the loan. Next, add the default penalty F, and the game results are shown in Table 3.

Table 3: Game Model of Credit Institutions and Borrowers

		The Borrower	
		Repayment $(1-P_2)$	Non-repayment (P_2)
Credit Institu	Loan (P_1)	$(Mr, M(i-r))$	$(-M(1+r), M(1+i)-\boldsymbol{F}$
	No Loan (1–	$(-Mr, -M(i-r))$	$(-Mr, -M(i-r))$

(3) $U = P_1(P_2(M(1+i)-F)+(1-P_2)M(1+i))+(1-P_1)(-P_2M(i-r)-(1-P_2)M(i-r)$

To maximize utility, take the derivative with respect to P and order $\partial \mathbf{Y} / \partial \boldsymbol{P} = \boldsymbol{0}$

(4) $P_2(M(1+i)-F)+(1-P_2)M(1+i)-(-P_2M(i-r)-(1-P_2)M(i-r))=0$

$$P_2 = M(2i+1-r)/\boldsymbol{F}$$

It can be seen from formulas (3 & 4) that when the loan yield i, interest rate r, and loan amount M are fixed, the default rate P2 of the borrower is negatively correlated with the default penalty F. When the default penalty is greater, the default rate the lower the value, the lower the default penalty, and the higher the default rate. Therefore, to maintain the regular operation of social microfinance institutions and reduce the occurrence of moral hazards, they must formulate corresponding punishment mechanisms. From the above game results, it can be seen that when the interest rate and other costs are too high, poor households will not choose loans, but if the interest rate is too low, lending institutions cannot maintain their development. The reason for facing adverse selection in the market-oriented operation of social microfinance for poverty alleviation is that the high interest rate of social microfinance will automatically exclude projects with low risk and low return. As a result, many poor households give up loans, or low-income families who do not plan to repay get loans, thereby disrupting the social microfinance for poverty alleviation market. The reason is that the risk of social microfinance for poverty alleviation institutions is too high. Therefore, while interest rates are reasonably set, other institutions, such as insurance institutions, can be introduced to share the risks. The reason for moral hazard is that the penalty for breach of contract is insufficient. Therefore, it is necessary to formulate a reasonable repayment incentive mechanism and sufficient penalty for breach of contract to prevent the occurrence of moral hazard.

Analysis and Discussion of Block-chain Application

Social Microfinance for poverty alleviation and block-chain System

An analysis of the causes of credit risk found that during the operation of social microfinance for poverty alleviation, poor farmers face high costs when they want to obtain loans. The first thing they face is the cost of interest rates. Poor households are willing to lend, but it is difficult for rural families in poor areas to find suitable projects, so many poor households are unwilling to lend. Poverty alleviation is a macro policy of the country, and it is difficult for a single organization to complete it. This paper builds a poverty alleviation block-chain system.

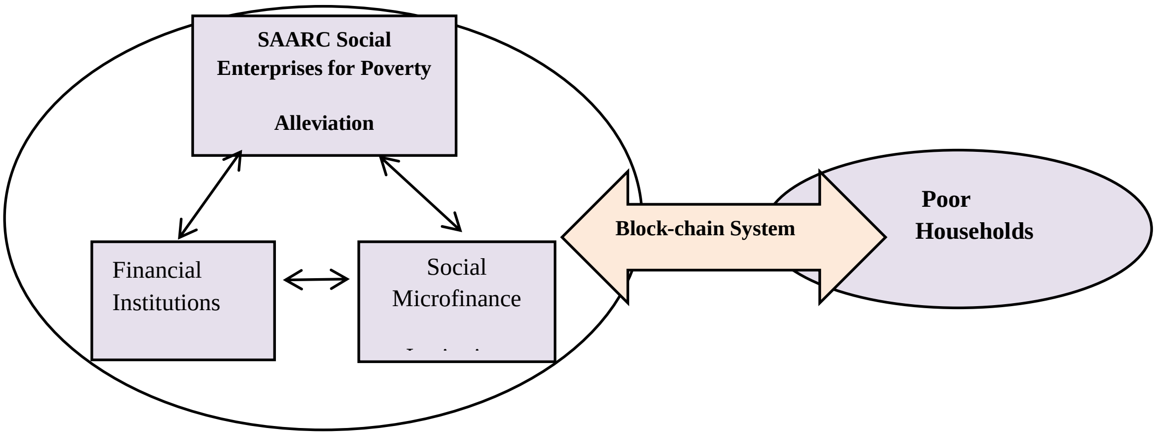


Figure 1: Block-chain participants

The participants are mainly government poverty alleviation agencies, financial institutions, insurance institutions, and poor households, as shown in Figure 1. Due to the high natural risk of agricultural production, the blockchain system in this paper also includes insurance institutions, mainly because of the role of agricultural insurance in protecting agricultural natural risks.

The Summary Statistics shown in Table 4 provide an overview of the central tendencies and variability in responses for each Likert-scale question related to blockchain adoption and its impact on credit risk mitigation, socio-economic outcomes, and operational factors. The mean (μ) represents the average response, indicating the general trend in the dataset, while the median (M) highlights the central value, offering robustness against outliers. For instance, the highest mean score of 4.20 for Credit Risk Mitigation Strategy Effectiveness reflects the respondents' strong consensus on its importance in managing credit risks, further supported by its low standard deviation (0.88), suggesting minimal response variability.

Table 4: Likert-scale Summary

Objects	Mean (μ)	Median (M)	Standard Devi (σ)
Blockchain Adoption L	3.55	4	1.12
Credit Risk Mitigatio Strategy	4.2	4	0.88
Socio-economic Outco	3.75	4	1.15
Technological Readine	4.1	4	1.02
Financial Feasibility	3.9	4	1.05
Operational Efficienc	3.7	4	1.28

In contrast, Operational Efficiency has a lower mean (3.70) and a higher standard deviation (1.28), pointing to a more diverse range of opinions, likely due to varying operational contexts across respondents. These statistics underscore the interconnectedness of technological, financial, and operational dimensions within the social enterprise ecosystem. The consistently high median values (M = 4) across all questions reveal a skew towards positive perceptions, indicating broad recognition of the potential benefits of blockchain integration. However, the variation in standard deviations highlights areas where respondents differ in their experiences, such as Socio-economic Outcome Improvement (σ = 1.15) and Operational Efficiency, suggesting that the benefits of blockchain adoption may not be evenly distributed across enterprises. These findings provide critical insights for policymakers and stakeholders, emphasizing the need for tailored strategies to address specific challenges and maximize the equitable impact of blockchain technologies within the SAARC region's social enterprises.

Table 5: Correlation Matrix

Content	Blockchain Adoption Level	Credit Risk Mitigation Strategy	Socio-economic Outcome	Technological Readiness	Financial Feasibility	Operational Efficiency
Blockchain Adoption Level	1	0.75	0.65	0.8	0.7	0.77
Credit Risk Mitigation Strategy	0.75	1	0.78	0.83	0.74	0.76
Socio-economic Outcome	0.65	0.78	1	0.79	0.72	0.71
Technological Readiness	0.8	0.83	0.79	1	0.77	0.82
Financial Feasibility	0.7	0.74	0.72	0.77	1	0.79
Operational Efficiency	0.77	0.76	0.71	0.82	0.79	1

The correlation matrix in Table 5 highlights the linear relationships between the measured variables, with correlation coefficients (rrr) ranging from 0 to 1, indicating the strength and direction of these relationships. The diagonal values of 1.00 represent perfect self-correlation, while the off-diagonal values show pairwise correlations between variables. For example, Blockchain Adoption Level has a strong positive correlation with Technological Readiness (r=0.80r = 0.80r=0.80) and Operational Efficiency (r=0.77r = 0.77r=0.77), suggesting that as blockchain adoption increases, technological readiness and operational efficiency also improve. Similarly, Credit Risk Mitigation Strategy and Technological Readiness exhibit the highest correlation (r=0.83r = 0.83r=0.83), emphasizing that enhanced technological readiness significantly impacts credit risk mitigation. Moderate correlations, such as between socioeconomic outcome and Blockchain Adoption Level (r=0.65r = 0.65r=0.65), indicate that these factors are related, though other influences may also contribute.

Overall, the matrix demonstrates strong positive correlations among all variables, reflecting their interconnected nature. The findings suggest that improvements in one domain, like Technological Readiness, can drive progress in others, such as Credit Risk Mitigation and Operational Efficiency. This underscores the importance of integrating blockchain technology and enhancing technological capabilities to achieve better outcomes in social enterprises. The data provides actionable insights for prioritizing investments and interventions, particularly in areas with the strongest relationships, to maximize impact across the socio-economic and operational spectrum.

Table 6: Linear Regression Results

Variable	Coefficient (	Standard Error	t-valu	p-valu	Significan
(Intercept)	2.85	0.32	8.91	<0.00	***
Blockchain Adoption L	0.28	0.06	4.67	<0.00	***
Technological Readin	0.35	0.08	4.38	<0.00	***
Financial Feasibility	0.21	0.07	3	0.003	**

The Regression Analysis in Table 6 demonstrates the predictive power of key variables on Socio-economic Outcome Improvement, with Blockchain Adoption Level, Technological Readiness, and Financial Feasibility emerging as significant predictors. The coefficients (β\betaβ) indicate the strength and direction of these relationships; for instance, a one-unit increase in Technological Readiness corresponds to a 0.35 unit increase in the outcome, highlighting its substantial positive impact. Similarly, Blockchain Adoption Level (β=0.28\beta = 0.28β=0.28) and Financial Feasibility (β=0.21\beta = 0.21β=0.21) also contribute positively. The model explains 68% of the variance (R2=0.68R^2 = 0.68R2=0.68), confirming its robustness. The low p-values (all p<0.01p < 0.01p<0.01) and high t-values further affirm the significance of the predictors. Collectively, these findings emphasize that technological and financial readiness, alongside blockchain adoption, are critical levers for enhancing socio-economic outcomes, providing valuable guidance for strategic decision-making in social enterprises.

System function design

The blockchain system is highly efficient. The transparent and fair operation of the blockchain system can effectively reduce the profound information asymmetry between financial institutions and poor households. The loan approval of the social microfinance for Poverty Eradication system based on blockchain technology no longer depends on the manual approval of financial institutions but is based on the innovative contract advantages of the blockchain system.

The information submitted by each household is carefully verified. When each node is verified, the blockchain system will transfer the loan to the poor farmer's account. Different from the slow approval cycle of loans in the past, the approval of the block-chain system can be approved within one day. It can be completed in a shorter time, which will greatly reduce the time cost of farmers and the labor cost of financial institutions, and improve efficiency. (Hawlitschek, Notheisen, B, & Teubner, T, 2018) Stated that the block-chain system can effectively prevent the occurrence of moral hazard. When the loan period is approaching, the block-chain system will remind poor households to repay the loan. When the repayment date is reached, the system will automatically transfer the money in the account of the poor households to the corresponding lending institution. The block-chain system is secure, and it has the characteristics of decentralization. Each participant is the center of the system, and system information will also be shared with each node, which greatly improves the security of the system.

The overall process of system operation

Since the established Social microfinance for poverty alleviation block-chain system is used for poverty alleviation and credit risk management, the participants of the system are poverty alleviation participants such as government poverty alleviation agencies, financial institutions, insurance institutions, and poor households, so the Social microfinance for poverty alleviation area The blockchain system belongs to the alliance chain, and the system operation is divided into four layers: data layer, network layer, contract layer, and application layer.

Data layer

The narrow definition of blockchain is the distributed data ledger shared by each node. The data layer is the bottom layer of the blockchain system and the foundation of the system. In the Poverty Eradication system based on blockchain technology, government poverty alleviation agencies, insurance agencies, and financial institutions enter their poverty alleviation information, save them as data blocks, and then share them with other nodes to realize distributed dissemination and storage of information. As shown in Figure 2.

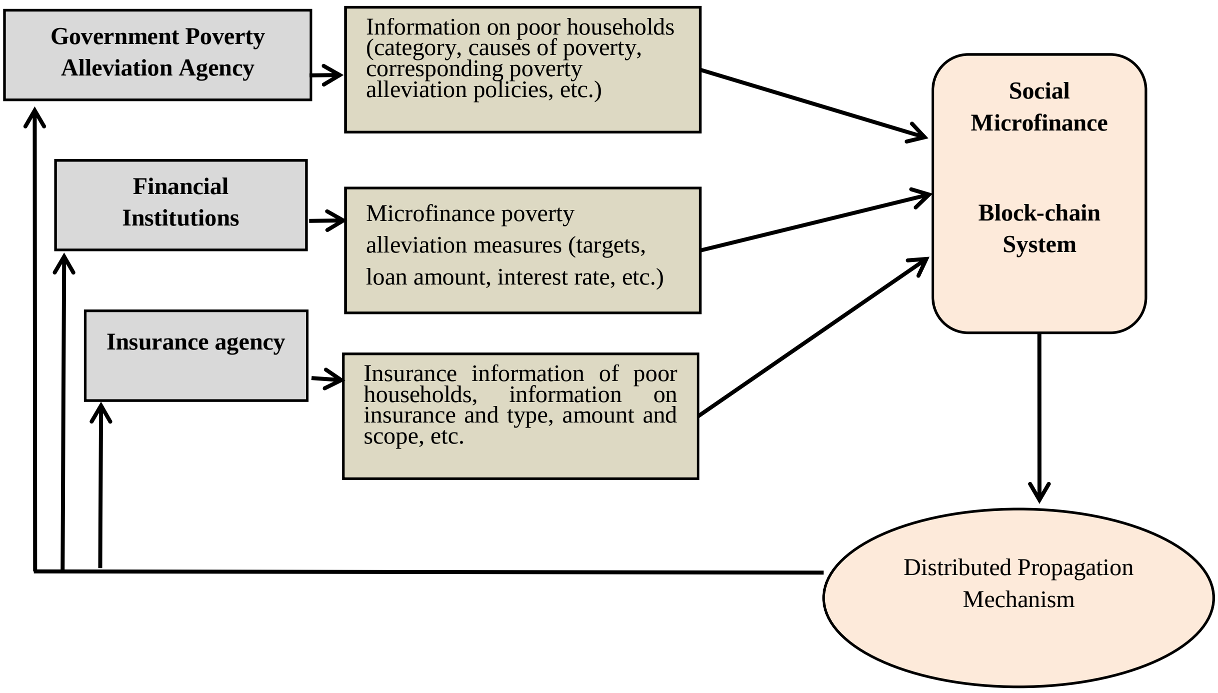
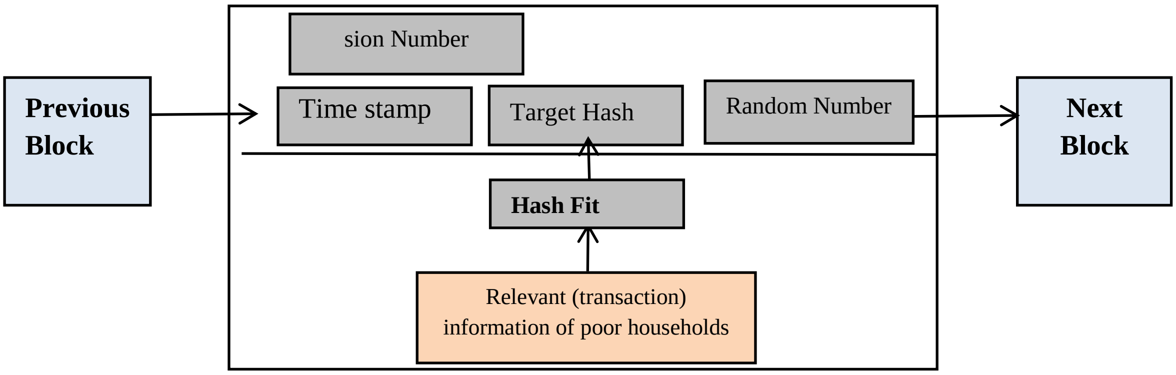


Figure 2: Data Layer of Poverty Eradication system based on blockchain technology

In this system, after each node inputs the corresponding information, it stores it in data blocks. The information input by government poverty alleviation agencies and insurance agencies is a data block based on the information of a single poor household, and the information of financial institutions is based on information related to poverty alleviation policies within a period. Each data block is connected and involves Timestamp, hash algorithm, and other technical elements; the data block structure is shown in Figure 3.



The timestamp endows the data block with time characteristics to ensure the integrity of the data and the realization of the non-tampered feature. The hash function records the information input by each node into the data block as a hash function value.

Network layer

The network layer includes elements such as the networking method of the Social Microfinance for Poverty Eradication system based on blockchain technology, the message dissemination protocol, and the data verification mechanism. The social microfinance for poverty eradication system based on blockchain technology uses an n-to-N network, with unlimited poor households and limited poverty alleviation participating institutions to complete the social microfinance process. When a poor household publishes information about its loan needs to the blockchain system, the data will be transmitted to each node in the blockchain through a distributed communication mechanism.
For example, a poor household publishes information related to its loan needs (including loan amount, acceptable interest level, poverty information, project information, insurance information, etc.) to the blockchain system, which will be passed on to all. Then, each node conducts its verification. Each financial institution verifies whether the amount, interest rate, project, and insurance information provided by it meets the requirements of the institution, and the relevant insurance institution verifies the authenticity of the insurance information provided by it; the government poverty alleviation agency verifies the pertinent information of poor households supplied by it, as shown in Figure 4, according to the verification information fed back by each node, the system proceeds to the next step of transaction processing.

Here, various financial institutions that carry out social microfinance business for poverty alleviation have different requirements for their loan objects, such as poverty category, loan amount, loan interest rate, and whether insurance protection is required, so the block-chain system will verify according to each node Judging whether the transaction will continue bypassing the situation, which involves the content of the smart contract, will be explained in detail in the next section.

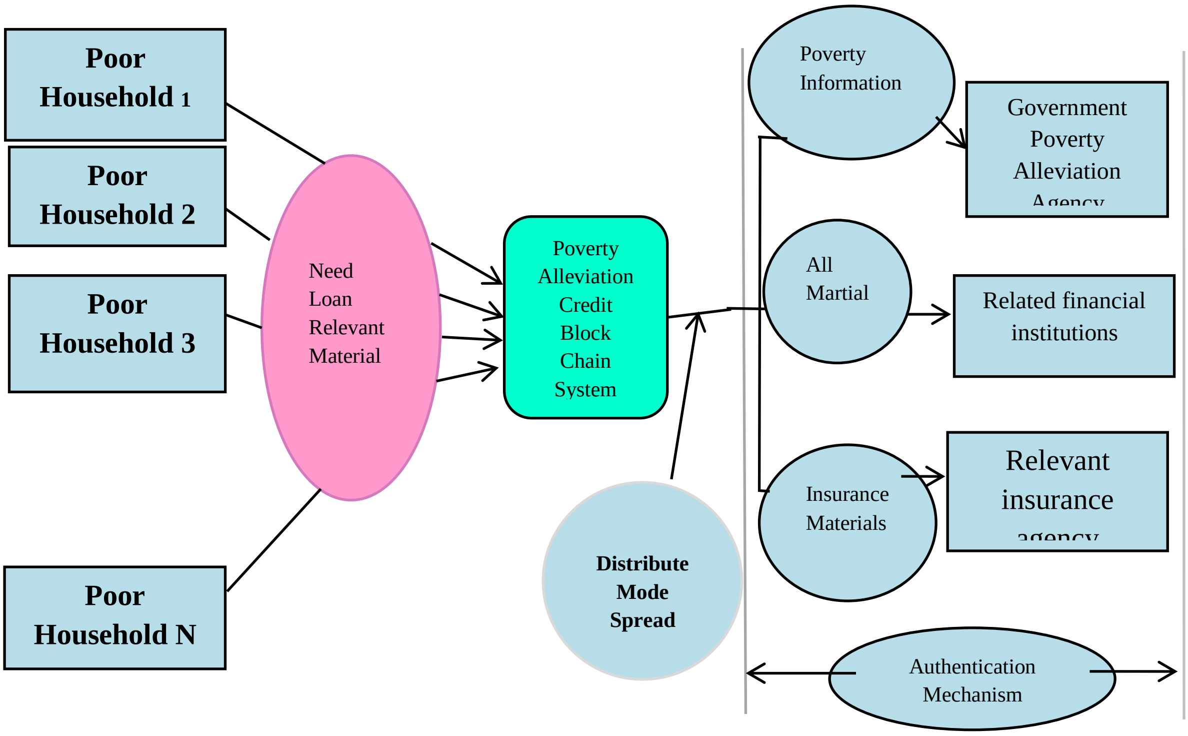
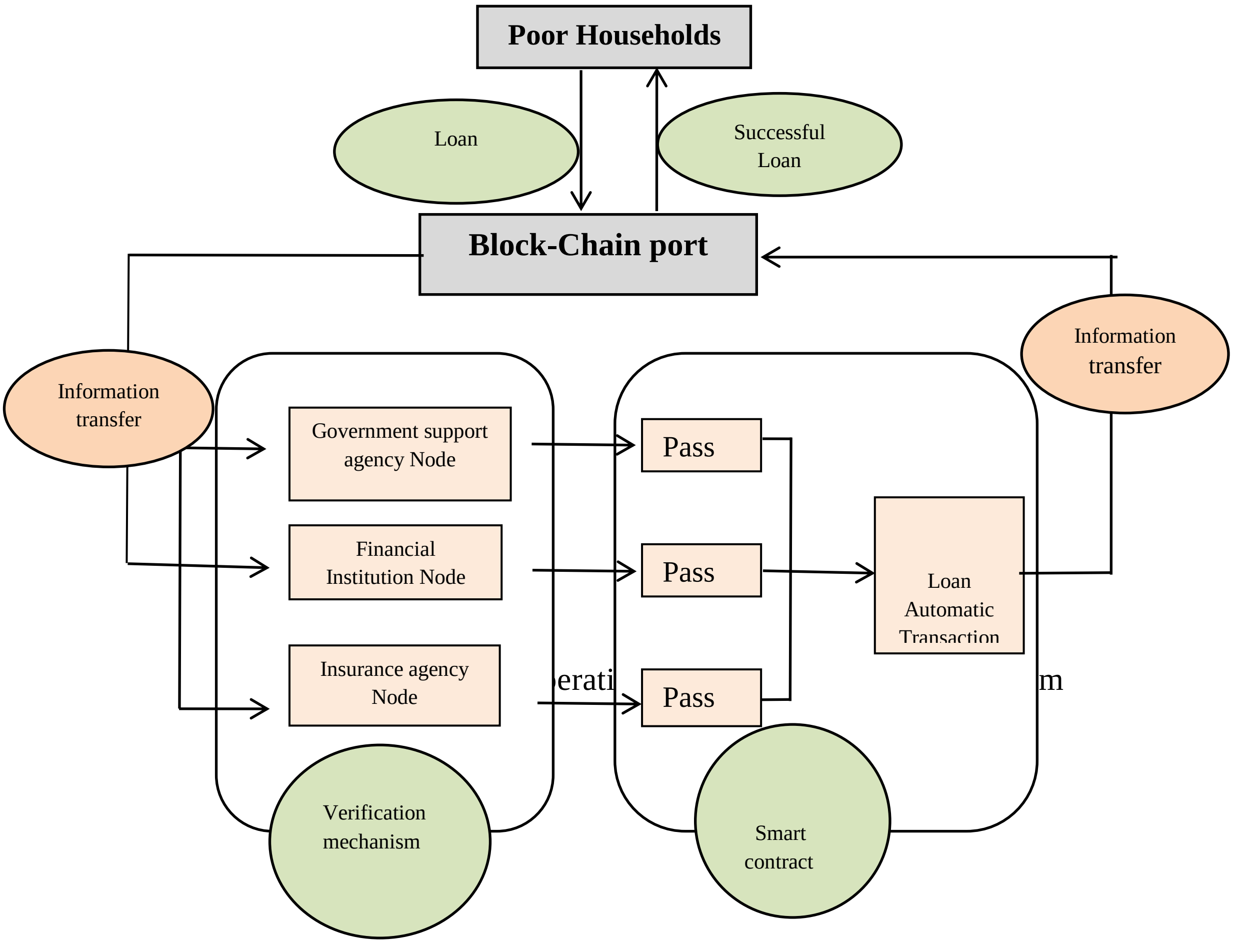


Figure 4: Distributed propagation and verification, n-to-N network Contract layer

The contact layer includes various script codes, algorithms, and complex smart contracts generated by the social microfinance for Poverty Eradication system based on blockchain technology. Here, we will focus on smart contracts, which are an essential condition for the efficient operation of this system. In the Social microfinance for poverty alleviation blockchain system, after the poor households enter the loan-related information into the system, the distributed information dissemination mechanism will transmit the corresponding information to the relevant nodes, and a node will verify it. After the node verification is passed, the system's innovative contract agreement is triggered, the loan transaction is automatically completed, the blockchain system automatically transfers the loan to the account of the poor household, and the loan is issued successfully, as shown in Figure 4-9. The first confirmed node will obtain the customer if multiple financial institutions are interested in the poor household. If other nodes, such as government poverty alleviation agencies or insurance agencies, fail to pass the verification, the loan transaction cannot be concluded. Relevant financial institutions also set their loan conditions through smart contracts to select the most suitable customers to ensure their economic sustainability and reduce the risk of default.

Application layer

Poor households apply for loans at the application port, and the poverty identification information, loan project information, loan amount, acceptable interest rates, and other relevant information they provide are shared with the corresponding nodes of government poverty alleviation agencies, financial institutions, and insurance companies for verification. When all information is verified, the blockchain system automatically transfers the loan funds to the accounts of poor households based on the smart contract terms, and the loan approval and disbursement stage is completed efficiently, as shown in Figure 5.



When the loan period expires, the blockchain system automatically transfers the funds in the poor household's account to the corresponding lending institution. After the loan is completed, the corresponding transaction record information is shared with each system node. It will be used as a corresponding reference when borrowing. If poor households default on the contract, their dishonesty records will also be shared with each node of the blockchain system, and the records of dishonesty will be permanently recorded in the system and cannot be changed. Have very adverse effects.

Analysis of Blockchain's Credit Risk Prevention Benefits

Banks' existing credit investigation mode mainly involves the credit information center of the central bank managing credit data in a unified manner and then providing data query services to financial institutions. The distributed storage, information disclosure, and transparency of the blockchain system enable each node to query the corresponding data. A user's credit record can be known at a glance, which can effectively reduce costs. And because the real-time nature of blockchain data records ensures the integrity and timeliness of data, it can effectively manage the credit risk of financial institutions.

Reduce transaction costs and information asymmetry

The reason for the adverse selection problem in the operation of social microfinance is that there is a severe information asymmetry between credit institutions and borrowers, and information asymmetry causes poor households to incur more costs in finding suitable lending institutions. Based on considering the cost, those high-quality poor households with stable income and low risk will give up loans. In contrast, those high-risk poor households insist on looking for loans. Hence, lending institutions select high-risk customers, like poor-quality customers in the social microfinance market, driving out high-quality customers. The phenomenon of adverse selection. In The Social Microfinance for Poverty Eradication System, which is based on blockchain technology, each center will enter its information into the system. For example, financial institutions will list the loan conditions one by one. When poor households enter loan applications into the system, the blockchain system will be based on the conditions for poor households to find the most suitable credit institution and, at the same time, pass the corresponding information to the corresponding nodes for verification. If each node passes the verification, the loan application will be approved, and the blockchain system will automatically enter the loan based on the smart contract terms in the accounts of poor households. In this system, first of all, poor households save themselves the search cost of finding credit institutions, and the system automatically matches them with suitable lending institutions, tantamount to saving more costs for poor areas with remote geographical locations and poor information. In addition, the system's node verification mechanism replaces the manual approval process of traditional lending institutions, shortening the generally long approval and lending time to within one day, which significantly saves the time cost of poor households and will not affect Agricultural Production. The blockchain system also saves the cost of selecting customers for credit institutions. In the system, each credit institution lists its loan conditions one by one, and the system will also select the most suitable customers for it, avoiding the reverse Choice; at the same time, the verification mechanism of the block-chain system also saves the labor cost of the credit institution's review of the loan information, increases its overall profit margin, and promotes the further development of the credit institution.

Conclusions and Prospects

Conclusion

This paper integrates new institutional economics and blockchain technology to analyze the Social Microfinance for Poverty Eradication system, focusing on credit risk while examining how blockchain can enhance poverty alleviation efforts and improve credit risk management within the system. The main research results of the paper are now summarized as follows: Firstly, the credit risk of social microfinance for poverty alleviation is more specific than that of general loans. Most poor households are located in remote areas with low economic and cultural levels, a severe lack of understanding of credit, and no awareness of repayment or the impact of dishonesty on them. Secondly, poor households cannot accept higher interest rates due to limited conditions, and social microfinance institutions can't set lower interest rates to ensure their financial sustainability in commercial operations. As a result, credit institutions choose customers with higher risks, while the poorest and most in need of funds cannot get loans. Because social microfinance for poverty alleviation faces high credit risks, the returns are average, and many formal financial institutions participate in the benefits, but enthusiasm is not high. Additionally, blockchain technology is an effective tool for solving economic problems. The blockchain's decentralization and distributed transmission and storage characteristics can effectively deal with the systemic risks of the financial system and the risk of hacker attacks; the de-trust feature solves the problem of trust between the two parties in the transaction. Thirdly, the blockchain system can effectively manage the credit risk of social microfinance for poverty alleviation. The social microfinance system for poverty alleviation is brilliant and automated. Each participant enters their conditions into the system in detail, and the system automatically conducts transactions according to the agreement, which saves a lot of time and other costs for financial institutions; it seriously affects the delectation of poverty alleviation preferential policies for poor households in the future, and can effectively reduce the risk of default by poor households. Finally, the effective operation of the social microfinance block-chain system for poverty alleviation should pay attention to the government poverty alleviation agencies to ensure the authenticity and timeliness of data on poor households in the system, popularize education on credit and loan awareness of poor households, and ensure the participation of various institutions.

Policy and Implications

The government should strengthen the work of updating the data of poor farmers to establish cards and register files. Therefore, it is also necessary for poor households to Strengthen the cultivation of credit awareness of low-income families to understand that breach of contract is an illegal act, which will bring them many adverse effects; in the block-chain poverty alleviation system, dishonesty records will be shared with every department in the poverty alleviation system, and its dishonest behavior will affect its future poverty alleviation credit, poverty alleviation insurance, and enjoyment of government poverty alleviation preferential policies, etc., through incentives and the two-way guidance of the punishment mechanism reduces the credit risk caused by the malicious default of poor households. Establish and improve the training mechanism for blockchain-related talents. Block-chain-related talents must also narrow the gap between SAARC's block-chain and the international level. Therefore, SAARC should establish a sound blockchain talent training mechanism soon. Improve the laws, regulations, and regulatory policies related to blockchain applications.

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